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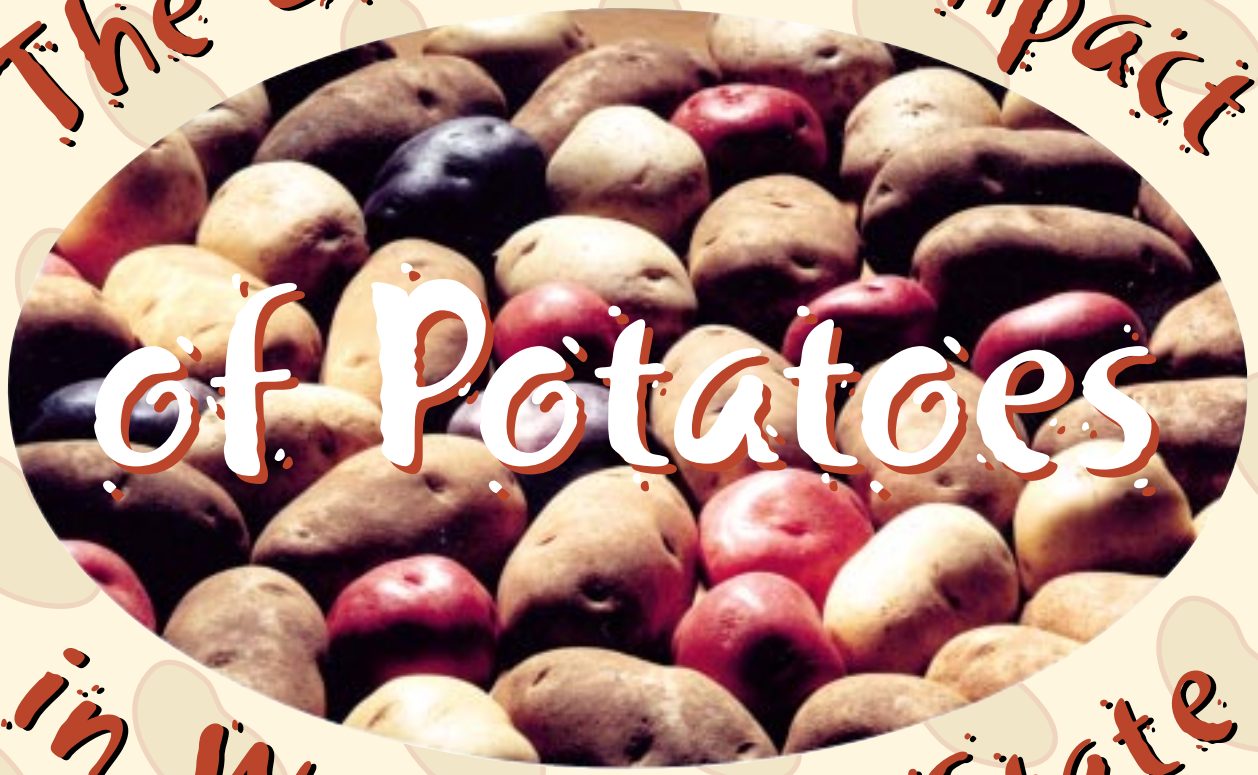
The Economic Impact of Potatoes in Washington State



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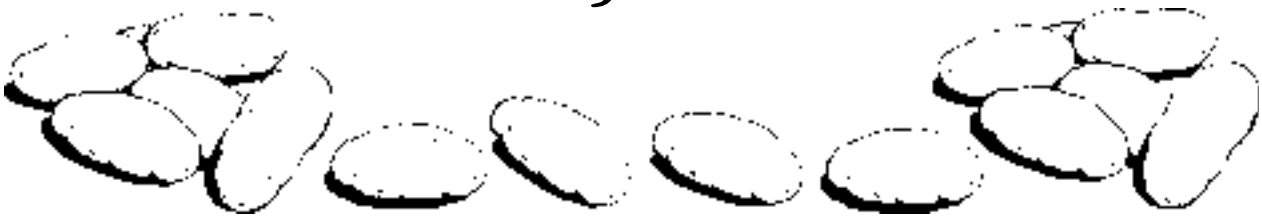

Introduction

The Washington State potato industry is the second largest producer (behind Idaho) of potatoes in the United States (Washington Agricultural Statistics Service, 1997–1998). In the 1996 production and 1996–1997 marketing years, which are the focuses of this study, the value of Washington potato production at the farm gate was $451 million. Yet, as economically important as this figure is, it fails to capture the true economic significance of the potato industry as it impacts the job and economic output in Washington. The reason is that unlike any other agricultural commodity produced in Washington, potato production sets off a chain of economic activities that dwarf the original production industry.

With potato production comes the fresh packing of raw potatoes for use in restaurants, commercial kitchens, and for direct consumption in households. But, potato production also spawns the processing of potatoes for French fries and other frozen products as well as the processing of potatoes for potato chips. In Washington, the frozen potato products industry is clearly dependent on Washington potato production and in terms of sales is more that one and one-half times as large as potato production. The production of dehydrated potato products such as potato flakes and de-hydrofrozen potato cubes uses processed grade potatoes from the fresh pack and frozen potato products as well as raw potatoes purchased directly from growers. This industry is also a vital component of those industries whose existence is driven by potato production. Finally, this discussion would not be complete without noting that a major part of the cattle feeding industry in Washington is likewise dependent on potato production, because of the use of potato waste mainly in the form of peels and processed grades as a major ingredient of cattle feed.

