Section 2: The 2012 Washington Input-Output Table: Methodology and Data

The 2012 Washington Input-Output Study was based on a combination of data sources. The first step involved defining the sectors that we used in model development (Table 2-1). The second step was developing a survey of establishments, to estimate purchases and sales distributions. However, this survey did not result in a robust sample. So, we instead relied largely on basic data from the 2007 Washington Input-Output model to define final demand composition and input proportions. At the same time, we estimated output, value added and employment for each sector. Data sources for the estimation were: the 2012 Economic Census, Bureau of Economic Analysis state employment, income, and gross domestic product by state series, and other miscellaneous reports from trade associations and government (Table 2-2).

Step 1: Define 2012 industrial sectors

Over time, new industries evolve or old industries decline in the state economy. Existing establishments may change their production processes to adapt to new technologies or to shifting markets. These changes required examination of industrial sectors in the new I-O table, because in the I-O concept every industrial sector is assumed to be homogeneous. Homogeneity means 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, we defined the sectoring plan for the 2012 table (as shown in Table 2-1). This is the same sectoring plan we used in the 2007 table. In the 2007 table, two of the sectors in the 2002 table were disaggregated into more detailed sectors. We divided the construction into highway, street and bridge construction, and all other construction. We divided retail trade into nonstore retailers, and all other retail trade.

Table 2-1. 2012 Washington Input-Output Study Sectoring Plan

Industry Name	NAICS Code
1. Crop Production	111
2. Animal Production	112
3. Forestry and Logging	113 (Incl. DNR and USFS.)
4. Fishing, Hunting and Trapping	114
5. Mining	21
6. Electric Utilities	2211 (Incl. local public utilities and Bonneville Power Administration)
7. Gas Utilities	2212
8. Other Utilities	2213 (Incl. local public utilities)
9. Highway, Street and Bridge Construction	2373
10. Other Construction	236-238 except 2373
11. Food, Beverage and Tobacco Manufacturing	311, 312
12. Textiles and Apparel Mills	313, 314, 315
13. Wood Product Manufacturing	321
14. Paper Manufacturing	322
15. Printing and Related Activities	323
16. Petroleum and Coal Products Manufacturing	324
17. Chemical Manufacturing	325
18. Nonmetallic Mineral Products Manufacturing	327
19. Primary Metal Manufacturing	331
20. Fabricated Metals Manufacturing	332
21. Machinery Manufacturing	333
22. Computer and Electronic Product Manufacturing	334
23. Electrical Equipment Manufacturing	335
24. Aircraft and Parts Manufacturing	3364
25. Ship and Boat Building	3366 (Incl. federal Puget Sound Naval Shipyard)
26. Other Transportation Equipment Manufacturing	3361, 3362, 3363, 3365, 3369
27. Furniture Product Manufacturing	337
28. Other Manufacturing	316, 326, 339
29. Wholesale	423-425
30 Non-Store Retail	454
31. Retail	44-45 except 454
32. Air Transportation	481
33. Water Transportation	483 (Incl. WA State Ferry System)
34. Truck Transportation	484
35. Other Transportation/Postal Offices	482, 485, 486, 487, 491, 492 (Incl. local transit and U.S Postal System)
36. Support Activities for Storage, Transportation and Warehousing	488, 493
37. Software Publishers & Data Processing, Hosting and Related Services	5112, 5182
38. Telecommunications	517
39. Other Information	5111, 512, 515, 516, 519
40. Credit Intermediation and Related Activities	521, 522
41. Other Finance and Insurance	523, 524, 525
42. Real Estate and Rental and Leasing	53
43. Legal /Accounting and Bookkeeping / Management Services	5411, 5412, 5416, 5418, 5419, 55
44. Architectural, Engineering and Computing Services	5413, 5414, 5415, 5417
45. Educational Services	61
46. Ambulatory Health Care Services	621
47. Hospitals	622
48. Nursing and Residential Care Facilities, Social Assistance	623, 624
49. Arts, Recreation and Accommodation	71, 721
50. Food Services and Drinking Places	722
51. Administrative/Employment Support Services	561
52. Waste Management/ Other Services, and Agriculture Services	562, 81, 115

Step 2: Compile the target-year data and information on Washington industries

We compiled data on 2012 industrial output, value-added, government expenditures, consumption by Washington residents, capital (investment) spending, and external trade (exports and imports). 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 used for construction of the 2012 model.

