

The Economic Impact of Potatoes in Washington State

By
David Holland and Nick Beleiciks

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By

David Holland

Professor, School of Economic Sciences,
Washington State University

&

Nick Beleiciks

Graduate Student, School of Economic Sciences,
Washington State University

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Table of Contents

Table of Contents	i
Table of Tables	ii
Table of Figures	ii
Introduction.....	1
Methods.....	1
The Economic Region and the I/O Model	2
Review of Input-Output Models and Analysis	2
The Potato Production and Processing Industries in Washington	4
The Commodity Balance Sheet — A Description of the Sources of Potato Demand.....	4
Industry Production Functions in the I/O Model.....	7
The Industry Balance Sheet — A Description of Input Requirements.....	7
Results of the Impact Analysis	15
Impact Scenario Assumptions.....	15
Impact Results.....	15
Direct Effects — Impacts on Output	15
Indirect Effect	16
Induced Effect.....	16
Impacts on Employment	17
Direct Effect.....	17
Indirect Effect	17
Induced Effect.....	17
Discussion.....	17
References.....	20
Appendix.....	22
Aggregation Template for Potato Impact Study	23

Table of Tables

Table 1. Potato Commodity Balance Sheet (commodity production = \$576.97 million) ...	5
Table 2. Industry Balance Sheet for Potato Production (\$576.97 million).....	8
Table 3. Industry Balance Sheet for Frozen Potato Products Production (\$1350 million)	9
Table 4. Industry Balance Sheet for Fresh Pack Potato Production (\$113 million)	10
Table 5. Industry Balance Sheet for Dehydrated Potato Products Production (\$55 million)	11
Table 6. Industry Balance Sheet for Potato Chip Production (\$107 million).....	12
Table 7. Output Impact (measured in \$ sales)	18
Table 8. Employment Impact (measured in the number of jobs)	19

Table of Figures

Figure 1 . Potato demand in Washington State (\$ millions).....	6
Figure 2. Potato sales as a driver of potato processing in Washington State (\$ millions)...	6

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Introduction

The Washington State potato industry is the second largest producer (behind Idaho) of potatoes in the United States (USDA National Agricultural Statistics Service, Washington 2003). In the 2003 production and 2003-2004 marketing years (the focus of this study), the value of Washington (including Morrow and Umatilla Counties in Oregon) potato production at the farm gate was \$577 million (USDA National Agricultural Statistics Service, Washington and Oregon 2003). Yet, as economically important as this figure is, it fails to capture the true economic significance of the potato industry. Unlike any other agricultural commodity produced in Washington, potato production sets off a chain of economic activities that dwarf the original on farm production value.

Potatoes grown in Washington are packed raw for use in restaurants, commercial kitchens, and direct consumption in households; however, raw potato production also spawns other industries such as the processing of potatoes for French fries, other frozen potato products, and potato chips. The frozen potato products industry in Washington, is clearly dependent on raw potato production from within the state, and in terms of sales is more than twice as large. In addition, the production of dehydrated potato products, such as potato flakes and de-hydrofrozen potato cubes, uses process-grade potatoes

from the fresh-pack industry as well as raw potatoes purchased directly from growers.

Methods

This is the second study based on the inter-industry relationships among the potato producing and processing industries and their joint economic impact on the Washington economy. Unlike the original study (Holland and Yeo 2001), the present work does not include the economic contribution from the potato waste used for cattle feeding operations. Although potato processing waste is a significant contribution to the cattle feeding industry, exclusion of the cattle industry impact provides an undistracted view of the potato's economic impact.

Data were collected by interviews with Dennis Conely, (Potato Industry Consultant, 2005) and from Washington State University enterprise budgets (see "*Understanding & Using WSU Crop Enterprise Budgets*" at <http://www.farm-mgmt.wsu.edu/PDF-docs/unpublished/EnterpriseBudgets.pdf> for an example of enterprise budgets) to construct purchase and sales information for the potato industry including the potato processing sectors. As with any study based on interviews, the data obtained are subject to some degree of uncertainty. Industry representatives based their estimates of total industry sales on their credible judgment and expertise. Interviews

were used for data collection because there is no official source for total county, or state, production for these processing industries as there is in the case of agricultural commodities.

We focused on five potato, and potato related, industries: raw potato production, fresh packing of potatoes, dehydrated potato products production, frozen potato products production, and potato chip production. It should be noted that the production functions are broadly representative of the whole industry and may not be representative of the production of an individual firm in the industry.

Using industry production functions, accounts for potato production and processing industries were incorporated into a potato oriented input-output (I/O) model of the Washington State economy. This economic model was used to estimate total jobs and industry sales that are linked to the potato production and processing industry's contribution to the Washington State export base.

The Economic Region and the I/O Model

This analysis uses a 2000 IMPLAN-based I/O model of the Washington State economy (Minnesota IMPLAN Group), adjusted to represent potato production and processing for the year 2003. The I/O model represents Washington State and Morrow and Umatilla Counties in Oregon. All I/O model estimates of regional supply and demand include these two Oregon counties because of their close economic linkage with the Washington State potato industry.

Morrow and Umatilla Counties are major producers of potatoes and contain potato

processing plants. Some of the potatoes grown in Washington are processed in Oregon; likewise, some of the potatoes grown in Oregon are processed in Washington. This area of Oregon is also included in USDA's statistical and production region for Washington State (Beleiciks 2005). As an example of the two Oregon counties' economic importance to the Washington potato economy, the estimated Washington State 2003 supply of \$505 million in raw potatoes was augmented by \$72 million from Morrow and Umatilla Counties, producing a total of \$577 million as used in the I/O model (Beleiciks).

Review of Input-Output Models and Analysis

The I/O framework of analysis was developed by Wassily Leontief (1986), for which he received the Nobel Prize in economics. The I/O model is a system of linear equations that describe the circular flow of income and product throughout an economy. The model represents all production and consumption in the economy and is known as a fixed price general equilibrium model. The assumptions underlying the model depict an economic world where supply is assumed to respond to demand. The endogenous variables are estimates of regional supply, while estimates of final demand (such as export demand) make up the set of exogenous variables.

There are two basic types of I/O models: Type I and Type II (Miller and Blair 1985). The personal consumption of the household sector is considered to be exogenous in the Type I model and endogenous in the Type II model. The household sector is treated as part of the final demand in the Type I model, while in the Type II model changes

in household income are treated as driving changes in household consumption. I/O models are comparatively static where the economy adjusts to a new equilibrium in response to a demand shock.

The A-matrix in the I/O model is called the “matrix of technical coefficients” and represents the production functions of all the industries in the model. Through algebraic manipulation of the A-matrix, we derive the I/O model and the output multipliers. The following system of simultaneous linear equations describe the derivation of the predictive model:

$$(1) \quad X = AX + Y$$

$$(2) \quad (I - A)X = Y$$

$$(3) \quad X = (I - A)^{-1} Y$$

where X is total industry output, (also known as industry supply or industry sales), I is an identity matrix, A is the matrix of technical coefficients, and Y is final demand.

This can also be interpreted as:

$$(4) \quad \Delta X = (I - A)^{-1} \Delta Y$$

where ΔX is change in total industry output and ΔY is change in final demand. The matrix $(I - A)^{-1}$ is known as the “Leontief inverse” (Miller and Blair 1985).