In spite of a general understanding by growers, food processing managers, and agricultural scientists of the above described complex, there has been no scientific study of the inter-industry relationships among the above named industries or their joint economic impact on the Washington economy. The purpose of this bulletin is to provide that information. Using industry production functions developed by production experts in potato production and potato processing industries, potato production and processing accounts for these industries were incorporated into the most recently available Washington State economic input-output model. This economic model was used to estimate total jobs and industry sales that are linked to the potato production and processing industry's part of the export base in Washington.

The Economic Region and the Input-Output Model

The analysis was conducted using a 1996 IMPLAN based input-output model of the Washington State economy. Individual production functions for potato production and potato processing were incorporated into the model in order to represent the economic impact of the potato industry as accurately as possible.

The input-output model that was constructed represents both Washington State and includes Umatilla County in Oregon. The reason for including Umatilla County in the economic region is that it has a very important regional economic linkage to the potato industry in Washington. In spite of the fact that it is across the border from Washington from a political perspective, from an economic perspective, Umatilla County is an integral part of the eastern Washington potato production and processing economy since it has major economic linkage with Washington potato production and potato processing.

Umatilla County is a major producer of potatoes and contains major potato processing plants within the county boundary. Some of the potatoes grown in Washington go into Umatilla County to be processed; likewise some of the potatoes grown in Umatilla County are processed in Washington. Umatilla County is also included in USDA's statistical and production region for Washington State. For purposes of this bulletin it should be understood that the Washington input-output model was constructed to be inclusive of Umatilla County in Oregon. This means that all estimates of model regional supply and demand include Umatilla. For example, in the case of the potato sector, the estimated Washington State 1996 supply of $451 million in raw potatoes is augmented by $44 million from Umatilla (Oregon Agricultural Statistical Service) for an industry total potato supply in the input-output model of $495 million.

Review of Input-Output Models and Analysis

The input-output framework of analysis was developed by Wassily Leontief for which he received the Nobel Prize in economics (Leontief). The input-output (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* models (Miller and Blair). The personal consumption of the household sector is considered to be exogenous in the model in the Type I model, while household consumption is assumed to be endogenous in the Type II model. In the Type I model, the household sector is treated as part of the final demand while in the Type II model, changes in household income are treated as driving changes in household consumption.

The A matrix in the input-output model is called the matrix of technical coefficients and represents the production functions of all the industries in the model (net of imported inputs). Through algebraic manipulation of the A matrix, we derive the input-output model and the output multipliers. The following equations describe the derivation of the predictive model:

(1) $\mathbf{X = AX + Y}$

(2) $\mathbf{(I - A)X = Y}$

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

where X is total industry output, I is an identity matrix, A is the A matrix, and Y is final demand.

This can be also interpreted as:

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

where $\Delta\mathbf{X}$ is change in total industry output and $\Delta\mathbf{Y}$ is change in final demand. The matrix, $(\mathbf{I} - \mathbf{A})^{-1}$ is known as the Leontief inverse.

The impact of changes in final demand ($\Delta\mathbf{Y}$) on changes in supply ($\Delta\mathbf{X}$) can be broken down into three following three components:

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

The input-output model constructed for this study utilizes a Type II closure treating household consumption as endogenous. The closure 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. This type of input-output model provides the most accurate representation of income-consumption relationships and the most accurate structure for the estimation of induced effects.

In configuring the economic analysis that shows the contribution of potato production to total jobs and output in Washington, the direct effects of the impact are configured as sales to final demand (mainly exports from the state) of each of the respective industries ($\Delta\mathbf{Y}$). The input-output model is then used to predict the resulting sales in all sectors throughout the economy ($\Delta\mathbf{X}$) as in equation (4).

It should be noted that potato production and potato processing sets off a chain of transportation, warehousing and marketing activities once the commodity leaves the farm or factory gate. The motor freight and warehousing sector includes not only trucking but also the activities involved in storage and handling of the product.

These activities are clearly dependent upon the production of the commodity in the state economy and should be legitimately included as part of the economic impact of the industry. Accordingly, the economic impact analysis includes estimates of the transportation, warehousing and marketing activities that accompany the finished product after it leaves the processing plant or fresh pack shed, or in the case of potatoes, the farm. The direct effects of these industries were estimated from the margin accounts in IMPLAN and are included as part of the direct effects of the potato industry.

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 in the social account related to the use of potatoes in the Input-Output model. The first section of balance sheet shows which of the industries produce the commodity. Some commodities are produced by more than one industry. The commodity balance sheet for potatoes shows that potatoes are produced by the potato industry only. The farmgate value of production was $495.1 million as shown at the bottom of the Commodity Balance Sheet.

The second section of the commodity balance sheet describes which regional industries use potato as an input and the Institution Demand. The gross absorption coefficient 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 coefficient .404 for Frozen Potato Products indicates that 40% of the value of frozen potato product is the cost of the raw potato. For potato chips, potatoes as an input represent only 7% of the cost of producing the chips.

The industries that have high inter-industry demand for potatoes are shown in Table 1. The most important sector in terms of industry demand is the frozen potato products sector, which purchased $357 million. The second most important source of demand is the fresh pack potato sector, which purchased $58 million. The potato chips sector purchased just $4 million, while dehydrated potato purchased $18 million. Total industry demand for potatoes including the potato industry itself was $472 million as shown in the first part of the Commodity Balance Sheet.

