BINATIONAL BORDER TRANSPORTATION PLANNING AND PROGRAMMING STUDY

DRAFT

Task 12:

Evaluation of U.S. and Mexican
Border Area Capabilities
to
Forecast Expanding Trade

Barton-Aschman
La Empresa

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FINAL REPORT

Preface

U.S./Mexico Binational Border Transportation Planning and Programming Study implements a significant binational policy making document entitled “Memorandum of Understanding of the Planning Process of Land Transport on Each Side of the Border” signed by the federal governments of Mexico and the United States at the first “NAFTA Transportation Summit” held in Washington, D.C., April 29, 1994.

The purpose of this study is to provide policymakers with information needed to establish a continuous, joint, binational, transportation planning and programming process. A goal of this study is to improve the efficiency of the existing binational policy making, planning procedures and funding criteria effecting our Border Land Transportation Systems (BLTS). The BLTS should be seen as a binational transportation system made of international bridges and border crossings and its land connections to major urban and/or economic centers, principal seaports, airports, and multimodal/transfer stations and, utimately, to its connections to national transportation facilities.

Disclaimer

The purposes of the Binational Planning and Programming Study and all of its reports were: to investigate current state and national transportation planning processes in both the United States and Mexico, to review available data on border transportation infrastructure and goods movement, and to recommend an ongoing, binational planning and programming process. The information contained in these reports was not developed to serve as the basis for making funding allocation or distribution decisions at either the federal or state level in the United States.

BINATIONAL BORDER TRANSPORTATION PLANNING AND PROGRAMMING STUDY TASK 12 EVALUATION OF U.S. AND MEXICAN BORDER AREA CAPABILITIES TO FORECAST EXPANDING TRADE

There are various methods of forecasting expanding trade in and between the United States and Mexico. This report provides an evaluation of the methods, data and existing forecasting models available to decision makers. Forecasting methodologies, including the time series model and the structural model are discussed. A compendium of existing border trade forecast studies in both the United States and Mexico is provided. Data needs and data sources for providing inputs to border state trade forecasts are also discussed.

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12.1
Introduction

This report provides an evaluation of the methods, data, and existing forecasting models available to decision makers facing U.S.-Mexican border trade flow issues.

Chapter 12.2 provides an elementary review of forecasting methodology. Two primary types of models are identified: the time series model and the structural model. The time series model emphasizes the pattern of movement of a data series over time, without the influence of outside variables. However, within the data are factors which determine the path of the series, including cyclical, trend, seasonal, and random influences. Structural models are typically causal models which express the variable to be forecast – such as trade flows – as a function of other variables, such as prices or Gross Domestic Product (GDP). Time series models are less expensive to produce than structural models, and are often quite accurate over a shorter time horizon. However, for the longer term planning horizon required for making decisions about infrastructure and issues relating to border trade, the more sophisticated, statistically based econometric structural model is required.

Chapter 12.3 is a review of existing border trade forecast studies in both the United States and Mexico. Surveys were conducted of federal agencies and of state and local agencies in the border states of both countries. None was found to be forecasting trade flows. However, a number of U.S. organizations have completed special studies of trade flows, and these are reviewed in this section. The California Intermodal Transportation Management System was a long term study that projected trade flows within California and between California and Mexico. However, certain inconsistencies were discovered in the longer term forecasts. The INFORUM model was an ambitious linking of U.S. and Mexican econometric models, but the approach has not been updated since 1990. The forecasts prepared for Task 11.5 of the Binational Planning and Programming Study are the only projections known to exist by Customs District for value and volume. However, these were based on a simple trend extrapolation time series methodology that is not suitable for long term planning into the next century. The survey of Mexican government agencies identified only one case of trade forecasts produced for the Secretariat of Communications and Transportation (Secretaria de Comunicaciones y Transportes-SCT) that included any analysis relating to the border states.

Chapter 12.4 discusses the data needed to produce border state trade forecasts. The first section evaluates the U.S. data that are available for trade flow forecasting by port of entry, by commodity. The main data set examined is the Bureau of Transportation Statistics data known as the Transborder Surface Freight Database, available to researchers on the internet and updated monthly. While continuing to improve, this series has some deficiencies, including the absence of information on weight and commodity by conveyance. However, there are a number of variables that could be forecast by port using both time series and econometric techniques. The second section evaluates the Mexican data that could be used to develop forecasting models of border state trade flows.

Chapter 12.5 examines the forecasts that are available as of today for policy makers. Global and national forecasts are accessible and of high quality. U.S. and Mexican trade by value is available, but forecasts by commodity, by port, and by any level of detail must be newly created if they are to be used by planners.

12.2
Review of Forecasting Methodology

The purpose of forecasting is to predict future levels of activity as measured by data. Forecasts are typically made with reference to a future point in time, and if the time horizon of the forecast is changed the forecast may also change. Forecasting activity is distinct from planning; forecasts are inputs to the planning process and represent one tool available to decision makers.

The basic assumption driving any forecasting effort is that there are patterns in the past data that can contribute to prediction or – at least – reduce uncertainty about the future.

There are two broad classifications of forecast methodologies, quantitative and qualitative. Quantitative forecasts rely on mathematical analysis of the historical patterns of the data to produce the forecast, while qualitative methods are based on judgments and expert opinion. Quantitative methods in turn have two general categories, time series and structural. These are described in the following sections.

12.2.1 Time Series Models

Times series methods rely on using the information within the historical movements of the data as the primary basis for future projections. Thus, trend extrapolation is a time series method, based on the assumption that future growth will be similar to growth in the recent past.

The simplest form of time series model is the "naïve" model, which states that the future value of a variable X expressed as X_{t+1} is equal to the current value, or

$$X_{t+1} = X_t$$

While it may appear that this formulation is so primitive and unrealistic as to be useless, it should be noted that, in the absence of any other information, decision makers very often use the naïve model as their de facto methodology.

Other types of time series models include moving averages, exponential smoothing, decomposition models, or more elaborate models such as the Box-Jenkins approach. The Box-Jenkins model is widely considered the most accurate of the time series methods, and it has the desirable feature of providing statistics on forecast error. But it also requires a larger data history than more basic models and uses an iterative approach which is costly to apply. [1]

The decomposition approach involves the same basic concepts as the much more complex Box-Jenkins analysis, so the decomposition model will be used here in evaluating some of the issues related to border trade forecasting that are discussed below. The decomposition method postulates that a variable such as truck crossings, denoted by X, is subject to four influences in the data. These are trend (T), cyclical (C), seasonal (S) and random (R).

[1] These issues are reviewed in standard forecasting textbooks such as Spryos Makridakis and Steven Wheelwright, *Forecasting: Methods and Applications, John Wiley and Sons, 1983*.

The simple representation of these relationships is

$$X = T \times C \times S \times R$$

In brief, the seasonal factor is found through analysis of 12 month moving averages; the trend is obtained by fitting a line to the moving averages (this can be done with simple regression methods); and since the seasonal and random influences have been removed by the moving averages, it can be shown that the cyclical factor will be determined by dividing the moving average value by the trend value. More advanced and sophisticated processes such as double exponential smoothing or Box-Jenkins techniques still deal with various treatments of these basic time series concepts.

Time series methods are often very accurate for short term forecasting, particularly if the trend line or the seasonal influence dominates the data. However, time series models are not useful for long term planning over longer time horizons (such as more than 2 or 3 years) and are not capable of capturing turning points effectively.

12.2.2 Structural Models

Structural forecasts may be non-statistical or statistical. Non-statistical models may be based on ratios or other relationships that have been observed or hypothesized. Statistical models are more complex. Both will tend to rely on casual relationships, where the data series to be forecast is seen to be related to or a function of other variables. The statistical models, typically using regression analysis, are often regarded as more precise since the statistical process produces confidence measures and information on the likelihood and size of forecast error.

An example of a typical statistical formulation is U.S. demand for imports of apparel from Mexico, which might be represented by

$$A = a + bGDP + cP + u$$

where *A* is value of apparel imports in a given period, the small letters (*a, b, c*) are statistically determined regression coefficients, and *u* represents an error term. The simple model states that apparel imports depend on GDP (Gross Domestic Product) in the U.S. and P (the price for apparel or, more typically, a ratio of U.S. to Mexican prices for apparel). The equation could be evaluated by statistical tests for significance and could be used as a forecasting equation if future values of GDP and P were known. Larger models would determine GDP, P, and such other macro variables as interest rates and employment and these could be used as inputs to the apparel equation. These types of models, since they combine statistics and economics, are known as econometric models.

In general, forecasting with functional relationships in econometric models is more costly and complex than forecasts based on examining patterns in time series analysis, but the resulting models are more powerful and accurate.