The impact of changes in final demand (ΔY) on changes in industry output (ΔX) can be broken down into the three following components:

- *direct effects* are changes to industries where a final demand change was made
- *indirect effects* are changes in inter-industry purchases as industries throughout the economy respond to new demands by directly affected industries
- *induced effects* are changes in household consumption as household income increases or decreases due to changes in production that stem from both direct and indirect effects

The closure in the Type II model (i.e. treating household income as endogenous) is called a social accounting closure (SAM) and utilizes all the information available in the accounts regarding industries, households, and the distribution of factor income to households. The Type II I/O model provides the most accurate representation of income-consumption relationships and the most accurate structure for the estimation of induced effects compared to a Type I I/O model.

In configuring the economic analysis showing the contribution of potato production to total jobs and output in Washington, the direct effects of the impact are configured as changes in sales to final demand (mainly exports from the state) by each of the respective potato and potato processing industries (ΔY). The I/O model is then used to predict the resulting change in sales (output) in all sectors throughout the economy (ΔX) as in equation (4).

Potato production and potato processing sets off a chain of transportation, warehousing and marketing activities after the commodity leaves the farm or factory gate. For example, the motor freight and warehousing sector includes not only trucking but also the activities involved in storage and handling of the product. Accordingly, this economic impact analysis includes estimates of the sectors that accompany the finished product after it leaves the processing plant or fresh-pack shed, or in the case of raw potatoes, the farm.

The direct effects of these industries are estimated from the margin accounts in IMPLAN Pro 2.0 (Minnesota IMPLAN Group) and are included as part of the direct effects of the potato industry. IMPLAN Pro 2.0 is the most recent version of IMPLAN. The software and regional I/O data from the Minnesota IMPLAN Group (1999) are used to construct the regional economic I/O model that is the basis for the economic impact analysis presented in this paper.

In terms of the equations showing the derivation of the model we used the I/O model of the Washington economy as represented in equation (3) to estimate the economic impact of potato and potato processing industries in Washington. The model estimates total sales (ΔX) across the economy from equation (4) as a function of deliveries to final demand (exports) of potatoes and processed potato products.

The Potato Production and Processing Industries in Washington

The Commodity Balance Sheet — A Description of the Sources of Potato Demand

The commodity balance sheet for potatoes shown in Table 1 depicts how potatoes are used in the economy and presents all information available related to the use of potatoes in the I/O model. Industry demand in Table 1 indicates gross inputs to each industry (identified by commodity).

The gross absorption coefficient (GAC) represents the value of the commodity purchased as inputs by regional industries expressed as a proportion of total dollar outlays for the particular industry. For example, the GAC of .4117 for dehydrated potatoes in Table 1 indicates that 41% of the value of dehydrated potato products is the cost of the raw potato. By comparison, potatoes represent only 7% (0.073 GAC) of the cost of producing potato chips (Table 1).

Institutional or final demand in Table 1 lists the economic sectors that use potatoes as an input along with the value of that input. The farm gate value of potato production (also equal to “total potato commodity demand,”) was \$576.97 million as shown at the bottom of Table 1.

Figure 1 is based on Table 1 and shows how potato production in Washington is distributed to various users in and out of the state. For example, the largest source of demand for potatoes is the Frozen Potato products industry, which absorbs an estimated \$405 million of potatoes annually (Figure 1). Other important uses for the crop are fresh-pack potatoes (\$62

million) (Schotzko and Lund 2002), dehydrated potatoes (\$23 million) (Conely 2005), and seed (\$64 million) (USDA National Agricultural Statistics Service, Washington 2003). Relatively small portions of the crop are exported (\$15 million).

Figure 2 depicts the distribution of the potato crop in Washington State to the downstream industrial users and indicates

the sales values of those industries. As noted earlier, nearly five-sixths (83%) of industry demand for the potato crop in Washington comes from the production of frozen French fries and other frozen potato products (Figure 2). The figure in parenthesis represents the total industrial output (\$ million sales annually) of the frozen potato products industry. For example, the output of the frozen potato product industry is estimated to be \$1,350 million in annual sales (Conely 2005).

Table 1. Potato Commodity Balance Sheet (Commodity Production = \$576.97 Million)

	Gross Absorption Coefficient	Gross Inputs
Industry Demand		
Potato (for seed)	0.112414	64.859920
Fresh Pack Potato	0.545475	61.669429
Dehydrated Potato	0.411670	22.711831
Frozen Potato	0.300000	405.046443
Potato Chips	0.073130	7.893756
Total Industry Demand		562.181379
Institutional Demand		
Households—Medium Income		0
Households—High Income		0
Federal Government NonDefense		0
Federal Government Defense		0
State/Local Gov't NonEducation		0
State/Local Gov't Education		0
Capital		0
Inventory Additions/Deletions		0
Foreign Trade		4.935
Domestic Trade		9.855
Total Institutional Demand		14.790
Total Potato Commodity Demand		576.970

Source: USDA National Agricultural Statistics Service, Washington 2003.

NOTE: The 2003 data presented for potato inputs in the table are expressed in millions of dollars and they have been obtained by the use of IMPLAN Pro 2.0. The purpose of the table is to show the demand for potatoes by different users in the Washington economy.

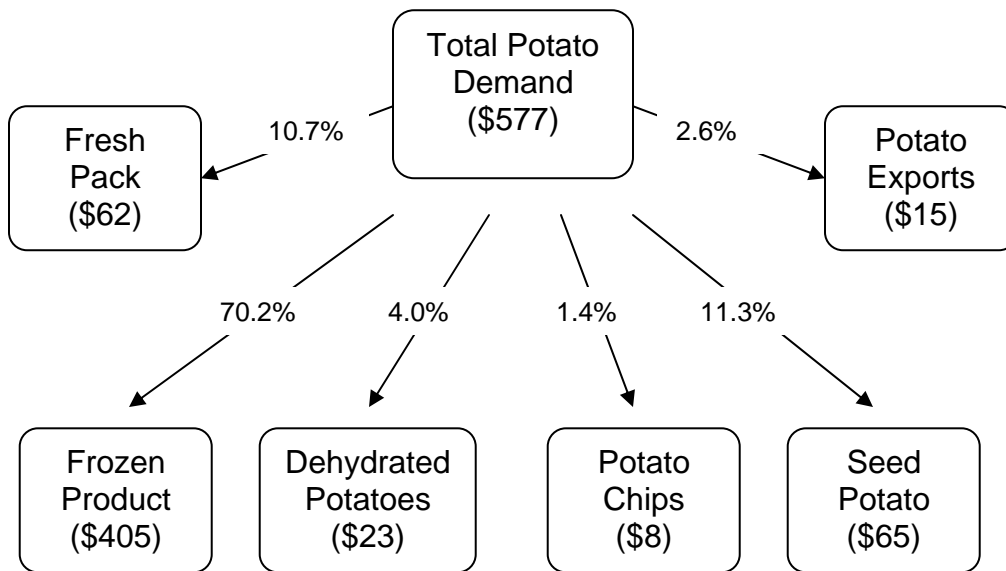


Figure 1 . Potato demand in Washington State (\$ millions).

