Chapter 2
The 2002 Washington Input-Output Table: Methodology and Data

The 2002 Washington Input-Output (I-O) Study was based on a combination of data sources. The first step involved defining the sectors to be used in model development. The second step was development of a survey of establishments; the survey was conducted under contract from the Office of Financial Management (OFM) by the Washington State Department of Employment Security. Simultaneously, output, value added, and employment were estimated for each sector. Data sources for the estimation are: the 2002 Economic Census, the Bureau of Economic Analysis state employment, income, and gross domestic product by state series, and other miscellaneous reports from trade associations and government.

The benchmark 2002 U.S. Input-Output Table was aggregated to the same sectoring plan as used in this 2002 Washington Input-Output table, and was adjusted to provide initial estimates of inter-industry structure for the state. Finally, careful analyses of sales and purchases patterns obtained from the survey were undertaken, comparing the survey-based distributions with the benchmark 2002 national input-output model, U.S. Bureau of Economic Analysis (BEA) estimates, and with prior Washington State input-output models.

Step 1: Define target-year industrial sectors

Over time, new industries evolve or old industries decline in the state economy. Furthermore, existing establishments may change their production processes to adapt to new technologies or to shifting markets. These changes required re-definition of industrial sectors in the new I-O table, because in the I-O concept every industrial sector is assumed to be homogeneous, meaning all establishments in the sector have a similar production process or input/purchasing pattern. Empirically, limitations in data availability may force adoption of more aggregate industrial sectors. After all these considerations the sectoring plan for the 2002 Table was defined, as shown in Table 2-1.

Step 2: Survey of Industrial sectors

A sampling plan was developed jointly by OFM, the Washington State Department of Revenue, and the Employment Security Department, and other members of the study team. The Employment Security Department distributed questionnaires to 6,050 establishments, and obtained 1,443 valid responses. The gross business volume of this sample was $269.1 billion, or 54.2% of the recorded gross business income (GBI) of all establishments in Washington State in 2002. Coverage was good in about 40 of the 50 sectors in the I-O model. The cover letter and questionnaire used for this survey are available at the links below.

Washington Input-Output Study Cover Letter

Washington Input-Output Study Questionnaire

Table 2-1
2002 Washington Input-Output Study
Sectoring Plan

Industry Name	NAICS Code
1. Crop Production	111
2. Animal Production	112
3. Forestry and Logging	113 (Incl. state forests, etc.)
4. Fishing, Hunting, and Trapping	114
5. Mining	21
6. Electric Utilities	2211 (Incl. public, BPA, etc.)
7. Gas Utilities	2212 (Incl. public)
8. Other Utilities	2213 (Incl. public)
9. Construction	236-238
10. Food, Beverage and Tobacco Products	311, 312
11. Textiles and Apparel	313, 314, 315
12. Wood Products	321
13. Paper Products	322
14. Printing	323
15. Petroleum and Coal Products	324
16. Chemical Products	325
17. Nonmetallic Mineral Products	327
18. Primary Metals	331
19. Fabricated Metals	332
20. Machinery Manufacturing	333
21. Computer and Electronic Product	334
22. Electrical Equipment	335
23. Aircraft and Parts	3364
24. Ship and Boat Building	3366 (Incl. federal/PSNS)
25. Other Transportation Equipment	3361, 3362, 3363, 3365, 3369
26. Furniture	337
27. Other Manufacturing	316, 326, 339
28. Wholesale	423-425
29. Retail	44-45 (Incl. state liquor stores)
30. Air Transportation	481
31. Water Transportation	483 (Incl. Ferry)
32. Truck Transportation	484
33. Other Transportation/Postal Offices	482, 485, 486, 487, 491, 492 (Incl. transit)
34. Support Activities for Transportation, Warehousing and Storage	488, 493
35. Software Publishers & Internet Service Providers	5112, 518
36. Telecommunications	517

Industry Name	NAICS Code
37. Other Information	5111, 512, 515, 516, 519
38. Credit Intermediation and Related Activities	521, 522
39. Other Finance and Insurance	523, 524, 525
40. Real Estate and Rental and Leasing	53
41. Legal /Accounting and Bookkeeping / Management Services	5411, 5412, 5416, 5418, 5419, 55
42. Architectural and Engineering /Computer Systems Design and Related Services	5413, 5414, 5415, 5417
43. Educational Services	61
44. Ambulatory Health Care Services	621
45. Hospitals	622
46. Nursing and Residential Care Facilities, Social Assistance	623, 624
47. Arts, Recreation, and Accommodation	71, 721
48. Food Services and Drinking Places	722
49. Administrative/Employment Support Services	561
50. Waste Management/Maintenance/Personal/ Civic /Religious/Household, and Agriculture Services	562, 81, 115

Step 3: Compile the target-year data and information on Washington industries

Data on 2002 industrial output, value-added, government expenditures, consumption by Washington residents, capital (investment) spending, and external trade (exports and imports) were compiled. Sometimes industrial details can only be derived through inferring, interpolating or extrapolating from available, but more aggregate, estimates. Table 2-2 shows the data categories and the respective data sources.