Figure 1 elaborates on the information in Table 1. Figure 1 is based on the Potato Commodity Balance Sheet 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 $357 million of potatoes annually (Figure 1). Other important uses for the crop are for Fresh Pack ($58 million), Dehydrated Potatoes ($18 million), and for seed ($17 million). Relatively small portions of the crop are exported or used in the production of potato chips.[1]

Figure 2 concentrates on the distribution of the potato crop in Washington State only to the downstream industrial users and indicates the sales values of those industries. The bold arrows indicate the primary uses of potatoes. The dashed arrows show the by-products or secondary uses. As noted earlier, roughly three-quarters (75%) of industry demand for the potato crop in Washington comes from the production of frozen French fries and other frozen potato products. 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 $884 million in annual sales.

The potato is processed into various frozen potato products such as frozen French fries and other frozen products such as hash browns and potato rounds. Due to size and other specifications, about 12% of the potatoes brought into frozen potato products processing plants end up as processed grade or cattle feed. These processed grade

[1]Shrinkage and loss are estimated at $17 million.

Table 1. Potato Commodity Balance Sheet.

Industry Production	Industry		Market Share		By-Products
	495.13		1.00		1.00
	Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficients	Regional Inputs
Industry Demand					
Raw Potato	0.068854	34.091000	0.508000	0.034998	17.328000
Fresh Pack Potato	0.533333	57.934000	1.000000	0.533333	57.934000
Dehydrated Potato	0.429700	18.185000	1.000000	0.429700	18.185000
Frozen Potato	0.404216	357.327000	1.000000	0.404216	357.327000
Potato Chips	0.072910	4.448000	1.000000	0.072910	4.448000
Total Industry Demand	1.509000	471.985000		1.509000	471.985000
Institutional Demand					
Households—Low Income		0.000	1.000000		
Households—Medium Income		0.000	1.000000		
Households—High Income		0.000	1.000000		
Federal Government NonDefense		0.000	1.000000		
Federal Government Defense		0.000	1.000000		
State/Local Govt NonEducation		0.000	1.000000		
State/Local Govt Education		0.000	1.000000		
Capital		0.000	1.000000		
Inventory Additions/Deletions		0.000	1.000000		
Foreign Trade		0.000	1.000000		
Domestic Trade		23.141	1.000000		
Potato Industry Production		**495.130**			
Total Institutional Demand		**23.141**			

NOTE: The 1996 data presented for inputs in the table are expressed in millions of dollars and they have been obtained by the use of IMPLAN Pro 2.0.

potatoes form an important input in the Dehydrated Potato processing sector of the industry (Figure 2). The processing of frozen French fries and other frozen potato products results in the production of by-products such as starch and potato waste (composed mainly of potato peels and processed grades from the production process). The starch is used as an input in the Paper Mills industry and the waste is used as feed in the Cattle Feed industry. Roughly 45 to 50% of the cattle on feed in Washington are fed on potato waste (private communication from Wendy Peay, Washington Cattle Feeders Association).

After accounting for potato sales to the Frozen Potato Products industry, the remaining 18% of the crop sold to in-state industry either ends up in the fresh pack industry (13%) or in the production of various dehydrated potato products (4%) and potato chips (1%) (Figure 2).

The supply of the fresh market for potatoes comes from various Fresh Potato Packers whose operations vary in size. 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 $108 million. 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. In fact, some of the Washington fresh potatoes are exported beyond the state.[2] Due to customer specifications about sizes, shapes, 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 the Frozen French Fry and Dehydrated Potato processors (Figure 2).

Dehydrated potatoes absorb about 4% of the potato crop and receives part of their potato input as processed grade from both the Fresh Pack and Frozen Potato Products industry. The Dehydrated Potato processors mainly produce potato flakes and 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 $42 million. The de-hydro-frozen potato products are in the form of potato cubes which are used either in the production of soups or sold directly to restaurants. By-products of the Dehydrated Potato sector are starch and waste. The waste is used in the cattle feed industry and the starch is used by the paper mill industry.

Finally, note should be made of the cattle feeding industry. Although not ordinarily considered part of the potato complex, it is clear that an important fraction (45–50%) of cattle on feed in Washington are fattened on potato waste. If the waste was not available, the production of fattened cattle and likewise the slaughter of those cattle in Washington would likely be diminished. In this study we have assumed it would not be economical to fatten the cattle that are fed potato waste if the waste was not available. In other words, that 45% of cattle feeding production would not exist in Washington if it was not for the potato production-potato processing industry. The total industry output of the cattle feeding industry dependent on the potato industry is therefore estimated to be nearly $180 million per year. To allow for the uncertainty in this estimate, no additional impact for the slaughter of waste-fattened cattle is included in this study.[3]

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[2]One of the fresh packers we talked with gave us estimates of 95% and 75% exports out of state during the summer and winter seasons respectively.

[3]Additional research is needed to give more precision to the value of potato waste in terms of its impact on the production of potato waste-fed cattle in Washington. By not including the possible ripple effects of the slaughter of cattle fed potato waste, this study implicitly adjusts for possible upward bias in the estimate of cattle dependent on potato waste.