Table 2-2. Input Data for The Target Year (2012)

Data Categories	Data Sources
Industrial Output	2012 Economic Census – Industrial Shipment $ 2012 Agricultural Census – Industrial Shipment $ Washington State Dept. of Agriculture – annual agricultural production and sales by crop type Washington Dept. of Revenue – Gross Business Income reports Bureau of Economic Analysis – 2012 U.S. Input-Output (Use) Table Washington Insurance Commissioner – Revenue and margins of insurance businesses
Value Added	Bureau of Economic Analysis – 2012 gross domestic product Bureau of Economic Analysis – 2012 labor earnings series Washington Employment Security Department – ES202 Wage and Salary series
Personal Consumption Expenditures	Bureau of Economic Analysis – 2012 National Income and Product Accounts Bureau of Economic Analysis – 2012 State personal income Series
Government Spending	Census Bureau – 2012 State and Local Government Expenditures series Census Bureau – 2012 Federal Government Expenditures reports Washington Office of Financial Management – state government expenditures accounting records Washington State Employment Security Covered Wages and Salaries data series
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 – 2012 U.S. Input-Output (Use) Table
Exports and Imports	The World Institute for Strategic Economic Research export 2012 database

Step 3: Development of Sales and Purchases Distributions

Step 2 developed "control values" from the various sources we described above, including sectoral output (sales), value added and labor income. We analyzed the structure of final demand (personal consumption expenditures, investment, state & local government, federal government, exports to other states in the United States, and foreign exports) for each sector using data from the 2002 and 2007 Washington input-output models. We also documented the share of intermediate sales by sector from the 2002 and 2007 models. We determined a draft sales distribution for each sector through these analyses.

We also focused on the share of intermediate purchases, value added, labor income, other value added, imports from the rest of the United States, and from foreign countries reported in the 2002 and 2007 Washington input-output models. Data from Step 2 provided actual values for value added, labor income and total purchases. Initial estimates of total intermediate purchases and imports were made based on these analyses.

We summed initial estimates of intermediate sales and purchases. We slightly adjusted initial total intermediate sales and purchases so that these totals were identical. We adjusted exports and imports to achieve balanced intermediate sales and purchases distributions.

Step 4: Development of new transactions table

The columns in the 2007 intermediate transactions matrix was divided by total intermediate purchases in each sector, yielding coefficients documenting the share of purchases in each sector made from each other sector. We then multiplied these values by 2012 total intermediate purchases in each sector. This resulted in estimated 2012 intermediate purchases in each sector.

We converted the resulting intermediate transactions matrix into a direct requirements matrix then used it to calculate a direct and indirect requirements matrix. We then compared multipliers from this matrix to the 2007 model. The average multiplier in the 2007 model was 1.916, while the average multiplier in the 2012 model was 1.938, a difference of 1.1%. Figure 2-1 is a scatter gram of values for each sector in the 2007 and draft 2012 models. The correlation between the two estimates is .89.