12.2.3 Forecast Types and Time Horizon

Note that if a customs official needs a forecast of northbound cement shipments on a Friday, it is likely that the best forecast may be obtained from looking at the actual cement shipments from the previous Friday, and this is likely to be a more accurate estimate than figures from a more elaborate and expensive multi-variable model. An even more accurate alternative might be an average of shipments over all Fridays or the value from Friday in the same month of the previous year.

But if the objective is to forecast cement shipments five years from now, it is unlikely that the value of shipments on the previous Friday will provide much help to decision makers. The naïve model

completely disregards trend and cycle, and is unable to incorporate basic relationships such as growth in population or income in the markets to which shipments are destined.

Therefore, as a general rule, the time series models based on recent data observations are most useful for short term decision making, and the more costly but accurate statistical models are recommended for longer term strategic planning.

Table 12.1 shows the relationships between types of model and the most appropriate time horizon for each. Immediate term forecasts are for very short periods, typically less than one month. Immediate term forecasts would be used for scheduling resources or anticipating bottlenecks, but typically because of the limited time available the responses to projected problems are limited in scope. Usually the most useful type of forecast is a smoothing method based on limited data.

Most practitioners define short term forecasting, shown in the second column, as having a time frame of less than one year, perhaps months or even weeks. Short run forecasting uses are for scheduling, personnel assignments, or allocation and distribution of existing resources. Users of short term forecasts (as compared with immediate forecasts) may make some attempts to modify projected outcomes, but the time horizon is insufficient for capital spending or major changes in procedures.

Table 12.1
Model Types and Time Horizon

	TIME HORIZON			
Model Types	Immediate (One Month) Scheduling	Short Term (1 Year) Resource Allocation	Intermediate (2 Years) Budgeting	Long Term (2 - 10 Years) Planning & Programming
Time Series Models				
Naïve	X	X		
Moving Average	X	X		
Exponential Smoothing	X	X		
Decomposition		X	X	
Box-Jenkins		X	X	
Structural Models				
Simple Regression		X	X	
Multiple Regression			X	X
Econometric Model				X
Technological Forecasting				
Delphi/Survey			X	X

Source: Barton-Aschman - La Empresa, 1997

In the immediate and short term time periods extending up to one year ahead, the trend, cyclical, and seasonal factors will all be present, but seasonal and trend will be likely to dominate, especially if the cycle involved is longer than one year. All time series models will be reasonable for using to forecast one year ahead and simple regression may also work well in some instances.

Intermediate term forecasts are for up to two years, usually the time required to prepare and submit a budget. Intermediate term forecasts would be used for those intending to reallocate resources among competing alternatives or enhance existing structures or procedures at the margin. Usually an intermediate term forecast introduces economic variables, and trends and the phase of the business cycle are increasingly important. Seasonality is not a factor over this time period. The decomposition or regression approaches are most appropriate for this time period.

One aspect of the intermediate term is that there may be turning points in the business cycle. If the user of the forecast needs to know whether there will be turning points, a more sensitive and complex model is needed. In addition, forecasting accurately in the intermediate term often requires bringing to bear additional information of a qualitative nature such as examining consensus forecasts from economic newsletters, trade publications, or even surveys of experts on the likely course of the economy. Forecasts from the model can then be adjusted in light of this information.

Long term forecasts of trade data are for two years, five years, or more, defining the planning horizon for strategic change, long term capital expenditures, and obtaining policy goals. Long term forecasts would be used to project when certain border crossings would exceed capacity, given current physical characteristics, or would project broad trends in commodities (e.g., changes in flows of certain types of consumer goods as incomes rise).

Long term models are most accurate when they are structural in nature, typically involving regression based systems of equations, often complemented by qualitative factors based on expert opinion. Long term models are much more costly to construct than the simpler time series models. Further, they introduce an additional longer term cost factor; they will need to be corrected over time in the face of sudden shocks to the economy which were not part of the model, such as a peso revaluation or a downturn in the rate of growth of GDP. A basic problem is that, although the models are based on past relationships, the future will be different from the past. The model “knows” the history but will need to be maintained over time to adjust to changes in the historical patterns and relationships in the data.

Although complex statistical models are often viewed as the ultimate forecasting tool, the benefits of qualitative (or “technological”) forecasting should not be underestimated. Technological forecasting may involve Delphi procedures (surveys sent to experts asking their opinions on future changes), panels of experts meeting from time to time, or simply experts reacting to and suggesting modifications to forecasts from econometric models. Since people “know” more than models about possible changes in regulations or other more complex possibilities, the value to decision makers of supplementing statistical forecasts with informed judgment may often be significant.

12.3
Existing Border Trade Forecasts

12.3.1 The United States

An extensive survey of federal, state, local, and private agencies in the United States found a limited number of current models designed to forecast border trade activity between the United States and Mexico.

National, State and Local Organizations

Federal agencies were contacted through internet addresses or from addresses on documents and reports written on border trade issues in the recent past. These included:

- U.S. Department of Commerce, International Trade Administration
- U.S. Trade Commission
- U.S. General Accounting Office
- Federal Reserve Board of Governors
- U.S. Customs Bureau
- U.S. Department of Transportation

These offices provided references to a number of broad sources dealing with issues related to border trade flows. However, there were limited references provided for the very specific topics of models designed and existing for the purpose of forecasting border trade flows between the United States and Mexico.

Private organizations contacted included the two leading forecast services in the nation, WEFA, Inc. and DRI/McGraw-Hill, both of whom maintain forecasts of the U.S. and Mexican economies, including trade flows.

Telephone, fax and electronic mail contact was made with more than 20 forecasters in the border states, as shown below:

California

- Bank of America
- California Department of Finance
- California Legislative Analyst's Office
- Chapman University
- Pacific Gas & Electric Co.
- UCLA Business Forecasting

Arizona

- Arizona Department of Economic Security
- Arizona Joint Legislative Budget Committee
- Arizona Office of the Treasurer
- Arizona Public Service Company

- ECON-LINC
- Elliott Pollack & Co.
- Maguire Company
- Northern Arizona University
- University of Arizona
- Salt River Project

New Mexico

- University of New Mexico
- New Mexico State University

Texas

- Federal Reserve Bank of Dallas
- Perryman Group
- SBC Communications
- Texas State Comptroller of Public Accounts
- University of Houston
- University of Texas

From these contacts, some special studies were obtained, as described below. However, the general conclusion is that there is no systematic on-going forecasting of border trade flows in place in these states. As with WEFA and DRI, the Bank of America maintains data on the Mexican economy, but does not forecast border flows. The University of Texas, through the Center for Transportation Research, has a number of studies underway at any point in time but does not have a forecast database available to analysts.

California Intermodal Transportation Management System

The California Intermodal Transportation Management System (ITMS) is designed to assist transportation planners who need to analyze the state transportation network, particularly in support of capital investment decisions. The intent is to allow evaluation of alternative scenarios resulting from various investment options. The *Basic Documentation* volume contains a section on "Forecast Methodology" which provides insight into general approaches that might be taken for cross border transport forecasting.[2]

The ITMS draws on the Transearch Data Base from Reebie Associates for both base data and freight forecasts. Since this source is often mentioned in the transportation forecast literature, a brief explanation of the Transearch Data Base is provided here.

The Transearch Data Base is a proprietary multimodal freight database which includes base data and a ten year forecast. However, for the ITMS study the forecast horizon was extended to 30 years by Reebie Associates using a national macroeconometric model (DRI) and long term forecasts from the U.S. Census Bureau.

Transearch is annually updated from information on freight traffic flows. The data base is origin-to-destination flows by four digit STTC commodities for seven modes of transportation: rail, rail/truck intermodal, truckload, less-than-truckload, private truck, air and water. Annual

[2] California Intermodal Transportation System (ITMS), *Basic Documentation*, April, 1996, prepared by Booz-Allen & Hamilton for the California Department of Transportation.

construction of the database involves combining traffic flow data with production and shipment information. Derivation of the trucking information is the most complicated and depends somewhat on identification of shipments by other modes, leaving the residual to be explained by truck flows.