Figure 1. Potato Demand ($ Millions) in Washington State.[4]

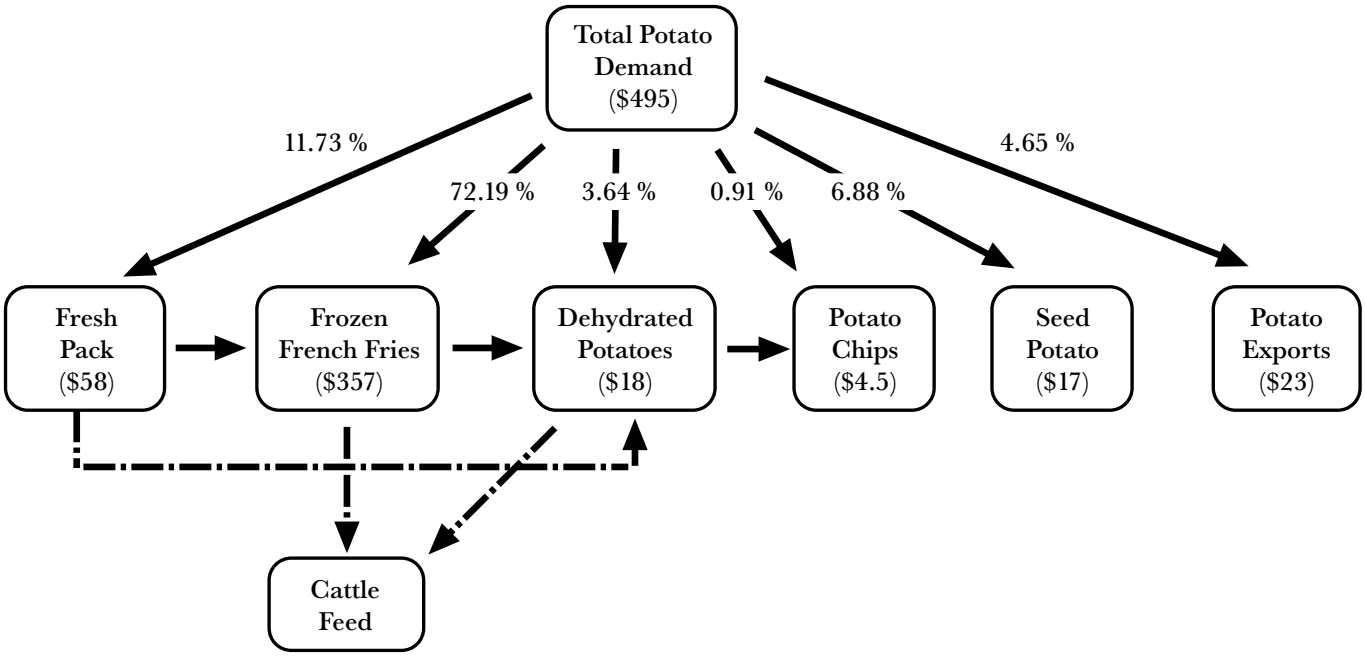
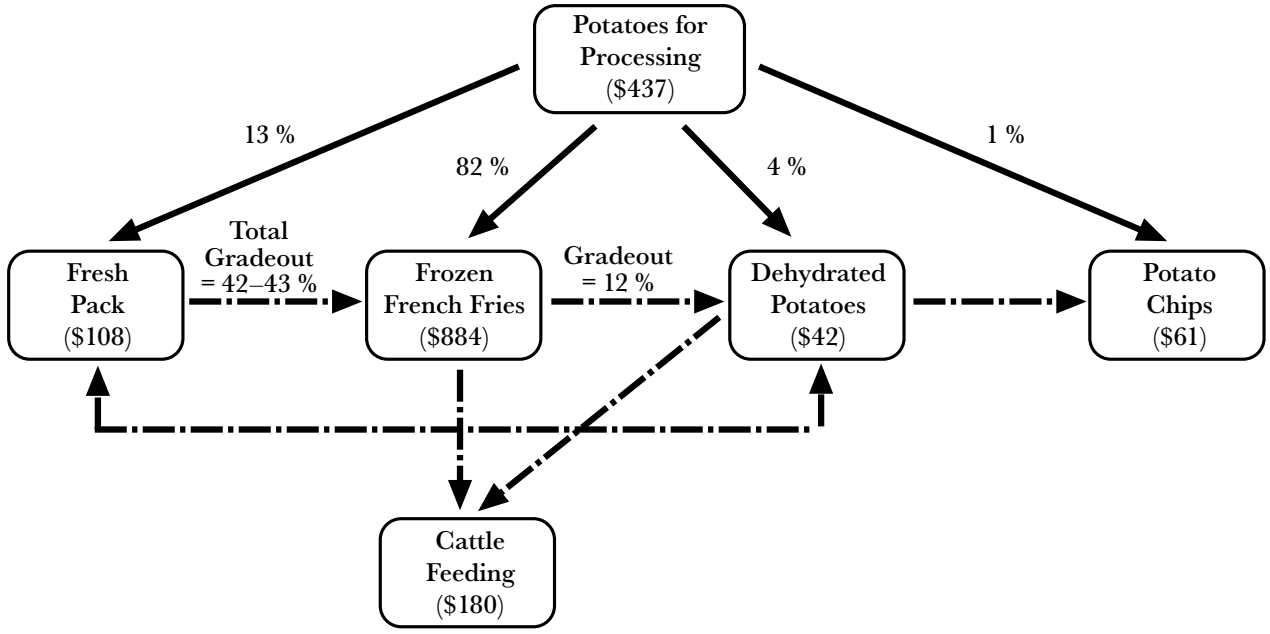


Figure 2. Potato Production Sales as a Driver of Potato Processing in Washington State.[5]



[4] Data used included Umatilla County, OR.