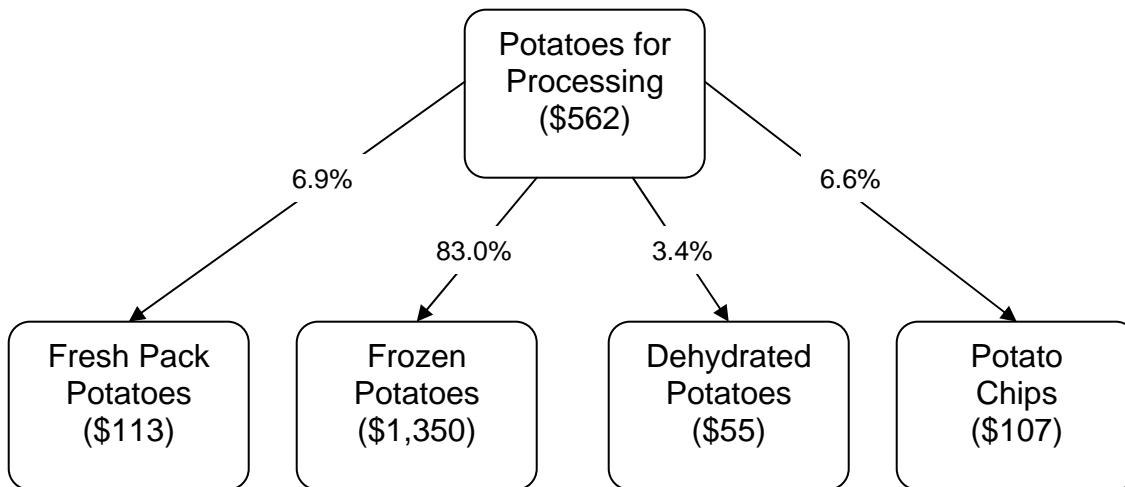


Figure 2. Potato sales as a driver of potato processing in Washington State (\$ millions).

The processing of frozen potato products results in the production of by-products such as starch and potato waste (composed mainly of potato peels and defects). The starch is used as an input in the paper mill industry and the waste is used as feed in the cattle feed industry. Roughly 8% of the potato volume that enters a frozen French fry plant becomes a waste by-product.

The market for fresh (raw) potatoes is supplied by the fresh potato packing industry. These packers prepare the potatoes for the fresh market by cleaning, sorting, grading, and bagging before shipping to final destinations. The total industrial output (\$ sales) of the fresh-pack industry is \$113 million (Schotzko and Sund 2002). The fresh-packers supply supermarkets/grocery stores and other users of fresh potatoes such as restaurants. The market for fresh potatoes is not limited to Washington; some of the Washington potatoes are exported beyond the state. Because of customer preferences for size, shape, and blemishes, about 42-43% of the potatoes brought into the fresh-pack sheds are graded out. These process-grade potatoes end up being used by dehydrated potato processors.

Dehydrated potato processors absorb about 4% of the potato crop (Figure 1) and receive part of their potato input as process-grade from the fresh-pack industry. The dehydrated potato processors mainly produce potato flakes, granules (used as mashed potatoes or as the primary/base input for the manufacture of Pringles® potato chips), and de-hydrofrozen potato products. Total annual sales for the industry are roughly \$55 million (Conely 2005; Figure 2). The de-hydrofrozen potato products are in the form of potato cubes which are used either in the production of soups or sold directly to restaurants. As

with the frozen potato products industry, by-products of the dehydrated potato sector are starch and waste which are used by the paper mill and cattle feed industries, respectively.

Industry Production Functions in the I/O Model

The Industry Balance Sheet — A Description of Input Requirements

The industry balance sheets (Tables 2, 3, 4, 5, and 6) show the gross absorption coefficient (GAC) (technical coefficients) for both intermediate (industry) inputs and final (labor and capital) inputs. The product of the GAC and total industry output measured in sales (\$576.97 million) gives the gross input figure. The regional purchase coefficient (RPC) shows the proportion of commodity demand in Washington that is met by supply from Washington. The product of gross inputs and the RPC gives the regional input. Regional input is the input into the production process that is estimated to come from within the region (Washington). For example, Table 2 shows that potato production requires \$45.3 million of nitrogenous and phosphatic fertilizers (202). The RPC indicates that 15.6% of nitrogenous and phosphatic fertilizers is met by supply from Washington. Thus, the input of nitrogenous and phosphatic fertilizers supplied by Washington firms is estimated to be \$7 million (denoted in the “regional inputs” column of the table).

The industry balance sheet for potato production (Table 2) and fresh pack potatoes (Table 4) are based on enterprise budgets developed in the Department of Agricultural Economics at Washington State University (Hinman et al. 2001 and

Table 2. Industry Balance Sheet for Potato Production (\$576.97 million)

	Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand					
26 Agricultural- Forestry- Fishery Services	0.045455	26.225969	0.802255	0.036466	21.039884
189 Inorganic Chemicals N.E.C*	0.032347	18.663483	0.052833	0.001709	0.985634
202 Nitrogenous and Phosphatic Fertilizers	0.078471	45.275802	0.155704	0.012218	7.049573
204 Agricultural Chemicals- N.E.C*	0.149734	86.392018	0.126154	0.018890	10.902138
209 Chemical Preparations- N.E.C*	0.000364	0.209808	0.330384	0.000120	0.069291
210 Petroleum Refining	0.009536	5.501987	0.777727	0.007416	4.279057
309 Farm Machinery and Equipment	0.017053	9.838838	0.519202	0.008854	5.108526
433 Railroads and Related Services	0.005917	3.413970	0.721000	0.004266	2.461473
435 Warehousing	0.088978	51.337834	0.872629	0.077645	44.794361
436 Water Transportation	0.000478	0.275650	1.000000	0.000478	0.275650
437 Air Transportation	0.000212	0.122542	0.462100	0.000098	0.056627
438 Pipe Lines- Except Natural Gas	0.000093	0.053591	0.097497	0.000009	0.005225
443 Electric Services	0.018798	10.846140	0.916300	0.017225	9.938318
445 Water Supply and Sewerage Systems	0.014287	8.243067	0.944434	0.013493	7.783811
447 Wholesale Trade	0.076060	43.884634	0.995665	0.075731	43.694581
451 Automotive Dealers & Service Stations	0.000021	0.011909	0.950000	0.000020	0.011314
456 Banking	0.040048	23.106617	0.607500	0.024329	14.037271
459 Insurance Carriers	0.001079	0.622568	0.633100	0.000683	0.394148
462 Real Estate	0.169186	97.615267	0.700000	0.118430	68.330688
473 Equipment Rental and Leasing	0.000376	0.216923	0.756000	0.000284	0.163994
530 Potato	0.112414	64.859920	1.000000	0.112414	64.859920
Total Commodity Demand	0.860907	496.718539		0.530778	306.241484
Value Added	Coefficient	Value Added			
Indirect Business Taxes	0.003233	1.865536			
Other Property Income	0.060805	35.082927			
Proprietary Income	0.000000	0.000000			
Employee Compensation	0.075055	43.304302			
Total Value Added	0.139093	80.252765			

Source: Data obtained from IMPLAN Pro 2.0 and Hinman et al.

NOTE: The 2003 input data are expressed in \$ millions.

*N.E.C. Not elsewhere classified.