The Transearch traffic flow data sources are shown in the following listing reproduced from ITMS *Basic Documentation*, California Department of Transportation:

Primary Domestic Traffic Flow Sources

- Annual Motor Carrier Data Exchange
- Annual ICC Railroad Waybill Sample
- Annual Corps of Engineers Waterborne Commerce Statistics
- Import/Export Trade Statistics & Inland Traffic Survey
- Annual Department of Energy Coal Movement Statistics
- Annual Department of Agricultural Produce Movement Data

To estimate truck activity, the database next requires information on production and shipments:

Primary Production and Shipments Sources

- Annual Census of Manufacturers
- Annual Bureau of Mines Commodity Reports
- Annual Motor Carrier Industry Financial & Operating Statistics
- Annual Railroad Freight Commodity Statistics
- Federal Reserve Board Industrial Production Indices
- Survey of Current Business
- Trade Association Production and Shipment Reports
- Annual County Employment and Population Data
- State Economic Output By Industry
- Inter-Industry Trade Patterns (input/output table)

The starting point is to obtain value figures on national production of all manufactured goods from the *Census of Manufacturers* and *Annual Survey of Manufacturers*. This value information is converted from value to tonnage using a conversion scheme developed by Reebie Associates. Production is distributed by state on the basis of employment levels in relevant industries and cross checked against other information where available. Import information by commodity from ports is combined with domestic production figures to create a measure of total shipments to be transported by all modes.

Trucking activity is obtained by subtracting rail, water and air shipments derived from known sources, including computations elsewhere in Transearch. Finer details on type of truck transport are based on prior historical patterns as identified by Transearch. The trucking activity by commodity is distributed into state by state flow patterns based on Data Exchange records of motor carriers.

The Transearch data base now has a component for U.S.-Mexican trade, based on 1994 U.S. Census data by Customs District. To make the database consistent with the domestic Transearch components, trade data as reported by the Census Bureau were converted from harmonized code to Standard Transportation Commodity Classification (STCC), through a bridge (conversion) table created by Reebie Associates. Conversion from dollars to tons was done using a table of United States dollars per pound for STCC groups at the 4 digit level. State of origin in Mexico was estimated by Reebie Associates on the assumption that Mexican exports to the United States from a given state were proportionally the same as to the rest of the world.

The methodology in this study is a combination of statistical and non-statistical structural models. The DRI model is one of the most extensive econometric models in existence, well maintained and generally regarded as very accurate. In this study, the forecasts for economic variables from DRI were combined with transportation variables in a non-statistical procedure, involving ratios, proportions, and other functional relationships to derive the forecasts for transportation variables. This is a type of model and an overall approach well suited to long range planning, but expensive to develop and costly to maintain and update.

California Trade and Goods Movement Study - ITMS Freight Forecasts

The California Trade and Goods Movement Study was conducted by Barton-Aschman Associates for the California Department of Transportation, and freight forecasts were specifically addressed in *Interim Report 5.1, ITMS Freight Forecasts*.[3] This report re-examined the Reebie Associates Transearch forecasts of California trade flows prepared for the ITMS project described above.

The emphasis of the Barton-Aschman efforts was on an analysis of domestic transport with California as state of origination and destination, and intrastate flows. Forecasts were presented for Canadian and Mexican traffic combined, but no detail on Mexico was provided. While these results do indicate that the Transearch methodology could be applied to forecasting of cross-border traffic for all border states, the report also noted some inconsistencies between the U.S. Bureau of Economic Analysis (OBERS) population forecasts and the trade forecasts associated with these. In particular, Barton-Aschman analysts found that goods movements were projected to increase 35 percent between 1992 and 2022, while population was forecast to rise by 40 percent, implying a decrease in shipments per capita over time.

These findings illustrate some of the difficulties in attempting to meld disassociated modeling approaches. Typically, an econometric model is designed to be self-contained and generate consistent forecasts (for example, exports by sector would sum to total exports for the nation). When the DRI econometric model was matched with the OBERS projections developed outside the model by different methodology, and both were combined with the Reebie Associates non-statistical process for trade forecasts, inconsistencies developed.

Southwest Passage Corridor Traffic Analysis

This report was prepared for the Southern California Association of Governments by DRI/McGraw-Hill as part of an overall study conducted by Jack Faucett Associates and supporting firms. This review is based on a draft dated June, 1996. The objective of the study was to "demonstrate the significance and role of the Southwest Passage Corridor which links East-West trade routes along the U.S.-Mexican border." The study determined that, by value, one-third of U.S.-Mexican trade moves to and from the Corridor states while two-thirds of U.S.-Mexican trade moves through the Southwest Passage Corridor states as it is transported to other states.

[3] California Trade and Goods Movement Study, prepared by Barton Aschman Associates, Inc. for California Department of Transportation and San Diego Association of Governments, January, 1996.

Freight movement estimates for the study were based primarily on previous DRI work on goods movement, a DRI forecast from a 1995 state to state freight transportation database prepared by Reebie Associates (Transearch), supplemented by analysis of cross border and international freight traffic.

The report presents forecasts of trade between Mexico and California, but does not extend the forecasts to other states. No specific methodology is reviewed and the source of the forecasts and supporting assumptions are not provided. The figures for Mexican/California tonnage are shown in Table 12.2. No modal breakouts are provided.

The modeling approach for this study again is a combination of the statistical and non-statistical structural methodologies as described in the previous sections above.

INFORUM - Interindustry Forecasting at the University of Maryland

The University of Maryland prepared a report for the U.S. Department of Labor in 1990, titled *Industrial Effects of a Free Trade Agreement Between Mexico and the USA*.[4] The objective was to estimate the effects on the Mexican and U.S. economies of eliminating tariffs and significant non-tariff trade barriers. The report is of interest not so much for the results, which are now dated, but because of the potential for replication of the study with more current data.

The INFORUM researchers linked a 78 sector model of the U.S. economy with a 74 sector Mexican model. The models were constrained with the requirement that the value of U.S. imports from Mexico equaled the value of Mexican exports from the United States. The converse relationships were constrained to hold as well. Each model was constructed to determine domestic employment, production and prices, as well as exports and imports in all sectors.

Table 12.2
Mexican/California Trade Tonnage Forecasts (Thousands of Tons)

Trade Direction	1995	2000	2005	2010
Mexico from California	4,566	5,891	7,715	9,501
Mexico to California	5,292	5,980	9,078	13,455

Source: Southwest Passage Corridor Traffic Analysis, DRI/McGraw Hill and Southern California Association of Governments, June 1997

The purpose of the 1990 report was to analyze effects of trade agreements on both economies, but the models involved could be used for forecasting changing trade patterns over time in the two economies due to other shocks, such as interest rate changes, or due to more gradual effects of such variables as relative price changes, labor productivity, or changes in labor force participation.

The INFORUM methodology differs from other modeling efforts in that the benefits from input-output analysis are combined with the macro features of an econometric model based on regression techniques. The model determines such macro variables as income, savings, interest rates, and employment, but the sources of causation have their foundation in industry specific detail as contained in input-output tables.

Among the 78 sectors in the U.S. model were food, textiles, apparel, steel, copper, and construction. For each sector the model showed output, imports of similar products, and sales of

[4] "Industrial Effects of a Free Trade Agreement Between Mexico and the USA," prepared by the Interindustry Economic Research Fund, Interindustry Forecasting at the University of Maryland (INFORUM), for the U.S. Department of Labor, Clopper Almon, Principal Investigator, September, 1990.

the product to other sectors, to consumers, to government, to export, to inventory, and to capital investment. In the INFORUM model, the total exports for the economy are the sum of the industry specific exports, where exports for each product are determined by industry specific foreign and domestic (relative) prices and foreign demand. Similarly, imports depend on relative foreign and domestic prices and product-specific domestic demand. Current output, imports, and inventory change all depend on each other

Linked to a similar model for Mexico, the two models together were capable of showing various impacts on products (or commodities) as well as on macro variables such as employment, due to changes in tariffs and resulting trade flows. The model could be used for forecasting by developing alternative scenarios for key variables such relative prices in the United States and Mexico.

The INFORUM has not been updated as of this time. However, the approach represents a most desirable feature in the linking of the Mexican and U.S. economies with two models. Further, the input-output approach provides a basis for sectoral detail lacking in other, more macro oriented models. The INFORUM results are for value figures only, however, and do not address any issues relating to volume, mode of transport, or physical trade flows.

Impact of the North American Free Trade Agreement on the U.S. Economy and Industries: A Three Year Review

The U.S. International Trade Commission undertook a study of the effects of NAFTA[5], at the request of the International Trade Representative in April 1997. The report is available on the internet at www.ustic.gov and extends some 500 pages in length. As with the INFORUM study, the ITC report does not address issues of border trade flows, infrastructure needs, or other aspects of the transport of goods. However, the report is worthy of review because of its scope – analysts attempted to model nearly 200 industries accounting for over 85 percent of trade between U.S. and NAFTA partners.

The methodology involved a series of regression equations for exports and imports of each commodity. The objective was to show if, given other factors present influencing shipments of commodities, NAFTA affected exports and imports, employment, and productivity in these industries. Considering U.S. exports to Mexico, the study found exports increased in 13 industries and were not significantly affected in 78 others. Those not significantly affected accounted for 43 percent of bilateral trade. There were 16 import industries where imports from Mexico to the United States increased, and 92 (or 36 percent of bilateral trade) not significantly affected.