[5] Data used included Umatilla County, OR. Numbers in parentheses are expressed in millions of dollars.

Industry Production Functions in the Input-Output Model

The Industry Balance Sheet— A Description of Input Requirements

Data were collected by interview to construct purchase and sales information for the potato industry and its related processed products. We focused upon five potato and potato related industries: raw potato production, fresh pack potato production, 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 function of an individual firm in the industry.

The industry balance sheets show the gross absorption coefficient (technical coefficients) for both intermediate (industry) inputs and for final (labor and capital) inputs. The product of the gross absorption coefficient times total industry output measured in sales gives the gross input figure. The regional purchase coef-ficient shows the proportion of commodity demand in Washington that is met by supply from Washington. The product of gross inputs times the regional purchase coefficient (RPC) gives the regional input. The regional input shows the input into the production process that is estimated to come from within the region (Washington). For example, in Table 2, the Industry Balance Sheet for potatoes shows that potato production requires $49.7 million of Nitrogenous and Phosphatic Fertilizers (commodity 202).[6] The RPC indicates that 10.6% 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 $5.27 million (denoted in the "Regional Inputs" column of the table).

The Industry Balance Sheet for potato production is based on enterprise budgets developed in the Department of Agricultural Economics at Washington State University. The main difference between the input-output type 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 input-output accounts all input purchases are denoted in producer (factory gate) terms.

For example, the purchase of fertilizer by potato growers in the input-output budget is accounted for by 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 2–6 are in standard input-output accounting (producer price) format. Tables 3–5 were constructed from interviews conducted with various industry experts. 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.

[6]All fertilizers used in potato production are included in this sector.

Table 2. Industry Balance Sheet for Potato Production.

		Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand						
26	Agricultural—Forestry—Fishery Services	0.132977	65.840000	0.781103	0.103869	51.430000
52	Potato	0.068854	34.090000	0.508000	0.034998	17.328000
202	Nitrogenous and Phosphatic Fertilizers	0.100306	49.660000	0.106184	0.010651	5.270000
204	Agricultural Chemicals—N.E.C.*	0.140325	69.480000	0.119679	0.016794	8.320000
210	Petroleum Refining	0.008367	4.140000	0.628007	0.005255	2.600000
309	Farm Machinery and Equipment	0.009489	4.700000	0.509258	0.004832	2.390000
433	Railroads and Related Services	0.005743	2.840000	0.721000	0.004141	2.050000
435	Motor Freight Transport and Warehousing	0.020805	10.300000	0.974125	0.020267	10.030000
436	Water Transportation	0.000953	0.470000	1.000000	0.000953	0.470000
437	Air Transportation	0.000410	0.200000	0.462100	0.000189	0.090000
438	Pipe Lines, except Natural Gas	0.000081	0.040000	0.275300	0.000022	0.010000
443	Electric Services	0.020807	10.300000	0.916300	0.019065	9.440000
446	Sanitary Services and Steam Supply	0.004994	2.470000	1.000000	0.004994	2.470000
447	Wholesale Trade	0.087468	43.310000	0.999500	0.087424	43.290000
451	Automotive Dealers & Service Stations	0.000018	0.010000	0.950000	0.000017	0.010000
459	Insurance Carriers	0.001307	0.650000	0.633100	0.000827	0.410000
462	Real Estate	0.039014	19.320000	0.700000	0.027310	13.520000
503	Business Associations	0.012692	6.280000	0.612540	0.007774	3.850000
	Total Commodity Demand	0.654610	324.115000		0.383239	189.750000

Value Added	Coefficient	Value Added
Employee Compensation	0.021731	10.759000
Proprietary Income	0.133560	66.129000
Other Property Income	0.186183	92.184000
Indirect Business Taxes	0.003916	1.939000
Total Value Added	0.345390	171.010000

*N.E.C. Not elsewhere classified.

NOTE: The 1996 data presented for inputs in the table are expressed in millions of dollars. They have been obtained by the use of IMPLAN Pro 2.0.

Table 3. Industry Balance Sheet for Frozen Potato Products Production.

		Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand						
52	Potato	0.404216	357.330000	1.000000	0.404216	357.330000
72	Flour and Other Grain Mill Products	0.007818	6.910000	0.059986	0.000469	0.410000
81	Sugar	0.008167	7.220000	0.019932	0.000163	0.140000
90	Shortening and Cooking Oils	0.095597	84.510000	0.205240	0.019620	17.340000
103	Food Preparations—N.E.C.*	0.005705	5.040000	0.658790	0.003758	3.320000
122	Cordage and Twine	0.004641	4.100000	0.012246	0.000057	0.050000
164	Paperboard Containers and Box	0.046185	40.830000	0.700233	0.032341	28.590000
167	Bags—Plastic	0.020769	18.360000	0.001570	0.000033	0.030000
168	Bags—Paper	0.025962	22.950000	0.000770	0.000020	0.020000
189	Inorganic Chemicals—N.E.C.*	0.007891	6.980000	0.003796	0.000030	0.030000
205	Adhesives and Sealants	0.004569	4.040000	0.583401	0.002666	2.360000
209	Chemical Preparations—N.E.C.*	0.005733	5.070000	0.318306	0.001825	1.610000
433	Railroads and Related Service	0.002210	1.950000	0.721000	0.001594	1.410000
435	Motor Freight Transport & Warehousing	0.044126	39.010000	0.974125	0.042984	38.000000
436	Water Transportation	0.000318	0.280000	0.000000	0.000318	0.280000
437	Air Transportation	0.000149	0.130000	0.462100	0.000069	0.060000
443	Electric Services	0.039961	35.330000	0.916300	0.036617	32.370000
444	Gas Production and Distribution	0.018809	16.630000	0.684137	0.012868	11.380000
445	Water Supply and Sewage Systems	0.011048	9.770000	0.852837	0.009422	8.330000
446	Sanitary Services and Steam Supply	0.002756	2.440000	0.000000	0.002756	2.440000
447	Wholesale Trade	0.014135	12.500000	0.999500	0.014128	12.490000
476	Detective and Protective Services	0.002756	2.440000	0.559817	0.001543	1.360000
	Total Commodity Demand	0.773523	683.794000		0.587495	519.350000
Value Added		Coefficient	Value Added			
	Employee Compensation	0.137801	121.816000			
	Proprietary Income	0.000000	0.000000			
	Other Property Income	0.074072	65.480000			
	Indirect Business Taxes	0.014478	12.798000			
	Total Value Added	0.226477	200.210000			

*N.E.C. Not elsewhere classified.

NOTE: The 1996 data presented for inputs in the table are expressed in millions of dollars. They have been obtained by the use of IMPLAN Pro 2.0.

Table 4. Industry Balance Sheet for Fresh Pack Potato Production.

		Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand						
52	Potato	0.533333	57.930000	1.000000	0.533333	57.930000
56	Maintenance and other Repair	0.028467	3.090000	0.917516	0.026119	2.840000
122	Cordage and Twine	0.003929	0.430000	0.012246	0.000048	0.010000
164	Paperboard Containers and Boxes	0.034757	3.780000	0.700233	0.024338	2.640000
167	Bags—Plastic	0.021980	2.390000	0.001570	0.000035	0.000000
168	Bags—Paper	0.021980	2.390000	0.000770	0.000017	0.000000
205	Adhesives and Sealants	0.003869	0.420000	0.583401	0.002257	0.250000
433	Railroads and Related Service	0.000275	0.030000	0.721000	0.000199	0.020000
435	Motor Freight Transport and Warehousing	0.002436	0.260000	0.974125	0.002373	0.260000
436	Water Transportation	0.000177	0.020000	0.000000	0.000177	0.020000
437	Air Transportation	0.000140	0.020000	0.462100	0.000065	0.010000
441	Communications, except Radio and TV	0.002800	0.300000	0.527600	0.001477	0.160000
443	Electric Services	0.007467	0.810000	0.916300	0.006842	0.740000
445	Water Supply and Sewerage Systems	0.003733	0.410000	0.852837	0.003184	0.350000
447	Wholesale Trade	0.003789	0.410000	0.999500	0.003787	0.410000
459	Insurance Carriers	0.034533	3.750000	0.633100	0.021863	2.370000
469	Advertising	0.000373	0.040000	0.756000	0.000282	0.030000
	Total Commodity Demand	0.704040	76.477000		0.626396	68.040000
Value Added		Coefficient	Value Added			
	Employee Compensation	0.214060	23.253000			
	Proprietary Income	0.000000	0.000000			
	Other Property Income	0.076533	8.314000			
	Indirect Business Taxes	0.005367	0.583000			
	Total Value Added	0.295960	32.150000			

NOTE: The 1996 data presented for inputs in the table are expressed in millions of dollars. They have been obtained by the use of IMPLAN Pro 2.0.

Table 5. Industry Balance Sheet for Dehydrated Potato Products Production.

		Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand						
52	Potato	0.429700	18.180000	1.000000	0.429700	18.180000
56	Maintenance and Repair—other Facilities	0.034000	1.440000	0.917516	0.031196	1.320000
122	Cordage and Twine	0.002105	0.090000	0.012246	0.000026	0.000000
164	Paperboard Containers and Box	0.008658	0.370000	0.700233	0.006063	0.260000
167	Bags—Plastic	0.006594	0.280000	0.001570	0.000010	0.000000
168	Bags—Paper	0.008478	0.360000	0.000770	0.000007	0.000000
198	Surface Active Agents	0.020342	0.860000	0.154145	0.003136	0.130000
205	Adhesives and Sealants	0.002073	0.090000	0.583401	0.001209	0.050000
433	Railroads and Related Service	0.000122	0.010000	0.721000	0.000088	0.000000
435	Motor Freight Transport and Warehousing	0.001418	0.060000	0.974125	0.001382	0.060000
436	Water Transportation	0.000057	0.000000	0.000000	0.000057	0.000000
437	Air Transportation	0.000069	0.000000	0.462100	0.000032	0.000000
443	Electric Services	0.007800	0.330000	0.916300	0.007147	0.300000
444	Gas Production and Distribution	0.056300	2.380000	0.684137	0.038517	1.630000
445	Water Supply and Sewage Systems	0.026500	1.120000	0.852837	0.022600	0.960000
447	Wholesale Trade	0.001684	0.070000	0.999500	0.001683	0.070000
459	Insurance Carriers	0.004000	0.170000	0.633100	0.002532	0.110000
469	Advertising	0.000400	0.020000	0.756000	0.000302	0.010000
470	Other Business Services	0.012200	0.520000	0.664520	0.008107	0.340000
473	Equipment Rental and Leasing	0.008600	0.360000	0.756000	0.006502	0.280000
	Total Commodity Demand	0.631100	26.708000		0.560295	23.710000
Value Added		Coefficient	Value Added			
	Employee Compensation	0.264400	11.189000			
	Proprietary Income	0.067000	2.835000			
	Other Property Income	0.029800	1.261000			
	Indirect Business Taxes	0.007700	0.326000			
	Total Value Added	0.368900	15.610000			