Step 4: Analysis of survey results

In the development of the 2002 Washington Input-Output survey, it was decided that establishments participating in the survey would not be asked to provide detailed inter-industry sales and purchases estimates, but rather total inter-industry sales and purchases made in Washington State. Data from the survey were analyzed, sector by sector.

Distributions of sales and purchases proportions for each sector were calculated, and compared to the 1997 Washington Input-Output table as well as the 2002 Benchmark U.S. Input-Output Table. In many cases the survey yielded reasonable estimates of these distributions. However, there were some sectors with very few respondents, and in which the patterns of sales and purchases were not consistent with other data sources. In some instances it was necessary to "triangulate" sales and purchases distributions based on prior or alternative estimates, and judgments.

Table 2-2
Input Data for the Target Year (2002)

Data Categories	Data Sources
Industrial Output	2002 Economic Census – Industrial Shipment $ Washington State Dept. of Agriculture – annual agricultural production by crop type Washington Dept. of Revenue – Gross Business Income reports Bureau of Economic Analysis – 2002 U.S. Input-Output (Use) Table Washington Insurance Commissioner – Revenue and margins of insurance businesses
Value Added	Bureau of Economic Analysis – Gross State Product Bureau of Economic Analysis – labor earnings series Washington Employment Security Department – ES202 Wage and Salary series
Personal Consumption Expenditures	Bureau of Economic Analysis – National Income and Product Accounts Bureau of Economic Analysis – State personal income Series Bureau of Labor Statistics – 2002 Consumer Expenditure Survey
Government Spending	Census Bureau -- State and Local Government Expenditures series Census Bureau -- Federal Government Expenditures reports Washington Office of Financial Management – State government expenditures accounting records
Investment	Census Bureau -- Building Permit report Washington Dept. of Revenue – abstract of county Assessed Values report Washington Dept. of Revenue – taxable sales database Bureau of Economic Analysis – 2002 U.S. Input-Output (Use) Table
Exports and Imports	The World Institute for Strategic Economic Research (WISER) export database Census Bureau – The 2002 Commodity Flow Survey Washington Department of Trade and Economic Development – studies of the impact of foreign exports and imports on the state economy

Step 5: Development of new transactions table

The 2002 Benchmark U.S. Input-Output Table was aggregated to the Washington sectoring plan, and location quotients were estimated for this sectoring plan. The 2002 benchmark U.S. transactions matrix was then reformulated as a matrix of direct requirements, and location quotients were used to modify (regionalize) the national direct requirements coefficients to the state level. In sectors with location quotients having values of one or greater, the row of direct requirements coefficients was not adjusted. In sectors with location quotients with values less than one, the row of coefficients was multiplied by the location quotient, lowering the estimated purchases share made in Washington State. The resulting adjusted direct requirements matrix was then multiplied by total purchases to develop a first estimate of a regional transactions matrix.

The initial regional transactions matrix underwent a number of adjustments. Some of these were related to known differences in production technology in Washington State compared to the United States. Two examples of these adjustments are as follows. In Washington State most electrical power is generated by hydroelectricity, with a large sale of electrical power from the Bonneville Power Administration to retail utilities in Washington State. The 2002 benchmark U.S. input-output table reflected the production structure common elsewhere in the U.S., where the primary reliance was on coal or petroleum products for energy inputs to the electricity production process. Using data provided by Bonneville Power Administration, and from the Census of Mines, the electricity production purchases were adjusted to reflect the structure of the Washington electricity sector. In the case of pulp and paper manufacture, in this region most of the raw material to this sector is residue from lumber and plywood production, while nationally it is wood fiber from logs. Using data from the Washington Department of Natural Resources, the estimate was adjusted to reflect log and wood fiber flows appropriate to Washington paper production.

The adjusted national model also had intraindustry flows that were well above likely levels in certain sectors, such as aerospace. Washington's aerospace location quotient is much above one, so the scaling procedure described above did not adjust the national purchases coefficients in the aerospace row. Nationally, there are strong intraindustry transactions within the aerospace sector, such as jet engines and subassemblies. A special tabulation of aerospace purchases and the Boeing Company's financial report were used to adjust the Washington intraindustry transactions to a more likely level.

After these adjustments were made, row totals for inter-industry sales were calculated, and compared to the values estimated through the adjusted survey data. In many sectors the differences between the survey data and the provisional transactions matrix based on the 2002 U.S. benchmark model were small, while in a few sectors it was necessary to reconsider the overall sales distributions due to large differences in estimates. Reference to the 1997 Washington Input-Output table and the 2002 U.S. Benchmark Input-Output Table guided the solution of these differences. Inter-industry sales in each row in the model were adjusted proportional to percentages of sales to each sector, to produce a balance between the inter-industry transactions and the values in final demand. The resulting matrix of inter-industry transactions has slightly lower estimated regional purchases as a share of sales (24.3%) than the 1997 Washington input-output model (26.7%).

Intermediate Purchases as a Share of Washington Total Industrial Input 1963-2002

WA Intermediate Share

Year	Value
1963	0.235
1967	0.211
1972	0.228
1982	0.246
1987	0.261
1997	0.267
2002	0.243