The report is an example of a sophisticated application of regression models that should be studied by those interested in gaining a better understanding of trade flows or possible forecasting models. The trade equations used for this study could be converted to at least intermediate term forecasting equations through substitution of forecast values for the variables influencing trade, such as GDP and prices. However, as noted above, there are no volume, conveyance, or transport variables either forecast or considered in this report.

[5] U.S. International Trade Commission, "The Impact of the North American Free Trade Agreement on the U.S. Economy and Industries: a Three Year Review," Investigation No. 332-381, 1997.

Forecasting Freight Traffic to the United States and Mexico

The Center for Transportation Research at the University of Texas at Austin has conducted a number of studies of border trade. This particular report was prepared for the Texas Department of Transportation in August, 1996[6].

The purpose of the study was to develop a model to predict mode and Mexican destinations for shipment traveling from the United States to Mexico. The study included a number of references to past transport modeling work, and is useful for that review of the literature, as well.

The methodology involved application of a statistical modeling approach (a multinomial logit model, which estimates probability) for commodity data from the Bureau of Transportation Statistics. The authors carefully noted some of the difficulties with these data (more detailed discussion of this database is provided below in Chapter 12.4). The study was restricted to three commodities, machinery, electronic goods, and vehicles, and therefore should be considered as a pilot project rather than offering definitive conclusions. Nonetheless, the results showed that using mode, commodity and market attribute as independent variables can yield an effective model for freight decisions. Variables included as important were value of commodity, employment at the destination, population at the destination, and distance traveled.

Although the title of the report implies there are forecasts compiled, the emphasis is on explaining observed historical patterns rather than forecasting into a time horizon of sufficient length to actually make strategic decisions on infrastructure or other programming.

Review of Task 11.5

In Task 11.5 of this study[7], preliminary forecasts were developed that specifically addressed some of the issues decision makers must deal with in planning and programming for expanded trade growth. Although value figures are important in evaluating the overall impact of trade on both the economies of Mexico and the United States, planning for infrastructure requires projections of the volume of tonnage that must be accommodated by the roadways and other facilities serving the transport industry. These preliminary tonnage forecasts are described below.

Barton-Aschman computed value-to-weight ratios for 1995 from reports of the U.S. Bureau of Transportation Statistics. These value-to-weight ratios, computed for each of the Schedule B commodities, are reported in the Task 10 report, *Border State Costs of US-Mexico Binational Trade*, Chapter 10.4. The forecasts for tonnage were developed by (a) converting value to weight, accomplished by applying the value-to-weight ratios of Chapter 10.4 to projections of the value of trade by Customs District and (b) projecting these volumes based on extrapolation of growth rates observed from 1990-1994. The methodology required projecting volume of northbound and southbound trade for each of the 98 Schedule B commodities for each district. The tonnage forecasts are for the three combined surface modes – truck, pipeline and rail.

Southbound volume flows (U.S. exports/Mexican imports) were projected to reach 41,762 thousand tons in the year 2000 (see Table 12.3). The projected tonnage increase is a gain of 12,477 thousand tons by the year 2000 as compared to 1995, the year of the Mexican recession. This volume represents an increase of 42.6 percent for the five year period.

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[6] Fang, Yolanda Y., Harrison, Rob, and Mahmassani, Hani S., *Forecasting Freight Traffic Between The U.S. and Mexico, Research Report 1319-2, Center For Transportation Research, University of Texas, Austin, Texas, August, 1996.*

[7] *Changes in U.S. and Mexican Cross Border Trade Flows by Land Transportation Systems*, Barton-Aschman Associates, January 16, 1998.

In 1995, the Laredo district accounted for two out of every three tons (66.5%) of southbound trade volume. By 2000, Laredo's share will decrease slightly, to 61.5 percent of tonnage. However, the Laredo district will capture nearly 50 percent of the total tonnage increase expected between 1995 and 2000, and will remain the dominant district for both southbound and northbound flows.

El Paso is projected to show the fastest southbound volume growth of any district, with an increase of 78 percent during the five year period between 1995 and 2000. Nogales will also record relatively rapid growth, at 70 percent, but will continue to have the smallest share of southbound trade (6.4 percent) in 2000. The share of trade volume in the San Diego district will decline slightly by the year 2000, to 10.8 percent of the southbound total.

Northbound volume in 2000 (Mexican exports/U.S. imports) is forecast to be 31,852 thousand tons, some 76 percent of the volume of southbound trade (Table 12.4). This pattern was also present in 1995, when southbound volume was 29,285 thousand tons and northbound volume was smaller at 20,447 thousand tons. (Note, however, that northbound value is forecast to exceed the value of southbound trade in 2000; since the devaluation of 1995 the value of Mexican exports to the United States has been greater than the value of imports, creating a positive trade balance with the United States for Mexico).

Table 12.3
Tonnage Forecasts by Custom Districts - Southbound (thousands of tons)

	Tonnage - All Modes				
	San Diego	Nogales	El Paso	Laredo	Total
Tonnage -1995	3,256	1,573	4,995	19,461	29,285
District Share	11.1%	5.4%	17.1%	66.5%	
Tonnage -2000	4,524	2,676	8,895	25,668	41,762
District Share	10.8%	6.4%	21.3%	61.5%	
Tonnage Change	1,268	1,103	3,900	6,207	12,477
Percent Growth	38.9%	70.1%	78.1%	31.9%	42.6%
Share of Growth	10.2%	8.8%	31.3%	49.7%	

Source: Barton-Aschman and Arizona State University, derived from US BTS data.

Table 12.4
Tonnage Forecasts by Custom Districts - Northbound (thousands of tons)

	Tonnage - All Modes				
	San Diego	Nogales	El Paso	Laredo	Total
Tonnage -1995	2,949	3,157	2,812	11,559	20,447
District Share	14.4%	15.4%	13.7%	56.4%	
Tonnage -2000	5,117	4,184	5,804	16,747	31,852
District Share	16.1%	13.1%	18.2%	52.6%	
Tonnage Change	2,168	1,027	2,992	5,188	11,375
Percent Growth	73.5%	32.5%	106.4%	44.9%	55.6%
Share of Growth	19.1%	9.0%	26.3%	45.6%	

Source: Barton-Aschman and Arizona State University, derived from US BTS data.

The San Diego and Nogales districts have a larger share of northbound trade volume than they do of southbound trade. Again, Laredo is the dominant district, with 52.6 percent of northbound volume in 2000. However, El Paso's tonnage is expected to double between 1995 and 2000 and El Paso will account for more than one fourth of the additional northbound tonnage recorded during the five year period.

The forecasts developed for Task 11.5 provide an illustration of the trade-offs between costs and complexity. The methodology is a time series approach, simple trend extrapolation, rather than multiple regression analysis where volume is determined by such demand factors as income and relative prices of goods. However, the data involved 98 commodities for 4 Customs Districts, both northbound and southbound, for a total of 784 variables. The time and costs of estimating 784 separate regression equations are significant. The ITC study noted above which estimated approximately 400 regression equations lists more than 50 analysts as participants in the overall effort. However, it is well known that trend extrapolation methods lose accuracy rapidly as they are extended into the future, and undoubtedly many of the forecasts for 2000 computed in Task 11.5 will be too high or too low.

12.3.2 Mexico

In order to determine the status of Mexican forecasts and/or forecasting models of trade flows across the U.S.-Mexican border, the consultants utilized a literature review, personal interviews, and a survey of government officials in each of the border states. The results of these efforts indicate that no such forecasting models have been developed and that no Mexican entity currently produces the type of forecasts of U.S.-Mexican trade flows that are desired for transportation planning. While aggregate national trade forecasts for Mexico are currently prepared by specialists in the field, the search also revealed that, with few exceptions, these national forecasts were not being used as input for forecasts of U.S.-Mexican border trade.

Educational Institutions

The economics collections (including theses completed within the past four years) of the major universities in the metropolitan Mexico City area were searched for materials relating to U.S.-Mexican trade. This exercise found a broad variety of documents on NAFTA-related topics, primarily relating its economic effects and growth of global trade. Some of the publications did focus on specific issues relating to the border region but did not provide specific information about trade forecasts. In some cases, the materials did address the development of econometric models, but they did not include listings of actual models or forecasts produced by the models. In addition, a search of a research data bank at the Autonomos University of Mexico (Universidad Autonoma de Mexico-UNAM), which is linked with several other research schools, did not uncover references to Mexican research studies on forecasts or forecasting models of border trade flows

Members of the academic staff from the Graduate Economics Program at UNAM were also interviewed concerning the current status of the forecasting border trade flows. They had no knowledge of any current academic research studies within Mexico relating to border trade flows.