Table 3. Industry Balance Sheet for Frozen Potato Products Production (\$1350 million)

		Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand						
72	Flour and Other Grain Mill Products	0.007818	10.555510	0.061456	0.000480	0.648700
81	Sugar	0.008167	11.026713	0.091321	0.000746	1.006978
90	Shortening and Cooking Oils	0.095597	129.070743	0.227370	0.021736	29.180377
122	Cordage and Twine	0.004641	6.266068	0.026396	0.000123	0.165401
103	Food Preparations- N.E.C.*	0.005705	7.702633	0.621059	0.003543	4.783790
164	Paperboard Containers and Boxes	0.046185	62.356900	0.617324	0.028511	38.478224
167	Bags- Plastic	0.020769	28.041364	0.002278	0.000047	0.063875
168	Bags- Paper	0.025962	35.052719	0.002566	0.000067	0.089949
189	Inorganic Chemicals N.E.C*	0.007891	10.654072	0.052833	0.000417	0.562651
205	Adhesives and Sealants	0.004569	6.168857	0.334704	0.001529	2.063980
209	Chemical Preparations- N.E.C*	0.005733	7.740437	0.330384	0.001894	2.556365
433	Railroads and Related Services	0.002210	2.983842	0.721000	0.001593	2.151350
	Motor Freight Transport and					
435	Warehousing	0.044126	59.576929	0.872629	0.038506	51.983307
436	Water Transportation	0.000318	0.429349	1.000000	0.000318	0.429349
437	Air Transportation	0.000149	0.201173	0.462100	0.000069	0.092962
443	Electric Services	0.044297	59.807446	0.916300	0.040589	54.801564
444	Gas Production and Distribution	0.034328	46.347910	0.741489	0.025454	34.362423
445	Water Supply and Sewerage Systems	0.013435	18.139115	0.944434	0.012688	17.128509
446	Sanitary Services and Steam Supply	0.002756	3.721027	1.000000	0.002756	3.721027
447	Wholesale Trade	0.014135	19.084438	0.995665	0.014074	19.001790
476	Detective and Protective Services	0.002756	3.721027	0.638471	0.001760	2.375596
530	Potato	0.300000	405.046443	1.000000	0.300000	405.046443
	Total Commodity Demand	0.691546	933.694715		0.498659	670.694606
Value Added		Coefficient	Value Added			
	Indirect Business Taxes	0.014478	19.547541			
	Other Property Income	0.165974	224.090406			
	Proprietary Income	0.000000	0.000000			
	Employee Compensation	0.128002	172.822115			
	Total Value Added	0.308454	416.460062			

Source: Data obtained from IMPLAN Pro 2.0 and Conely.

NOTE: The 2003 input data are expressed in \$ millions.

*N.E.C. Not elsewhere classified.

Table 4. Industry Balance Sheet for Fresh Pack Potato Production (\$113 million)

		Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand						
56	Maintenance and Repair Other Facilities	0.015752	1.780858	1.000000	0.015752	1.780858
122	Cordage and Twine	0.005567	0.629414	0.026396	0.000147	0.016614
164	Paperboard Containers and Boxes	0.054455	6.156501	0.617324	0.033616	3.798957
167	Bags- Plastic	0.034844	3.939314	0.002278	0.000079	0.008973
198	Surface Active Agents	0.035325	3.993678	0.138474	0.004892	0.554330
204	Agricultural Chemicals- N.E.C*	0.008451	0.955397	0.126154	0.001066	0.120565
205	Adhesives and Sealants	0.005398	0.610232	0.334704	0.001807	0.204172
433	Railroads and Related Services Motor Freight Transport and	0.000351	0.039730	0.721000	0.000253	0.028646
435	Warehousing	0.006028	0.681479	0.872629	0.005260	0.594618
436	Water Transportation	0.000169	0.019158	1.000000	0.000169	0.019158
437	Air Transportation	0.000160	0.018083	0.462100	0.000074	0.008356
443	Electric Services	0.004575	0.517181	0.916300	0.004192	0.473893
444	Gas Production and Distribution	0.001626	0.183832	0.741489	0.001206	0.136294
445	Water Supply and Sewerage Systems	0.001626	0.183832	0.944434	0.001536	0.173590
447	Wholesale Trade	0.008943	1.011040	0.995665	0.008904	1.006661
456	Banking	0.003175	0.358986	0.607500	0.001929	0.218084
459	Insurance Carriers	0.006255	0.707206	0.633100	0.003960	0.447732
469	Advertising	0.001178	0.133216	0.756000	0.000891	0.100711
470	Other Business Services	0.000734	0.082943	0.616278	0.000452	0.051116
473	Equipment Rental and Leasing	0.008214	0.928663	0.756000	0.006210	0.702069
494	Legal Services	0.000276	0.031157	0.792700	0.000218	0.024698
503	Business Associations	0.002626	0.296900	0.652337	0.001713	0.193683
507	Accounting- Auditing and Bookkeeping	0.000276	0.031157	0.792700	0.000218	0.024698
530	Potato	0.545475	61.669429	1.000000	0.545475	61.669429
	Total Commodity Demand	0.751478	84.959384		0.640020	72.357906
	Value Added					
	Indirect Business Taxes	0.003315	0.374784			
	Other Property Income	0.079294	8.964744			
	Proprietary Income	0.000000	0.000000			
	Employee Compensation	0.165913	18.757492			
	Total Value Added	0.248522	28.097020			

Source: Data obtained from IMPLAN Pro 2.0 and Schotzko and Sund.

NOTE: The 2003 input data are expressed in \$ millions.

*N.E.C. Not elsewhere classified.

Table 5. Industry Balance Sheet for Dehydrated Potato Products Production (\$55 million)

	Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand					
56 Maintenance and Repair Other Facilities	0.034001	1.875835	1.000000	0.034001	1.875835
63 Condensed and Evaporated Milk	0.017500	0.965475	0.517776	0.009061	0.499993
122 Cordage and Twine	0.002105	0.116133	0.026396	0.000056	0.003065
164 Paperboard Containers and Boxes	0.008658	0.477662	0.617324	0.005345	0.294748
167 Bags- Plastic	0.006594	0.363791	0.002278	0.000015	0.000829
168 Bags- Paper	0.008478	0.467731	0.002566	0.000022	0.001200
198 Surface Active Agents	0.020342	1.122268	0.138474	0.002817	0.155773
205 Adhesives and Sealants	0.002073	0.114367	0.334704	0.000694	0.038265
433 Railroads and Related Services	0.000122	0.006731	0.721000	0.000088	0.004853
435 Motor Freight Transport and Warehousing	0.001418	0.078231	0.872629	0.001237	0.068260
436 Water Transportation	0.000057	0.003145	1.000000	0.000057	0.003145
437 Air Transportation	0.000069	0.003807	0.462100	0.000032	0.001759
443 Electric Services	0.008646	0.477016	0.916300	0.007923	0.437090
444 Gas Production and Distribution	0.102754	5.668915	0.741489	0.076191	4.202944
445 Water Supply and Sewerage Systems	0.026501	1.462060	0.944434	0.025028	1.380603
447 Wholesale Trade	0.001684	0.092906	0.995665	0.001677	0.092504
459 Insurance Carriers	0.004000	0.220680	0.633100	0.002532	0.139712
469 Advertising	0.000400	0.022068	0.756000	0.000302	0.016683
470 Other Business Services	0.012200	0.673074	0.616278	0.007519	0.414805
473 Equipment Rental and Leasing	0.008600	0.474462	0.756000	0.006502	0.358693
530 Potato	0.411670	22.711831	1.000000	0.411670	22.711831
Total Commodity Demand	0.677872	37.398187		0.592767	32.702590
Value Added					
	Coefficient	Value Added			
Indirect Business Taxes	0.007696	0.424588			
Other Property Income	0.073151	4.035743			
Proprietary Income	0.000000	0.000000			
Employee Compensation	0.240741	13.281682			
Total Value Added	0.321588	17.742014			

Source: Data obtained from IMPLAN Pro 2.0 and Conely.