Figure 2-1: Correlation of 2007 and 2012 Output Multipliers

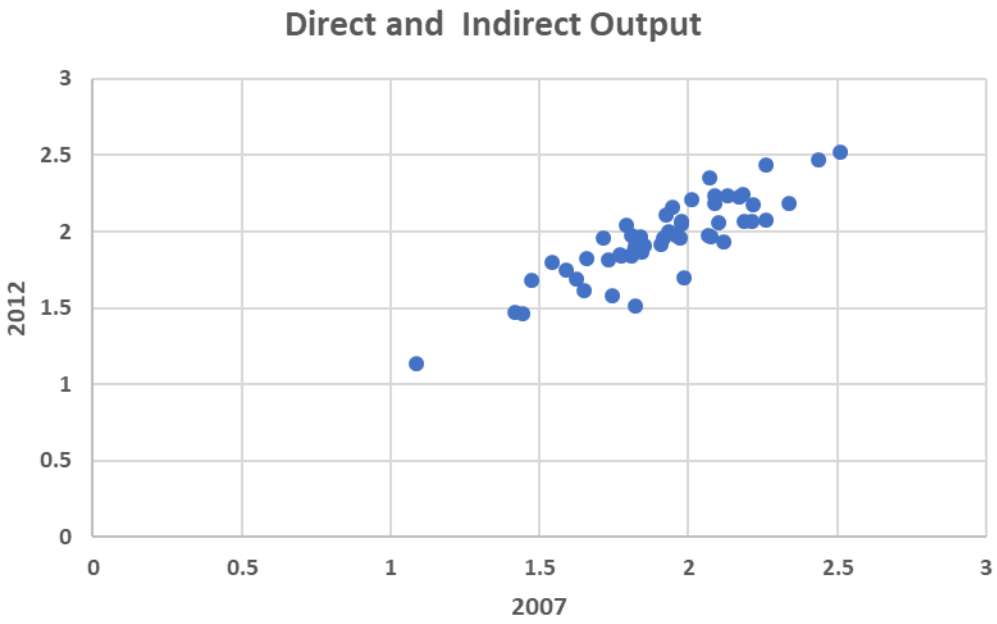

Figure 2-1 depicts a scatter gram of multiplier values for each sector in the 2007 and 2012 models. The correlation between the two estimates is .89.

The initial regional data estimates in Table 2-2 underwent a number of adjustments. For example, we included the Washington State ferry system in the water transportation sector. The Bremerton Naval Yard was also included in shipbuilding. We introduced data into the transaction matrix for cases of this type, and defined their most likely markets and sources of supply defined. The resulting matrix of interindustry transactions has slightly lower estimated regional purchases as a share of sales (24.3%) than the 2007 Washington input-output model (25.2%). However, the share of intermediate purchases closely tracks the history of Washington's input-output models. We included labor income in the computation of the direct, indirect and induced requirements matrix, along with intermediate purchases. The combined proportion of total purchases accounted for by intermediate purchase and labor income are very similar in the 2007 and 2012 models, .537 and .536 respectively.

Figure 2-2: Intermediate Purchases as a Share of Washington Total Industrial Input, 1963-2012

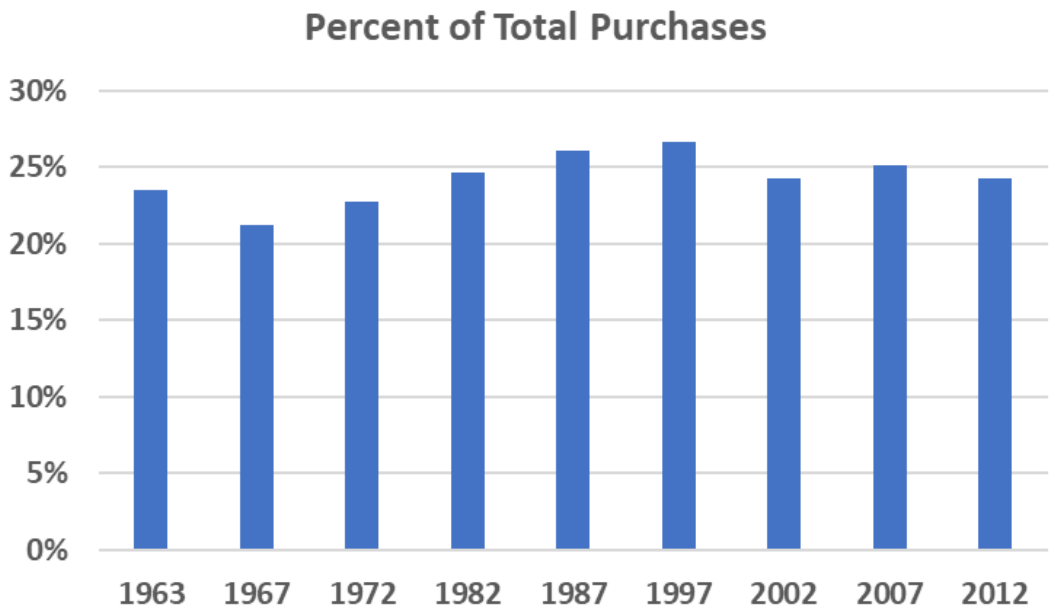

Figure 2-2 depicts the combined proportion of total purchases accounted for by intermediate purchase and labor income and are very similar in the 2007 and 2012 models, .537 and .536 respectively.