Private Sector Firms

The main publications of the two major consulting firms in Mexico specializing in economic forecasting were reviewed. These publications were found to contain national-level forecasts of aggregate macroeconomic variables and analyses of specific economic sectors but not forecasts of variables for individual states. Neither of the two major economic forecasting firms currently

provide forecasts of border trade flows to their subscribers, nor have they developed specific models to forecast border trade flows[8].

In an interview, an official of one of the major forecasting firms said that the firm had plans to develop a new forecasting product but that it would have a sectoral emphasis and would not include regional forecasts. He also stated that development of regional forecasts would require a large effort and would not be undertaken until they are convinced that a market exists for such forecasts.

It must be recognized that any forecasts developed by private consulting firms cannot be considered as official figures and are typically only available for use by the firms' clients. If and when proprietary regional forecasting models are developed for the Mexican border states, their forecasts of border trade flows and other economic variables would be useful to the U.S.-Mexican border transportation planning process, and it may well be worthwhile for federal/state transportation agencies to become subscribers.

Government Agencies

This phase of the investigation allowed the consultants to complete an inventory of information collected during other tasks of the study. This review of governmental publications found no trade flow forecasts or published research relating to forecast models of U.S.-Mexican trade at either the national or regional level. Most of the references related to this topic were publications of the National Institute of Statistics, Geography and Infomation (Instituto Nacional de Estadistica Geografia e Informacion-INEGI). Most of them contained historical data, with the most recent information providing figures for the previous year and preliminary estimates for the current year. In general, this review revealed that data collection and analysis related to international trade by official agencies other than INEGI is limited and is focused on national rather than state-level data.

Interviews were conducted with officials responsible for data collection and statistical analysis at the Bank of Mexico (Banco de Mexico), the Secretariat of Commerce and Industrial Development (Secretaria de Comercio y Fomento Industrial -SECOFI), and the SCT.

Officials in each of the border states were surveyed by both phone interviews and a mail questionnaire. Use of the mail survey allowed the collection of comparable information from all sources. After distribution of the survey, a second phone interview determined that none of the state governments were able to provide detailed responses to the survey because they were not using trade or traffic forecasts as a decision-making tool in their planning. For those cases in which relevant activities were found, however, a more in-depth interview was conducted to collect more detailed information.

<u>Bank of Mexico (Banco de Mexico)</u>

Interviews with officials from different areas of the Center for Economic Investigations (Direccion General de Investiagciones Economicas) confirmed that the Bank does not produce forecasts of border state trade. The Bank does compile some statistics relating to border crossings and border trade flows. But this is apparently only a partial database, since it includes only the number of individuals leaving but not those returning to Mexico, for example. The officials indicated that the Bank has an interest in tracking foreign trade at the national level and does produce unpublished

[8] The two consulting firms whose publications were analyzed were Macro Asesoría Económica y Grupo de Económistas Asociados (GEA). The publications consulted (analyzed) were: "Macroperspectivas" y "Macrocoyuntura" from the first consulting firm, and "GEA Eonómico", "GEA Sectorial" y "Prospectiva GEA" from the second. As mentioned previously, none of the publications contemplate trade flow forecasts by state.

forecasts at a national level for internal use. Information about the methodology used to produce these forecasts could not be obtained.

Secretary of Commerce and Industrial Development (Secretaria de Comercio y Fomento Industrial -SECOFI)

Interviews conducted with officials of the Subsecretariat of International Commercial Negotiations (Subsecretaria de Negociaciones Comerciales Internacionales) indicated that the agency does not have any systematic forecasting program. In cases when forecasts are required, the staff assigned to that specific case are responsible for their development, and each case may employ different methods. At the present time, such forecasts have been focused on global commerce and aggregate trends in trade with the United States and Canada associated with NAFTA. No forecasts relating to border state trade flows have been prepared. One official also indicated that there is a joint forecasting effort with the Center for Information and Statistics (Direccion General de Informacion y Estadistica), but the specialized personnel contracted for the work have not yet accomplished their task.

Secretariat of Communications and Transportation (Secretaria de Comunicaciones y Transportes-SCT)

Within the SCT, interviews were conducted with officials from the Center for Planning (Direccion General de Planeacion). Their responses indicated that the agency did not currently have forecasting models for traffic flows at border crossings or on federal highways and did not contemplate producing such forecasts in the future. The agency did provide access to forecasts previously developed for the SCT by consultants. These documents included ten-year national level forecasts (based upon the Bank of Mexico import and export classifications). These forecasts were produced from multiple regression models, using macroeconomic variables, but were not integrated into an overall econometric model. In addition, the analysis considered the impacts of traffic volumes on border crossings.[9] However, these forecasts have not been updated, and there are no continuing forecasting efforts by the department.

The national-level models developed for the SCT are not applicable to forecasting border trade flows, because the border states' characteristics are much different from the rest of the country, and disaggregated state-level historical data are not available for the variables used in the regression models.

State of Sonora

Information collected during interviews with officials of the Planning and Information Studies Department of the Subsecretariat of Economic Planning and Productivity (Area de Planeacion e Informacion de Estudios in the Subsecretaria de Desarrollo Economico y Productividad) indicated that Sonora is one of the border states that is concerned with medium and long term foreign trade planning. The agency has efforts underway to collect information and to identify feasible methodologies for the development of forecasting models, but to date no models that forecast trade flows have been developed. A recent joint study conducted with the University of Sonora

[9] The economic variables analyzed were exchange rate (pesos for dollars) and Gross Domestic Product (GDP). In addition, data base information from customs by port of entry, transportation mode used, type of product (commodity) were used. The construction of the equations considered as a maximum two independent variables to explain the dependent variable, however, the functions were not able to articulate within the simultaneous equation model. For this reason, the forecasts obtained could have a long term error margin.

(Universidad de Sonora) and the Technological Institute of Higher Studies (Instituto Tecnologico y de Estudios Superiores) has examined the selection of variables to be used and other aspects of formulation of forecasting models.[10]

State of Tamaulipas

The point of contact was the Project Evaluation Department (Subdireccion de Evaluacion de Proyecto), within the Infrastructure Project Department (Direccion de Proyectos de Infraestructura), which is part of the State Secretariat of Economic Planning (Secretaria de Desarrollo Economico del Estado). Officials of that unit indicated that information on vehicular traffic flows across bridges under Federal Toll Highways and Bridges (Caminos y Puentes Federales-CAPUFE) jurisdiction is available but that no data relating to the flow of people or traffic flows across privately-owned bridges is collected. The vehicular traffic data is collected by CAPUFE and provided to the agency. The information is available from 1983 to the present, and is classified by number of axles. While it is recognized that this is an important statistical series, the state has not developed models for forecasting traffic flows. When needed, simple projections are produced based on average growth rates.

[10] It was not possible to obtain a copy of the document mentioned. The Planning Department from the state did not give the exact name of the study conducted by both academic institutions.

State of Baja California

Interviews were conducted with two agencies: the Office of Urban Planning (Direccion de Planeacion Urbana), part of the Secretariat of Urban Development (Secretaria de Desarrollo Urbano), and the Office of Statistics (Direccion de Estadisticas) in the Secretariat of Economic Development (Secretaria de Desarrollo Economico).

The Office of Urban Planning has the responsibility of monitoring traffic flows using data from traffic counts conducted by the SCT and Customs. The information is compiled as an input for urban planning but no forecasts are developed. The agency indicated that economic and equipment limitations have been the main reasons for not developing forecasts.

The Office of Statistics is in charge of tracking economic activity in the state but does not currently prepare forecasts and has not formulated any forecasting model. The department indicated that it is in the process of identifying a consulting firm to assist them in the development of social accounting system and an input-output model for the state. They indicated that with this support that they also expect to be able to develop forecasting models for the state's main economic variables, including trade flows with the United States at some point in the future.

State of Chihuahua

Information for the survey was provided by the office of the Center of Studies and Information (Direccion del Centro de Informacion y Estudios), which is part of the Secretariat of Economic Development (Secretaria de Fomento Economico). This department is responsible for compiling information for the state and the development of statistics measuring state economic activity. To do this, the agency analyzes the behavior of the different sectors (primary, secondary, and tertiary) of the local economy. However, the unit has not developed a model that would produce forecasts of trade flows with the United States or the rest of the world as part of these activities. For exceptional cases where forecasts of state economic variables are required, the department relies upon techniques based upon projecting existing trends.

According to responses during the interview, the department does not contemplate undertaking any efforts to develop a forecasting model in the near future.