NOTE: The 2003 input data are expressed in \$ millions.

Table 6. Industry Balance Sheet for Potato Chip Production (\$107 million)

		Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand						
12	Feed Grains	0.007568	0.816901	0.101002	0.000764	0.082509
13	Hay and Pasture	0.008135	0.878104	0.101130	0.000823	0.088802
20	Miscellaneous Crops	0.014884	1.606600	0.216569	0.003223	0.347940
21	Oil Bearing Crops	0.000633	0.068327	0.011514	0.000007	0.000787
23	Greenhouse and Nursery Products	0.005722	0.617641	0.461694	0.002642	0.285160
27	Landscape and Horticultural Services	0.000256	0.027633	0.643658	0.000165	0.017786
37	Coal Mining	0.001390	0.150039	0.119827	0.000167	0.017979
56	Maintenance and Repair Other Facilities	0.006601	0.712521	1.000000	0.006601	0.712521
68	Dehydrated Food Products	0.015237	1.644703	0.089218	0.001359	0.146737
70	Frozen Fruits- Juices and Vegetables	0.002552	0.275467	0.125818	0.000321	0.034659
72	Flour and Other Grain Mill Products	0.015227	1.643624	0.061456	0.000936	0.101011
76	Wet Corn Milling	0.008045	0.868389	0.055757	0.000449	0.048419
81	Sugar	0.000279	0.030116	0.091321	0.000025	0.002750
86	Cottonseed Oil Mills	0.001142	0.123269	0.133008	0.000152	0.016401
87	Soybean Oil Mills	0.005383	0.581049	0.088725	0.000478	0.051565
88	Vegetable Oil Mills- N.E.C*	0.010748	1.160154	0.301798	0.003244	0.350132
90	Shortening and Cooking Oils	0.015099	1.629808	0.227370	0.003433	0.368468
100	Potato Chips & Similar Snacks	0.001859	0.200663	0.769990	0.001431	0.154508
103	Food Preparations- N.E.C*	0.000138	0.014896	0.621059	0.000086	0.009251
123	Textile Goods- N.E.C*	0.000174	0.018782	0.004025	0.000001	0.000076
126	House furnishings- N.E.C*	0.000135	0.014572	0.351300	0.000047	0.005119
162	Paper Mills- Except Building Paper	0.000101	0.010902	0.002034	0.000000	0.000022
163	Paperboard Mills	0.000049	0.005289	0.002631	0.000000	0.000014
164	Paperboard Containers and Boxes	0.030971	3.343054	0.617324	0.019119	2.062880
165	Paper Coated & Laminated Packaging	0.017103	1.846122	0.000306	0.000005	0.000566
166	Paper Coated & Laminated N.E.C.*	0.037770	4.076948	0.000290	0.000011	0.001184
167	Bags- Plastic	0.016509	1.782005	0.002278	0.000038	0.004059
168	Bags- Paper	0.007079	0.764117	0.002566	0.000018	0.001961
170	Sanitary Paper Products	0.001091	0.117764	0.000606	0.000001	0.000071
179	Commercial Printing	0.001096	0.118304	0.232997	0.000255	0.027564
186	Alkalies & Chlorine	0.000004	0.000432	0.000000	0.000000	0.000000
187	Industrial Gases	0.000011	0.001187	0.524328	0.000006	0.000623
188	Inorganic Pigments	0.000012	0.001295	0.436686	0.000005	0.000566
189	Inorganic Chemicals N.E.C*	0.000063	0.006800	0.052833	0.000003	0.000359
190	Cyclic Crudes- Interm. & Indus. Organic Chem.	0.000245	0.026446	0.428623	0.000105	0.011335

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Table 6. (continued)

		Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand						
196	Soap and Other Detergents	0.002068	0.223223	0.054782	0.000113	0.012229
197	Polishes and Sanitation Goods	0.002140	0.230995	0.204196	0.000437	0.047170
205	Adhesives and Sealants	0.000153	0.016515	0.334704	0.000051	0.005526
210	Petroleum Refining	0.003874	0.418165	0.777727	0.003013	0.325219
213	Lubricating Oils and Greases	0.001953	0.210810	0.562690	0.001099	0.118625
220	Miscellaneous Plastics Products	0.064794	6.993956	0.001098	0.000071	0.007677
273	Metal Cans	0.003787	0.408774	0.215246	0.000815	0.087987
293	Crowns and Closures	0.000201	0.021696	0.021225	0.000004	0.000460
305	Metal Foil and Leaf	0.001761	0.190085	0.039475	0.000070	0.007504
321	Special Dies and Tools and Accessories	0.000160	0.017271	0.205134	0.000033	0.003543
330	Food Products Machinery	0.000679	0.073292	0.737049	0.000500	0.054021
335	Packaging Machinery	0.000065	0.007016	0.580481	0.000038	0.004073
347	Refrigeration and Heating Equipment	0.000384	0.041450	0.129664	0.000050	0.005375
354	Industrial Machines N.E.C.*	0.000813	0.087756	0.000001	0.000000	0.000000
355	Transformers	0.000445	0.048034	0.125586	0.000056	0.006032
367	Electric Lamps	0.000321	0.034649	0.000392	0.000000	0.000014
386	Motor Vehicle Parts and Accessories	0.000396	0.042745	0.102835	0.000041	0.004396
428	Brooms and Brushes	0.000201	0.021696	0.003929	0.000001	0.000085
433	Railroads and Related Services	0.005866	0.633184	0.721000	0.004229	0.456526
434	Local- Interurban Passenger Transit	0.001160	0.125212	0.740800	0.000859	0.092757
435	Motor Freight Transport and Warehousing	0.038762	4.184025	0.872629	0.033825	3.650733
436	Water Transportation	0.002922	0.315405	1.000000	0.002922	0.315405
437	Air Transportation	0.004369	0.471596	0.462100	0.002019	0.217925
441	Communications- Except Radio and TV	0.001399	0.151010	0.527600	0.000738	0.079673
443	Electric Services	0.005675	0.612568	0.916300	0.005200	0.561296
444	Gas Production and Distribution	0.007259	0.783547	0.741489	0.005382	0.580923
445	Water Supply and Sewerage Systems	0.000926	0.099954	0.944434	0.000875	0.094385
446	Sanitary Services and Steam Supply	0.002313	0.249669	1.000000	0.002313	0.249669
447	Wholesale Trade	0.069656	7.518768	0.995665	0.069354	7.486206
448	Building Materials & Gardening	0.000478	0.051596	0.940300	0.000449	0.048516
449	General Merchandise Stores	0.001039	0.112151	0.927000	0.000963	0.103964
450	Food Stores	0.001310	0.141403	0.950000	0.001244	0.134333
451	Automotive Dealers & Service Stations	0.000606	0.065413	0.950000	0.000576	0.062142
452	Apparel & Accessory Stores	0.000555	0.059907	0.940300	0.000522	0.056331
453	Furniture & Home Furnishings Stores	0.000558	0.060231	0.940300	0.000525	0.056636
454	Eating & Drinking	0.002548	0.275035	0.900000	0.002293	0.247531
455	Miscellaneous Retail	0.001500	0.161912	0.940300	0.001410	0.152246
456	Banking	0.010888	1.175266	0.607500	0.006614	0.713974

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Table 6. (continued)

	Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand					
458 Security and Commodity Brokers	0.000235	0.025366	0.598981	0.000141	0.015194
459 Insurance Carriers	0.002592	0.279784	0.633100	0.001641	0.177131
462 Real Estate	0.004473	0.482822	0.700000	0.003131	0.337975
463 Hotels and Lodging Places	0.006677	0.720725	0.688785	0.004599	0.496429
464 Laundry- Cleaning and Shoe Repair	0.000222	0.023963	0.750100	0.000167	0.017975
469 Advertising	0.023072	2.490424	0.756000	0.017442	1.882761
470 Other Business Services	0.003261	0.351997	0.616278	0.002010	0.216930
472 Services To Buildings	0.001042	0.112475	0.651793	0.000679	0.073311
473 Equipment Rental and Leasing	0.001359	0.146692	0.756000	0.001027	0.110899
474 Personnel Supply Services	0.004062	0.438458	0.727233	0.002954	0.318863
475 Computer and Data Processing Services	0.001893	0.204333	0.756000	0.001431	0.154476
476 Detective and Protective Services	0.000731	0.078905	0.638471	0.000467	0.050375
477 Automobile Rental and Leasing	0.001760	0.189977	0.673876	0.001186	0.128021
479 Automobile Repair and Services	0.001416	0.152845	0.900000	0.001274	0.137561
480 Electrical Repair Service	0.000621	0.067032	0.900000	0.000559	0.060328
482 Miscellaneous Repair Shops	0.001597	0.172382	0.756000	0.001207	0.130321
483 Motion Pictures	0.000313	0.033786	0.610618	0.000191	0.020630
489 Membership Sports and Recreation Clubs	0.000444	0.047926	0.601605	0.000267	0.028833
494 Legal Services	0.000611	0.065952	0.792700	0.000484	0.052280
503 Business Associations	0.000563	0.060771	0.652337	0.000367	0.039644
506 Engineering- Architectural Services	0.000632	0.068219	0.792700	0.000501	0.054077
507 Accounting- Auditing and Bookkeeping	0.000398	0.042961	0.792700	0.000315	0.034055
508 Management and Consulting Services	0.002645	0.285505	0.606651	0.001605	0.173202
509 Research- Development & Testing Services	0.000503	0.054295	0.756000	0.000380	0.041047
512 Other State and Local Gov't Enterprises	0.000635	0.068543	1.000000	0.000635	0.068543
513 U.S. Postal Service	0.000740	0.079877	0.749900	0.000555	0.059899
516 Non comparable Imports	0.000207	0.022344	0.000000	0.000000	0.000000
530 Potato	0.073130	7.893756	1.000000	0.073130	7.893756
Total Commodity Demand	0.613128	66.182017		0.312973	33.779405
Value Added	Coefficient	Value Added			
Indirect Business Taxes	0.009042	0.976008			
Other Property Income	0.232669	25.114670			
Proprietary Income	0.000000	0.000000			
Employee Compensation	0.145163	15.669130			
Total Value Added	0.386874	41.759808			

Source: Data obtained from IMPLAN Pro 2.0

NOTE: The 2003 input data are expressed in \$ millions.

*N.E.C. Not elsewhere classified.

Schotzko and Sund 2002). The main difference between the I/O budget and the enterprise budget is one of accounting assumptions. In the enterprise budget, all input expenses are denoted in purchaser price (grower paid) terms. In the I/O accounts all input expenses are denoted in producer (factory gate) terms.

For example, the purchase of fertilizer by potato growers in the I/O budget is accounted for by the value of the fertilizer at the producer (factory gate) price plus the marketing margins and transport margins that are necessary to move the product to the purchaser. So the fertilizer purchase is recorded as the producer value of the fertilizer plus the transportation and wholesale margins associated with delivering the product to the grower. All the industry balance sheets presented in Tables 2, 3, 4, 5, and 6 are in standard I/O accounting (producer price) format. Tables 4 and 5 were constructed from interviews with various industry experts (Conely 2005 and Schotzko and Sund 2002). Table 6 was constructed from information in the original production function for potato chips from IMPLAN. This explains why it has so much more sector detail than the previous tables.

Results of the Impact Analysis

Impact Scenario Assumptions

The volume of potato production and potato processing generates demand for the input suppliers not only in the potato industries, but also in the transportation and marketing sectors as these products are moved to final destination markets. It is assumed that potato production drives the production of the potato processing industries.

Impact Results

Direct Effects — Impacts on Output

As noted on page 5, the direct effects show the deliveries to final demand (\$ millions of sales) for the potato industries. Readers should note that sales to final demand represent exports to the rest of the U.S. and the world. These figures are different from estimates of total sales for a given industry. Total sales represent sales to intermediate demand (other industries) and final demand (exports). Estimates of foreign exports for processed and unprocessed potatoes were obtained from the U.S. Census Bureau and Foreign Trade Statistics (2003), while exports to the rest of the U.S. were obtained from IMPLAN and the authors' research (IMPLAN Pro 2). Of course, the major direct effect belongs to the frozen potato products industry (533) with \$1,242 million in total exports (Table 7).¹ Notice that the direct effect for potato production is relatively small because of relatively small deliveries to final demand by the potato sector. As shown in Figure 1, most of the demand for potatoes stems from other industries; this shows up as an indirect effect in the impact analysis (Table 7). Exports of fresh pack potatoes, dehydrated potatoes, and potato chips are also represented in the direct effects (Table 7).

¹ In Tables 7 and 8, the IMPLAN sectoring scheme has been aggregated in a way that preserves the main sectors of interest (potatoes and potato processing) and leaves the remaining sectors in aggregated form. Sectors which have been aggregated in the report are denoted by (AGG). The main reason for the aggregation is ease of presentation. The un-aggregated reports would run to more than 5 pages each. The template used to aggregate the individual sectors is summarized in the appendix. It is very close to a standard 2-digit Standard Industrial Classification aggregation (U.S. Census Bureau NAICS 2002).

Estimates of the transportation and marketing business that stems from potato production and potato processing are also included in the direct effects portion of Table 7. The industries involved are: railroads and related services, motor freight transport and warehousing, other transportation, and wholesale trade. Most of the sales impact in marketing and transportation is concentrated in the wholesale industry (447) and the motor freight transport and warehousing industry (435). Transportation and marketing figures are derived from the marketing and transportation margins found in IMPLAN. More than \$300 million in direct sales in these industries is estimated to derive from potato production and processing. Total direct effects, including factory gate export values and transportation and marketing to deliver the commodities to port, sum to \$1,756 million or \$1.8 billion (Table 7).

Indirect Effect

Indirect effects are derived from use of the I/O model. Much of the indirect effect is concentrated on the potato sector (530) - \$486 million dollars (Table 7). Deliveries to final demand (exports) for the processed commodities drive demand for potatoes as the main input into the processed commodity. This is reflected in the indirect effects column as sales of potatoes. The other major components of the indirect effects likewise stem from the input demand mainly from the potato processors. Construction (48), food processing (58)², pulp and paper (161), chemicals and allied industries (186), utilities (443), banking and insurance (456), real estate (461), and business services (469) all stand out as industries with major impacts (Table 7).

² Indirect use of processed potato products is included in "Food processing."

Likewise, the transportation and marketing sectors show large impacts. Again, these are the marketing and transportation margins on the products used as inputs needed in the respective production processes. For example, motor freight transport and warehousing (435) output is estimated to be \$139.4 million; the wholesale trade (447) sector is estimated to be \$88.7 million. Government (510) services are estimated to be \$82.5 million. Included in this aggregation are state and federal electrical utilities and the postal service, so it is not surprising that it shows a large indirect effect. Total indirect output impact is estimated at \$1,297 million or \$1.3 billion (Table 7).