Nuevo Leon

In Nuevo Leon, information was gathered from two sources: a state office, the Office of International Projects (Direccion de Proyectos Internacionales) of the Economic Development Secretariat (Secretaria de Desarrollo Economico-DPI); and the Fiduciary for the Northern Development of the State (Fideicomiso para el Desarrollo Norte del Estado-FIDENOR).

The DPI indicated that they focused on information relating directly to their investment projects rather than state trade variables. The department does not track border traffic information. Agency officials also said that they do not currently produce forecasts of any state economic variables and that there are no plans in the short term to develop any economic models.

The officials in charge at FIDENOR had only recently been incorporated into that office and were not able to provide information regarding the agency's forecasting activities. Traffic flow data were available, but the officials interviewed were not familiar with their source(s).

State of Coahuila

This was the only state where it was not possible to secure information relating to availability of forecasts and/or forecasting activity. Several attempts were made to establish communication with the SCT but they were unsuccessful.

Conclusions and Recommendations

One of the main results of the survey is the discovery that not all of Mexico's border states seem to be concerned about having all of the support elements for decision making in planning for the future growth of trade and traffic flows at their borders. Even for those states which did indicate concern for having forecast information for their planning process, the current efforts are still insufficient to produce the desired results.

According to the people interviewed, one of the main obstacles to reaching their objectives is the lack of sufficient economic and equipment resources within the state government to undertake the substantial task of developing a forecasting capability. Other causes identified include lack of awareness of information available from federal agencies and the unwillingness of the federal agency to share the information—both factors primarily due to a lack of coordination between levels of government.

The development of econometric models is an activity that requires substantial expertise. Since the secretariats in the border states do not appear to have personnel with experience in this activity, it may be more efficient for them to contract with an experienced private firm to develop their forecasting model. (This approach is currently being attempted in Baja California.) After the model is operational, the firm could then train staff of the public agency to operate the model, making them aware of the importance of the need for data collection and periodic updating of the model. With this approach, it would not be necessary to either create a new forecasting department in each state's secretariat or to significantly increase personnel within the current structures.

Based upon the survey, there seems to be little concern within the major educational institutions in Mexico concerning the border states' trade activities with the United States. Another possible approach would be to take advantage of the expertise available among university researchers through the establishment of agreements between the universities and public agencies for the development of state forecasting models. (There is one example of this approach in Sonora.)

Finally, there are several factors favoring the development of a general methodology for the creation of state-level econometric models. The development of such models would be a valuable tool supporting short-, medium-, and long-term planning activities in the states along the U.S. border, where long-term planning tends to be based upon a six-year cycle. A major part of the work needed to get the process of development underway is the creation of adequate communication between the different federal and state government agencies in Mexico, thereby allowing the efficient exchange of information.

12.4
Evaluation Data Sources and Needs

12.4.1 The U.S. Perspective

Previously the Binational Transportation Planning and Programming Study has pointed out many of the shortcomings of available data on border trade. The ideal series for border infrastructure planning would be number of conveyances by road and transport, supplemented by weight and value information, tallied by each border crossing port. However, such data do not exist, and are not likely to be available in the near future.

One restriction on data is the unwillingness of those involved to collect the data needed for forecasting and planning. Government agencies that collect transportation data are usually mindful of the need to avoid disclosure of information relating to scale of operation, methods of distribution, and other details that could lead to a breach of confidentiality. Yet, planners and analysts hoping to maximize the benefits of public investments have a need for freight flow information much more detailed than currently available.

Freight flow data from government sources for U.S. exports to Mexico and imports from Mexico have been available on a monthly basis since April 1993. This approximately 5 year period of data is made up of 60 monthly or 20 quarterly observations. This data set is known as the Transborder Surface Freight Data, maintained by the Bureau of the Census under contract to the Bureau of Transportation Statistics.

There are an adequate number of observations for standard time series forecasting methods such as smoothing techniques. Thus, short term forecasts could be produced that would be reliable for perhaps one or two years ahead. The 20 quarterly observations represent a minimum for multiple regression equations of the type used by the ITC in the 1997 study mentioned above, and these would be more reliable for longer term forecasts.

Below, the BTS data considerations for forecasting for planning and programming are discussed, first for U.S. exports/Mexican imports and then for U.S. imports/Mexican exports. Table 12.5 shows the various tables available from the BTS for U.S. exports/Mexican imports (tables are numbered 3A, 3B, 5A and 5B in the BTS data available to researchers from the internet).

Data available for export variables are less accurate than for imports due to the U.S. emphasis on enforcement of illegal cargo. The Census Bureau works with export documents as received, but does perform some edits and corrections to produce the following variables. There are no weight figures in the export data, which introduces difficulties for forecasting of roadway costs and measuring the number of conveyances.

Mode of Transport

The modes of transport include truck, rail, pipeline, mail and other. This variable is important for planning and programming, since a movement to a higher proportion of goods by rail, for example, would have implications for roadways and other infrastructure as well as staffing, congestion, and the environment.

Table 12.5
Monthly BTS Data Availability for US Exports/Mexican Imports

Data Elements	BTS DATABASE TABLES U.S. Exports/Mexican Imports			
	3A	3B	5A	5B
Mode of Transport	Yes	Yes	Yes	Yes
Schedule B. Commodity Code	Yes	Yes	No	No
U.S. State of Origin	Yes	No	No	No
U.S. State of Exporter		Yes		Yes
Mexican State of Destination	Yes	Yes	Yes	Yes
Value	Yes	Yes	Yes	Yes
Weight	No	No	No	No
District and Port of Export	No	No	Yes	Yes

Source: Based on review of data tables produced by U.S. Census Bureau for Transborder Surface Freight Database of the Bureau of Transportation Statistics

Mode of transport should be analyzed for each border crossing, but it is most likely that changes will occur slowly over time, and therefore a simple trend analysis of proportionate shares to truck, rail, etc. could well be adequate for planning purposes. However, this is a hypothesis which should be tested by analysis of shares, especially in recent years.

U.S. State of Origin

The U.S. state of origin is the state from which the shipment starts its journey to the port of export. For many large agricultural and bulk shipments, the state may actually reflect the consolidation point or port of exit. The initial impression of those studying the data is that state of origin is the true locus of where the goods were grown, manufactured or produced. However, the state of origin may also represent the mailing address of the U.S. exporter or may be the location of an intermediary such as a wholesaler, retailer, or distributor.

Given the poor reliability of this variable, it does not seem practical to attempt to forecast state of origin. It is also not clear that there is a need to do so for planning for border crossing infrastructure improvements. Undoubtedly, where a product came from and where it is destined are important aspects of trade flows, but given physical characteristics of the terrain, the location of industries, and the likelihood that choice of border crossing changes very slowly, this variable seems less important than some others.

This conclusion to de-emphasize this variable may not be easily accepted by all observers, since the state of origin information is widely cited by state agencies and publicized as evidence of the involvement of states in export activity. The two well known documents that are produced from this variable are the *State of Origin of Movement Series* and the *State of the Exporter Location Series*. More information on these data series is available at the International Trade Administration website at the following address:

http://www.ita.doc.gov/industry/otea/state/state_ex.html.

U.S. State of Exporter

Similarly, the U.S. state of exporter variable is the state of the U.S. exporter who is responsible for initiating the export shipment. This may not be the actual exporter or may be a different address from that of the locus of production. Again, it is probably not practical or useful to attempt to emphasize this variable in forecasts for planning and programming.

Commodity Code (Schedule B)

This variable is the Schedule B commodity classification number as published in the *Schedule B, Statistical Classification of Merchandise Exported from the United States.* the Schedule B for exports is based on the international Harmonized System, as is the Harmonized Tariff Schedule of the United States Annotated (TSUSA) which is used for duty and statistical purposes for imports. Therefore, the import and export codes are essentially the same at the 2-digit level.

The commodity codes are important for examining different commodities that cross at the respective gateways in any given time period, but it is less certain that forecasts by commodity are necessary for long term planning. This issue is addressed below.

District and Port of Export

The customs port where the shipment is cleared for export represents the last customs port cleared. Additional port detail was added to the data set with the January 1997 data month. Mexican border Customs Districts now include all public ports. Knowledge of the point of exit from the country is important for planning since this is the basis for resource allocation decisions about infrastructure, staffing, development of trade corridors, and long term capital investment. Forecasts reported should be by port crossing to be most useful for planning.

Mexican State of Destination

The Mexican state of destination is the state in which the ultimate consignee is located in Mexico, and is not necessarily the state of final destination. Census captures the data field for the Mexican state of destination (or MEXSTATE) from the ultimate consignee's address. Knowing where a shipment is going in Mexico is not as important as knowing where it actually crossed the border. Given difficulties with this variable it is of lesser value in forecasting.

Value vs. Weight vs. Conveyances

The value of the goods for export is the selling price plus insurance and freight at the U.S. port of export. The value, as defined, excludes the cost of loading the merchandise aboard the exporting carrier at the port of export and also excludes freight, insurance, and any charges or transportation costs beyond the U.S. port of exportation. Value is a fundamental driver of resource decisions, but weight is not recorded on export shipments. Therefore, analysts must convert value to volume in order to forecast volume.

Barton-Aschman has developed a method for converting U.S. export value to weight through construction of conversion tables for selected years. To be most useful, such tables should be computed for each month or quarter (depending on the periodicity of the data used) and forecasts would then be made for volume as well as value. However, knowing volume may not be sufficient for planning and programming as envisioned as part of the Binational study. There should also be a count of conveyances either recorded or estimated. Since this series is not maintained by U.S. officials, procedures are needed to estimate truck and rail cars associated with various shipments by commodity and value. A review of approaches to determining the relationship between value and equipment needed to convey the shipments is set out in the Task 14 report

Methodologies for Developing Estimates of Costs and Benefits for Assessing Transportation Impacts of U.S.-Mexican Trade, in Chapter 14.5.

Table 12.6 shows data available from the BTS Transborder Surface Freight Database for northbound goods crossing into the United States (U.S. imports/Mexican exports).

The import tables in this data series represent general imports and include imports for immediate consumption and imports into bonded warehouses or foreign trade zones under Customs control.

Several variables are similar for imports and exports, including mode and commodity type (imports are classified by the Harmonized Tariff Schedule of the United States Annotated (TSUSA) based on the International Harmonized System). There is no Mexican state of origin data for U.S. imports, but as noted above, this may not be essential to the planning and programming process.

U.S. State of Destination

The U.S. state of destination for imports is taken from the importer's address, where the "importer" is the party making payments for duties. Therefore, the state may not always represent the physical destination of the import goods, since the importer's address may not necessarily be the same state as the destination of the goods.

District and Port of Entry

This field identifies the Customs port where the entry documentation was filed with Customs and the duties paid. It may not always reflect the port where the shipment physically crossed the border into the United States. This is because, under current Customs regulations, importers may file import documentation at one port while the shipment actually enters at another port. Knowledge of future flows through ports of entry is vital to the planing process. Efforts to fine tune the data process to make these records more accurate can help the planning process. Forecasts will be most useful if they accurately relate to port of entry.

Table 12.6
Monthly BTS Data Availability For U.S. Imports/Mexican Imports

	BTS DATABASE TABLES U.S. Imports/Mexican Exports	
Data Elements	**9**	**11**
Mode of Transport	Yes	Yes
TSUSA Code	Yes	No
U.S. State of Destination	Yes	Yes
Value	Yes	Yes
Weight	Yes	Yes
District and Port of Export	No	Yes

Source: Based on review of data tables produced by U.S. Census Bureau for Transborder Surface Freight Database of the Bureau of Transportation Statistics

Value and Freight Charges

Import figures include Customs value or the value of merchandise for duty purposes, usually the selling price in Mexico, the foreign country of origin. They exclude freight costs, insurance and

other charges incurred in bringing the merchandise from the foreign port of export to the United States. These are entered and available as a separate data series, measuring the cost of freight and insurance from the origin point in Mexico to the U.S. border. Value is again an important forecast variable for planning and resource allocation decisions.

Shipping Weight

Since 1995 Customs has reported shipping weight in kilograms for Mexican shipments for all surface modes of transportation. For calendar year 1996, transshipment weights were included for products imported into the United States through Canada or Mexico from a third country. Transshipments were removed for 1997 and reported separately. However, since transshipments represent border crossing flows and activity, they should be included in any forecast produced. As noted above, the ideal data for programming would be the number and characteristics of conveyances, and conversion tables should be developed until these data are collected directly.

12.4.2 The Mexican Perspective

One result of work performed on previous tasks has been the identification and evaluation of the statistical data (and the sources of these data) that would be required to develop forecast models for trade and traffic flows for the border states of Mexico. While some of these data, such as national level import and export figures, are published or otherwise accessible, a portion of the variables are not available for public use. Thus one of the first steps in the process of developing border trade models would be agreement among the several agencies that control these data (federal agencies, such as the office of Customs (Direccion General de Aduanas), the SECOFI, the Bank of Mexico, SCT, and agencies from the border states) to provide the information to an agency that would have the responsibility of developing models to produce short- and medium-term forecasts of goods, people, and traffic flows through U.S.-Mexican border crossings. Based upon the assumption of such an agreement, the following is a list of the main variables to be incorporated in these forecast models:

Import and Export Figures

The SECOFI database could serve as the primary source of these data. For accurate state models, the methodology currently used to classify origin and destination in the SECOFI import and export data must be modified. This classification is vital to producing trade figures by state, but currently the decision criteria are based upon the location where a company is registered with the Secretariat of the Treasury (Secretaria de Hacienda y Credito Publico-SHCP), not necessarily the true origin or destination of the international shipment. To improve the classification process, it would be necessary to work closely with the SHCP to improve the current system, or SECOFI must give representatives of the states the task of establishing more suitable mechanisms for classification.

Regardless of the current limitations of these data, these series are fundamental to the development of a trade forecasting model. Monthly data for 1993 through the first months of 1997 (with the exception of a few months which could not be recovered), with an increase in fields in the database have already been collected as part of this study.

Commodity Figures

In some tasks, measures of the values and/or volumes of commodities were used in the analyses of growth in demand for cargo transportation. Measures of goods production or sales are important variables for use in forecasting models, and efforts should be made to collect detailed data on both values and volumes of production by sector and activity within the border states.

Based upon the experience in other studies, the sector requiring the most effort will be the manufacturing sector due to difficulties in calculating state-level data. Such information is simpler to obtain for the primary sector, since production data is generally available from a federal agency.

Traffic Counts

The SCT database has detailed historic data on traffic flows for at least four years at each of the border crossings by type of vehicle and number of axles. These data could be aggregated to the state level and used immediately to develop state traffic flow models. The data are publicly available in SCT publications and are released with a moderate lag (approximately one year for published data). In some states, this information is available from the corresponding state agency. This simplifies access and makes it possible to obtain the information more quickly for use in the forecasting models for those states.

Person Flows

There are only two source agencies for information on the numbers of people crossing the U.S.-Mexican border: the Bank of Mexico and the National Institute of Migration (Instituto Nacional de Migracion-INM).

The Bank of Mexico data are based upon a survey of a sample that probably is not representative for the purposes of this study. In addition, the survey information is considered confidential so that it might be a complicated process to obtain access to the final results and the database.

In the case of the INM's information, both access to the data and its consistency are open to question. The INM's information is also considered to be confidential due to fact that it includes the migration status of the individuals. In addition, it was not possible to determine whether the data are available in an electronic format.

Macroeconomic Variables

A variety of economic measures would be needed as explanatory variables in the forecasting models. Key macroeconomic variables would include the exchange rate, the national consumer price index (it would also be feasible to incorporate price indexes for some border cities depending upon the availability of the information from the Bank of Mexico), the producer price index, and measures of real gross domestic product (producto interno bruto-PIB) by sector and activity.

Historic time series of these variables are readily available from public sources, and current figures for most data series are released with minimal lag (no delay for exchange rates, inflation measures lag only fifteen days, and PIB with a one quarter lag, for example). These measures are widely used by specialized consulting firms to develop forecasting models, so that considerable prior knowledge about the expected parameter values for these variables is available.

State-Level Variables

The Secretariats of Economic Development in each state have access to a wide range of specific information related to their states (number of companies by sector, detailed measures of economic activity, foreign and domestic investment, expected growth, changes in land use, etc.), whose variety is beyond the scope of this study to list in detail. However, the inclusion of some of these state-specific measures into the forecasting models would allow a more specific regional or state character and capture unique features of each state's economy. For use in the forecasting models, time series of consistent historical data must be available for these state-level measures.

12.5
Evaluation of Available Forecast Models and Methods

Planning and programming decisions to accommodate needs of expanded border trade flows must be founded on a broad base of information. Some of this information is descriptive in nature – which goods cross the border, the value of these goods, the volume, where they cross, and how they cross.

Other necessary information is more analytic – why do goods cross the border? While the question may be answered correctly in somewhat simplistic fashion ("goods cross to get to the other side"), this answer masks deep complexities. Economists would tend to argue that goods move in response to demand. Therefore the best way to look at border trade is as imports, not exports, since exports are only undertaken to supply the demand for imports of a trading partner. Demand is driven by price and ability to pay, so the value and volume of goods crossing the border is determined in large part by changes in relative prices and incomes of importers. But in a global economy the influence of competing sources for goods, the existence of regulations such as tariffs and other non-tariff restrictions, and different business cycles for different regions and nations confounds analysis of trade flows.