Induced Effect

The induced impact shows the industry sales to meet the household consumption demand associated with the income stemming from direct and indirect effects. In other words, payrolls associated with the direct and indirect effects generate household consumption in Washington, which is measured by the induced effect. The major induced effects are concentrated in the services industries. The exceptions are in the construction sector (48; reflecting maintenance and repair of dwellings), other food processing (58; reflecting processed food), and petroleum products (210; reflecting fuel). The major induced impacts are \$73 million on retail trade (448), \$59 million on real estate (461), \$56 million on health services (490), and \$40 million on banking and insurance (456). Total induced output impact is estimated to be \$424.3 million (Table 7).

The total economic impact of the potato industry is estimated to be \$3,477 million (Table 7) on the Washington economy. In other words, the export base of the potato complex (product shipped from

Washington) directly and indirectly generates \$3.48 billion of sales throughout the Washington economy.

Impacts on Employment

Direct Effect

Employment effects are estimated by knowing the sales to employment ratio for each industry and translating changes in sales for each industry into the associated change in jobs. The estimate for the more significant direct employment effects is 5,176 jobs in frozen potato products (533), 1,353 in wholesale trade (447), 1,168 in motor freight transport and warehousing (435), and 436 in fresh pack potato (531) and 308 in dehydrated potato (532) (Table 8). The total direct employment impact is estimated to be 8,763 jobs (Table 8). This is a simple jobs count in the directly affected industries. It includes full-time and part-time employment.

Indirect Effect

Indirect employment is 1,446 from potato (530) production, 1,148 from motor freight transport and warehousing (435), 863 from business services (469), and 713 from wholesale trade (447). Total indirect employment impact is 7,274 jobs (Table 8).

Induced Effect

Retail trade (448) is a dominant part of the induced employment impact providing 1,424 out of 4,634 total jobs (Table 8). The induced employment impact is 690 in health services (490), 379 in business services (469), and 282 in banking and insurance (456). Total induced employment impact is 4,634 jobs (Table 8).

The total employment in Washington estimated to be driven by potato production

and potato processing totals 20,670 jobs when indirect and induced effects are considered (Table 8).

Discussion

The best evidence for believing that the production functions and sales figures presented in this study for the processing industries are a reasonable estimate, is that total demand for potatoes from the impact analysis is very close (Table 7; Potato 530; \$500 million) to the independently estimated total potato production (\$577 million) obtained from the USDA's National Agricultural Statistics Services Oregon and Washington. Because the export driven impact analysis result is a close match to the value for potato supply, it lends credence to the depiction of the potato processing industries presented in this publication. The input-output analysis says that exports of processed products account for \$500 million of the \$577 million of potatoes produced in the state. The remaining- potatoes are used to meet Washington household demand for fresh pack and processed potato products.

To put this economic impact analysis in perspective, it may be useful to consider the combined regional economy of Morrow and Umatilla Counties in Oregon with Adams, Benton, Franklin, Grant, and Walla Walla Counties in Washington. This is the region where much of the potato production and potato processing takes place in Washington and Oregon, and it is the area where much of the economic impact in this study is located.³

³ In western Washington, the major potato production area is Skagit County

Table 7. Output Impact (Measured in \$ Sales)

Sector #	Industry	Direct	Indirect	Induced	Total
1	Other Agriculture (AGG)	0	3,398,069	4,122,697	7,520,766
25	Commercial Fishing	0	1,134	13,724	14,858
26	Ag Services (AGG)	0	18,199,848	1,051,561	19,251,408
28	Other Mining (AGG)	0	1,047,552	157,488	1,205,040
48	Construction (AGG)	0	28,676,420	7,209,681	35,886,100
58	Food Processing (AGG)	0	35,742,896	10,478,528	46,221,424
108	Textiles and Apparel (AGG)	0	406,435	2,159,414	2,565,850
133	Wood Products (AGG)	0	1,636,169	597,644	2,233,814
148	Furniture (AGG)	0	10,726	694,111	704,837
161	Pulp and Paper (AGG)	0	40,837,032	576,500	41,413,528
174	Printing and Publishing (AGG)	0	5,333,887	3,386,044	8,719,932
186	Chemicals and Allied (AGG)	0	23,703,994	5,608,513	29,312,506
210	Petroleum Products (AGG)	0	29,290,064	7,191,649	36,481,712
215	Rubber Products (AGG)	0	297,095	24,228	321,323
221	Leather Products (AGG)	0	7,194	92,269	99,462
230	Stone, Glass and Clay (AGG)	0	370,273	255,035	625,307
254	Primary Metals (AGG)	0	140,362	16,650	157,012
273	Fabricated Metal (AGG)	0	399,467	161,566	561,033
307	Industrial Machinery (AGG)	0	5,912,339	646,435	6,558,774
355	Electrical Equipment (AGG)	0	1,527,767	1,321,294	2,849,061
384	Transportation Equipment (AGG)	0	764,297	1,862,012	2,626,308
400	Scientific Instruments (AGG)	0	204,925	775,293	980,218
415	Miscellaneous Mfg (AGG)	0	223,532	315,013	538,546
433	Railroads and Related Services	42,198,404	7,715,584	587,050	50,501,036
434	Other Transportation (AGG)	843,693	4,798,176	4,244,914	9,886,783
435	Motor Freight Transport and Warehousing	141,832,144	139,403,600	5,084,220	286,319,968
439	Transportation Services (AGG)	0	9,026,145	759,353	9,785,498
441	Communications (AGG)	0	12,557,005	9,870,791	22,427,796
443	Utilities (AGG)	0	69,303,720	7,665,530	76,969,248
447	Wholesale Trade	168,476,320	88,743,728	24,679,234	281,899,264
448	Retail Trade (AGG)	0	4,379,211	73,206,880	77,586,088
456	Banking and Insurance (AGG)	0	38,420,552	39,621,380	78,041,936
461	Real Estate (AGG)	0	72,833,072	59,020,204	131,853,272
463	Hotels and Lodging Places	0	3,743,271	4,640,048	8,383,319
464	Personal Services (AGG)	0	1,285,740	6,049,661	7,335,402
469	Business Services (AGG)	0	62,567,048	30,163,404	92,730,456
477	Automotive Services (AGG)	0	11,297,993	6,481,665	17,779,658
480	Repair Services (AGG)	0	2,060,214	1,435,602	3,495,816
483	Motion Pictures	0	785,089	1,807,686	2,592,775
484	Recreation Services (AGG)	0	928,064	6,979,426	7,907,490
490	Health Services (AGG)	0	58,728	55,602,156	55,660,880
495	Education Services (AGG)	0	181,676	4,982,997	5,164,674
498	Social Services (AGG)	0	28,031	9,527,652	9,555,683
502	Non-profit Organizations (AGG)	0	776,660	5,301,758	6,078,419
510	Government (AGG)	0	82,544,824	16,223,272	98,768,096
525	Domestic Services	0	0	751,836	751,836
530	Potato	14,790,000	485,606,144	205,851	500,602,016
531	Fresh Pack Potato	74,966,000	0	115,579	75,081,576
532	Dehydrated Potato	47,757,000	0	22,139	47,779,140
533	Frozen Potato	1,241,870,976	0	310,543	1,242,181,504
534	Potato Chips	22,769,000	0	262,284	23,031,284
	Total	1,755,503,537	1,297,175,752	424,320,461	3,476,999,730

NOTE: (AGG) indicates a group of industries that are aggregated. See "Aggregation" in Appendix.