While explanation of why trade flows are as they are is complex enough, the challenges of forecasting border trade are exponentially greater. This section reviews the information available to transportation planners, and points out existing gaps in knowledge and tools.

12.5.1 Global Economic Outlook

Table 12.7 shows the forecast information that would be most helpful for planning for border trade. The first need is to have an understanding of how the U.S. and Mexican economies relate to the rest of the world. Economic effects are now transmitted more quickly from one nation to another and economic shocks in one portion of the globe can affect trade and economic cycles in regions thousands of miles away. Planning for growth and development in U.S.-Mexican trade must be undertaken in the context of an international economic network of interdependent nations.

There are a number of excellent sources, on the global outlook including the Organization for Economic Cooperation and Developments (OECD) forecast and analysis of 25 member and important nonmember countries *OECD Economic Outlook*[11]; the World Bank's review of developing countries, *World Development Report*[12]; the comprehensive International Monetary Fund (IMF) report and forecasts for all of the world economies in *World Economic Outlook*[13]*;* the private by-subscription publication with the same name but produced by WEFA*, World Economic Outlook*[14]; DRI's *World Markets Overview*[15]*; and the UN's World Economic Survey*[16]*.*

Table 12.7
Forecasts for Border Trade Planning and Programming

Forecast Category	Sources for Forecast

[11] Organization for Economic Cooperation and Development (OECD), Paris, issued in June and December.
[12] The World Bank, Oxford University Press, New York, annual.
[13] International Monetary Fund, Washington, DC, issued in May and October
[14] WEFA Group, Eddystone, PA, issued quarterly
[15] DRI/McGraw-Hill, Lexington, MA, issued quarterly.
[16] United Nations, New York, annual.

Global Outlook	OECD, World Bank, IMF, WEFA, DRI, UN
U.S. Outlook	DRI, WEFA, OMB, CBO, Blue Chip Economic Indicators
Mexican Outlook	DRI, WEFA, Secretaria De Hacienda Y Credito Publico, Bank of Mexico
U.S. Imports from Mexico - Value	DRI, WFA
Mexican Imports from United States - Value	DRI, WEFA
U.S. Imports by Port - Value	Not available - distribute from total value based on trend of shares/growth rates by port
Mexican Imports by Port - Value	Not available - distribute from total value based on tend of shares/growth rates by port
U.S. Imports by Port - Value By Commodity	Not available - short term forecasts from time series methods; long term forecasts from econometric model
Mexican Imports by Port-Value by Commodity	Not available - short term forecasts from time series methods; long term forecasts from econometric model
U.S. Imports by Port - Weight	Not available - short term forecasts from time series methods; long term forecasts from econometric model
Mexican Imports by Port - Weight	Not available - convert value to weight, short term forecasts from time series; long term from econometric model
U.S. Imports by Port - Weight by Commodity	Not available - short term forecasts from time series methods; long term forecasts from econometric model
Mexican Imports by Port-Weight by Commodity	Not available - convert value to weight, short term forecasts from time series; long term from econometric model
Southbound by Port - Conveyances	Not available - convert weight to conveyances, short term forecasts from time series; long term from econometric model
Northbound by Port-Conveyances	Not available - use conveyance data for short term forecasts from time series; long term from econometric model

12.5.2 U.S. Economic Outlook

Trade between Mexico and the United States is linked not only to the world economy, but even more directly to the economic health of each of these individual trading partners. As U.S. output rises, higher incomes in the United States have historically been associated with increasing imports from all sources. As a leading trading partner, Mexico can expect production and exports to rise when the U.S. economy is expanding.

There are a number of long-standing sources for information about the long and short term economic outlook of the United States. Public sources include agencies such as the Office of Management and Budget, the Congressional Budget Office, and the U.S. Department of Commerce. Private sources abound, including WEFA, DRI, and the 50 forecasters referenced each month in Blue Chip Economic Indicators (Capital Publications, Washington D.C.).

12.5.3 Mexican Economic Outlook

One of the driving forces of international trade is differential prices. The rise and fall of the Mexican peso affects competitiveness and influences the decisions not only of consumers, but also producers who use traded goods as intermediate inputs in the production process. A change in relative prices which makes Mexican goods less expensive will tend to increase northbound flows from Mexico to the United States, while higher prices for Mexican goods will reduce northbound trade. Rises in Mexican incomes will tend to increase southbound flows, if everything else is equal. Thus, knowledge of the likely course of the Mexican economy is crucial to planning for border trade.

Although Mexico is an important trading partner of the United States, the overall value of both northbound and southbound trade are but a small proportion of total U.S. GDP. However, Mexican

exports to the United States in 1997 were one quarter of total Mexican GDP. The relative importance of border trade in the two economies underlies the general absence of Mexican trade in U.S. economy models. U.S.-Mexican trade flows are not forecast by either the U.S. Department of Commerce or the U.S. Treasury Department, the Federal Reserve Board, or the Congressional Budget Office.

Private sources that study both economies concurrently include DRI and WEFA. Both of these sources produce detailed econometric analyses for both nations. The official Mexican source for forecasts of the Mexican economy is SHCP. A forecast is issued at the end of each year as an official government planning instrument for the year ahead.

12.5.4 U.S.-Mexican Imports by Port – Value

Forecasts by value by port of entry are not available at this time to planners and decision makers. However, such forecasts could be developed for the short term time horizon by using the forecasts for imports as reported by DRI or WEFA and distributing these over the ports of entry based on historical shares and recent trends in growth rates of these shares. Such an approach would not be accurate for longer term forecasts (two or more years time horizon). Longer term forecasting requires econometric equations relating trade value to other economic indicators which can in turn be predicted and analyzed.

12.5.5 U.S.-Mexican Imports by Port – Value By Commodity

Forecasts by port of entry by value by commodity are not available at this time, although historical series are available. Short term forecasts could be developed from simple time series methods (emphasizing trend and cycle). This would require, as noted above, 98 forecasts in each direction multiplied over all ports of entry. For the 4 border Customs Districts this would be 784 projections, and if individual ports of entry were to be included the number of forecasts would be greater. However, the number of forecasts could be reduced by only forecasting the top 15 commodities, which typically account for 75 to 90 percent of all trade activity by value. Longer term forecasts for long term planning would require more sophisticated regression models that developed a structural relationship between border trade and causal economic variables such as income, prices, and prices of substitute.

12.5.6 U.S.-Mexican Imports by Port – Weight and Weight by Commodity

Weight forecasts for imports are not consistently available. Import weights are collected by the United States and incomplete weight data are collected by SECOFI. Until such figures are systematically collected, estimates by weight could be developed from conversion tables based on weight to value for imports from Mexico to the United States. Then time series methods could be applied for short term forecasting. Again, more accurate long term forecasting of weight by border crossing would require economic models.

12.5.7 Southbound/Northbound Conveyances

Figures on conveyances are not available moving southbound, but the United States Customs Service maintains counts of northbound trucks. However, there is no weight nor commodity record by truck. Whether fully loaded, less than fully loaded, or empty, there is a congestion factor associated with number of conveyances even without knowing weight information.

Once again these series could be forecast northbound by time series methods in the short term and econometric equations could be tested for longer term forecasting.

12.5.8 Conclusions

The border (trade related) transportation planning and programming process requires knowledge of global economic trends for growth and trade on the macro level. Closer to home, decision makers looking at programming decisions for each side of the border must also understand each nation's economic health and stage of the business cycle.

Decisions to allocate resources, change procedures, and implement programs depend on at least a bare-bones set of projections on what the volume of trade will be, where conveyances are likely to cross, what they will weigh, and how many there will be. What they are carrying, where they have come from, and where they are bound are less critical. Over the very long term – 10 to 20 years – the commodities, their source of production and destinations may change greatly in response to technological change and what happens in global markets.

Good quality forecasts of global and national economic indicators such as GDP, the trade balance, growth in exports and imports as a proportion of the economy are available at reasonable cost. There is no evident need to commission extensive efforts to forecast these macro indicators for either the United States or Mexico.

But, once past the macro level, forecasts of border crossings by value, by weight, by conveyance, are simply not available. Increasingly reliable data to forecast some of these variables are available, but at this time no overall forecasting effort is underway or even in the planning stages.

The review of the data and evaluation of forecasting methodologies in this chapter suggest that simple time series forecasts could be produced that would provide much more information that is currently available. Methodologies for forecasting short term value and weight are available, and reasonably reliable. Such models would emphasize trend, seasonal, and cyclical components. When these models become better understood – and as the data improve – a transfer of forecasting efforts to econometric models of trade could take place, resulting in forecasts better suited to the longer term needs of planners and decision makers.