Table 8. Employment Impact (Measured in The Number of Jobs)

Sector #	Industry	Direct	Indirect	Induced	Total
1	Other Agriculture (AGG)	0	44.4	44.6	89
25	Commercial Fishing	0	0	0.1	0.1
26	Ag Services (AGG)	0	667.4	30.1	697.5
28	Other Mining (AGG)	0	5.4	0.8	6.3
48	Construction (AGG)	0	350.1	78.5	428.6
58	Food processing (AGG)	0	78.2	39	117.2
108	Textiles and Apparel (AGG)	0	4.1	18.7	22.7
133	Wood products (AGG)	0	12.7	4.4	17.1
148	Furniture (AGG)	0	0.1	6.6	6.7
161	Pulp and paper (AGG)	0	171.3	2.4	173.7
174	Printing and publishing (AGG)	0	43.4	26.3	69.7
186	Chemicals and allied (AGG)	0	71.9	7.5	79.4
210	Petroleum products (AGG)	0	11	2.8	13.8
215	Rubber products (AGG)	0	1.6	0.1	1.7
221	Leather products (AGG)	0	0.1	1	1.1
230	Stone, glass and clay (AGG)	0	2.5	2	4.5
254	Primary metals (AGG)	0	0.5	0.1	0.6
273	Fabricated metal (AGG)	0	2.4	1	3.4
307	Industrial machinery (AGG)	0	29.1	3	32.1
355	Electrical equipment (AGG)	0	6.3	6.4	12.7
384	Transportation equipment (AGG)	0	3.1	4	7.1
400	Scientific instruments (AGG)	0	1	3.8	4.8
415	Miscellaneous mfg (AGG)	0	2.3	2.7	5.1
433	Railroads and Related Services	199.9	36.6	2.8	239.3
434	Other Transportation (AGG)	2.9	32.5	41.8	77.2
435	Motor Freight Transport and Warehousing	1,168.00	1,148.00	41.9	2,357.80
439	Transportation Services (AGG)	0	117.3	10.2	127.5
441	Communications (AGG)	0	35.8	27	62.7
443	Utilities (AGG)	0	116.4	14.2	130.6
447	Wholesale Trade	1,352.60	712.5	198.1	2,263.20
448	Retail Trade (AGG)	0	81.9	1,424.20	1,506.10
456	Banking and Insurance (AGG)	0	288.1	281.9	570
461	Real estate (AGG)	0	390.2	111.8	502
463	Hotels and Lodging Places	0	59.2	73.4	132.7
464	Personal services (AGG)	0	25.1	146.6	171.7
469	Business services (AGG)	0	863.2	378.8	1,242.00
477	Automotive services (AGG)	0	110.2	70.3	180.5
480	Repair services (AGG)	0	25.4	18.1	43.5
483	Motion Pictures	0	10.1	23.2	33.3
484	Recreation services (AGG)	0	11.7	179.4	191.2
490	Health services (AGG)	0	0.9	689.9	690.7
495	Education services (AGG)	0	3.6	133.6	137.2
498	Social services (AGG)	0	0.6	198.2	198.8
502	Non-profit organizations (AGG)	0	17.4	140.4	157.9
510	Government (AGG)	0	232.1	71.4	303.5
525	Domestic Services	0	0	67	67
530	Potato	44	1,445.90	0.6	1,490.50
531	Fresh Pack Potato	436.2	0	0.7	436.8
532	Dehydrated Potato	308.4	0	0.1	308.6
533	Frozen Potato	5,175.90	0	1.3	5,177.20
534	Potato Chips	74.6	0	0.9	75.5
	Total	8,762.50	7,273.50	4,634.10	20,670.10

NOTE: (AGG) indicates a group of industries that are aggregated. See "Aggregation" in Appendix.

In 2003, total regional employment in this economy was 240,142 jobs, and total regional personal income was \$11,153 million or \$11.2 billion (Bureau of Economic Analysis 2003). Based on the analysis presented here, jobs based on potato production in the state of Washington equal 8.6% of the total employment in this seven county region. Given that some of the indirect and induced jobs are outside this region, but still in Washington, 8% (approximately 1 out of

12) is a rough estimate of the jobs in this seven county region that stem from potato production and processing. Making the same comparison for personal income indicates that personal income from potato production in the state of Washington equals 11.3% of the total personal income in the seven county region; therefore, it would appear that roughly 11% of all income in the region is accounted for by potato production and processing.

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Appendix

Aggregation Template for Potato Impact Study

<u>Aggregated Sector Name</u>	<u>Composed of</u>																		
1 Other Agriculture	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
	20	21	22	23	24														
25 Commercial Fishing	25																		
26 Ag Services	26	27																	
28 Other Mining	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
	47	57																	
48 Construction	48	49	50	51	52	53	54	55	56										
58 Food processing	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76
	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
	96	97	98	99	100	101	102	103	104	105	106	107							
124 Textiles and Apparel	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126
	127	128	129	130	131	132													
133 Wood Products	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147				
148 Furniture	148	149	150	151	152	153	154	155	156	157	158	159	160						
161 Pulp and Paper	161	162	163	164	165	166	167	168	169	170	171	172	173						
174 Printing and Publishing	174	175	176	177	178	179	180	181	182	183	184	185							
186 Chemicals and Allied	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204
	205	206	207	208	209														
210 Petroleum Products	210	211	212	213	214														
215 Rubber Products	215	216	217	218	219	220													

Continued on next page

Template (*continued*)

221 Leather Products

221 222 223 224 225 226 227 228 229

230 Stone, Glass and Clay

230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248
249 250 251 252 253

254 Primary Metals

254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272

273 Fabricated Metal

273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291
292 293 294 295 296 297 298 299 300 301 302 303 304 305 306

307 Industrial Machinery

307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325
326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344
345 346 347 348 349 350 351 352 353 354

355 Electrical Equipment

355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373
374 375 376 377 378 379 380 381 382 383

384 Transportation Equipment

384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399

400 Scientific Instruments

400 401 402 403 404 405 406 407 408 409 410 411 412 413 414

415 Miscellaneous Mfg

415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432

433 Railroads and Related Services

433

434 Other Transportation

434 436 437 438

435 Motor Freight Transport and Warehousing

435

439 Transportation Services

439 440

441 Communications

441 442

443 Utilities

443 444 445 446

447 Wholesale Trade

447

Continued on next page

Template (continued)

448 Retail Trade

448 449 450 451 452 453 454 455

456 Banking and Insurance

456 457 458 459 460

461 Real Estate

461 462

463 Hotels and Lodging Places

463

464 Personal Services

464 465 466 467 468

469 Business and Personal Services

469 470 471 472 473 474 475 476 494 506 507 508 509

477 Automotive Services

477 478 479

480 Repair Services

480 481 482

483 Motion Pictures

483

484 Recreation Services

484 485 486 487 488 489

490 Health Services

490 491 492 493

495 Education Services

495 496 497

498 Social Services

498 499 500 501

502 Non-profit Organizations

502 503 504 505

510 Government

510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 526 527 528

525 Domestic Services

525

530 Potato

530

Continued on next page

Template (continued)

531 Fresh Pack Potato
531

532 Dehydrated Potato
532

533 Frozen Potato
533

534 Potato Chips
534



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