NOTE: The 1996 data presented for inputs in the table are expressed in millions of dollars. They have been obtained by the use of IMPLAN Pro 2.0.

Table 6. Industry Balance Sheet for Potato Chip Production.

		Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand						
12	Feed Grains	0.007426	0.450000	0.129050	0.000958	0.060000
13	Hay and Pasture	0.008121	0.500000	0.089481	0.000727	0.040000
52	Potato	0.072910	4.450000	1.000000	0.072910	4.450000
20	Miscellaneous Crops	0.014853	0.910000	0.000000	0.014853	0.910000
21	Oil Bearing Crops	0.000615	0.040000	0.019845	0.000012	0.000000
23	Greenhouse and Nursery Products	0.005753	0.350000	0.385254	0.002216	0.140000
27	Landscape and Horticultural Services	0.000261	0.020000	0.653057	0.000170	0.010000
37	Coal Mining	0.001400	0.090000	0.122896	0.000172	0.010000
68	Dehydrated Food Products	0.015080	0.920000	0.087595	0.001321	0.080000
70	Frozen Fruits—Juices and Vegetables	0.002545	0.160000	0.110178	0.000280	0.020000
72	Flour and Other Grain Mill Products	0.015202	0.930000	0.059986	0.000912	0.060000
76	Wet Corn Milling	0.008018	0.490000	0.050288	0.000403	0.020000
81	Sugar	0.000279	0.020000	0.019932	0.000006	0.000000
87	Soybean Oil Mills	0.005339	0.330000	0.030939	0.000165	0.010000
88	Vegetable Oil Mills—N.E.C.*	0.010706	0.650000	0.064002	0.000685	0.040000
90	Shortening and Cooking Oils	0.015089	0.920000	0.205240	0.003097	0.190000
100	Potato Chips & Similar Snacks	0.001861	0.110000	0.719302	0.001339	0.080000
103	Food Preparations—N.E.C.*	0.000131	0.010000	0.658790	0.000086	0.010000
123	Textile Goods—N.E.C.*	0.000173	0.010000	0.001510	0.000000	0.000000
126	Housefurnishings—N.E.C.*	0.000135	0.010000	0.266586	0.000036	0.000000
162	Paper Mills, except Building	0.000101	0.010000	0.002312	0.000000	0.000000
163	Paperboard Mills	0.000050	0.000000	0.001654	0.000000	0.000000
164	Paperboard Containers and Box	0.031026	1.890000	0.700233	0.021725	1.330000
165	Paper Coated & Laminated Pack	0.017135	1.050000	0.000115	0.000002	0.000000
166	Paper Coated & Laminated—N.E.C.*	0.037779	2.300000	0.000269	0.000010	0.000000
167	Bags—Plastic	0.016553	1.010000	0.001570	0.000026	0.000000
168	Bags—Paper	0.007104	0.430000	0.000770	0.000005	0.000000
170	Sanitary Paper Products	0.001088	0.070000	0.001063	0.000001	0.000000
179	Commercial Printing	0.001102	0.070000	0.209037	0.000230	0.010000
186	Alkalies & Chlorine	0.012751	-0.780000	0.000000	0.000000	0.000000
187	Industrial Gases	0.000011	0.000000	0.216058	0.000002	0.000000
188	Inorganic Pigments	0.000012	0.000000	0.191435	0.000002	0.000000
189	Inorganic Chemicals—N.E.C.*	0.000062	0.000000	0.003796	0.000000	0.000000
190	Cyclic Crudes—Interm. & Indus. Organic Chem.	0.000245	0.010000	0.492697	0.000121	0.010000
196	Soap and Other Detergents	0.002062	0.130000	0.064611	0.000133	0.010000

*N.E.C. Not elsewhere classified.

		Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand						
197	Polishes and Sanitation Goods	0.002146	0.130000	0.233000	0.000500	0.030000
205	Adhesives and Sealants	0.000153	0.010000	0.583401	0.000089	0.010000
213	Lubricating Oils and Greases	0.001961	0.120000	0.445088	0.000873	0.050000
220	Miscellaneous Plastics Products	0.064791	3.950000	0.001272	0.000082	0.010000
273	Metal Cans	0.003795	0.230000	0.235034	0.000892	0.050000
293	Crowns and Closures	0.000200	0.010000	0.006736	0.000001	0.000000
305	Metal Foil and Leaf	0.001758	0.110000	0.043084	0.000076	0.000000
321	Special Dies, Tools, and Accessories	0.000159	0.010000	0.243125	0.000039	0.000000
330	Food Products Machinery	0.000669	0.040000	0.749905	0.000502	0.030000
335	Packaging Machinery	0.000061	0.000000	0.669380	0.000041	0.000000
347	Refrigeration and Heating Equipment	0.000382	0.020000	0.148895	0.000057	0.000000
354	Industrial Machines—N.E.C.*	0.000812	0.050000	0.000001	0.000000	0.000000
355	Transformers	0.000442	0.030000	0.126277	0.000056	0.000000
367	Electric Lamps	0.000319	0.020000	0.000406	0.000000	0.000000
386	Motor Vehicle Parts and Accessories	0.000393	0.020000	0.104670	0.000041	0.000000
428	Brooms and Brushes	0.000201	0.010000	0.001921	0.000000	0.000000
434	Local—Interurban Passenger Transit	0.001167	0.070000	0.740800	0.000865	0.050000
445	Water Supply and Sewage Systems	0.000932	0.060000	0.852837	0.000795	0.050000
448	Building Materials & Gardening Supplies	0.000478	0.030000	0.940300	0.000449	0.030000
449	General Merchandise Stores	0.001041	0.060000	0.927000	0.000965	0.060000
56	Maintenance and Repair Other	0.006677	0.410000	0.917516	0.006126	0.370000
86	Cottonseed Oil Mills	0.001138	0.070000	0.000000	0.001138	0.070000
210	Petroleum Refining	0.016673	1.020000	0.628007	0.010471	0.640000
433	Railroads and Related Services	0.005866	0.360000	0.721000	0.004229	0.260000
435	Motor Freight Transport and Warehousing	0.038807	2.370000	0.974125	0.037803	2.310000
436	Water Transportation	0.002894	0.180000	0.000000	0.002894	0.180000
437	Air Transportation	0.004335	0.260000	0.462100	0.002003	0.120000
441	Communications, except Radio	0.001407	0.090000	0.527600	0.000742	0.050000
443	Electric Services	0.005707	0.350000	0.916300	0.005229	0.320000
444	Gas Production and Distribution	0.007309	0.450000	0.684137	0.005000	0.310000
450	Food Stores	0.001312	0.080000	0.950000	0.001246	0.080000
451	Automotive Dealers & Service Stations	0.000608	0.040000	0.950000	0.000578	0.040000
446	Sanitary Services and Steam Supply	0.002326	0.140000	0.000000	0.002326	0.140000
447	Wholesale Trade	0.069581	4.240000	0.999500	0.069546	4.240000
454	Eating & Drinking	0.002557	0.160000	0.900000	0.002301	0.140000
456	Banking	0.010941	0.670000	0.607500	0.006647	0.410000
459	Insurance Carriers	0.002617	0.160000	0.633100	0.001657	0.100000

*N.E.C. Not elsewhere classified.

		Gross Absorption Coefficient	Gross Inputs	Regional Purchase Coefficient	Regional Absorption Coefficient	Regional Inputs
Commodity Demand						
462	Real Estate	0.004510	0.280000	0.700000	0.003157	0.190000
463	Hotels and other Lodging Places	0.006705	0.410000	0.794500	0.005327	0.320000
470	Other Business Services	0.003281	0.200000	0.664520	0.002180	0.130000
472	Services to Buildings	0.001053	0.060000	0.613825	0.000646	0.040000
474	Personnel Supply Services	0.004082	0.250000	0.735159	0.003001	0.180000
475	Computer and Data Processing	0.001902	0.120000	0.756000	0.001438	0.090000
477	Automobile Rental and Leasing	0.001771	0.110000	0.724345	0.001283	0.080000
479	Automobile Repair and Service	0.001418	0.090000	0.900000	0.001276	0.080000
480	Electrical Repair Service	0.000625	0.040000	0.900000	0.000562	0.030000
482	Miscellaneous Repair Shops	0.001601	0.100000	0.756000	0.001210	0.070000
494	Legal Services	0.000615	0.040000	0.792700	0.000488	0.030000
507	Accounting—Auditing and Book	0.000401	0.020000	0.792700	0.000318	0.020000
508	Management and Consulting Services	0.002658	0.160000	0.566725	0.001506	0.090000
512	Other State and Local Govt. Enterprises	0.000638	0.040000	0.000000	0.000638	0.040000
516	Noncomparable Imports	0.000208	0.010000	0.000000	0.000000	0.000000
452	Apparel & Accessory Stores	0.000556	0.030000	0.940300	0.000523	0.030000
453	Furniture & Home Furnishings	0.000559	0.030000	0.940300	0.000526	0.030000
455	Miscellaneous Retail	0.001503	0.090000	0.940300	0.001413	0.090000
458	Security and Commodity Broker	0.000236	0.010000	0.607500	0.000143	0.010000
464	Laundry—Cleaning and Shoe Repair	0.000222	0.010000	0.872386	0.000194	0.010000
469	Advertising	0.023185	1.410000	0.756000	0.017528	1.070000
473	Equipment Rental and Leasing	0.001362	0.080000	0.756000	0.001030	0.060000
476	Detective and Protective Services	0.000735	0.040000	0.559817	0.000411	0.030000
483	Motion Pictures	0.000314	0.020000	0.635671	0.000200	0.010000
489	Membership Sports and Recreation Clubs	0.000446	0.030000	0.657678	0.000293	0.020000
503	Business Associations	0.000566	0.030000	0.612540	0.000347	0.020000
506	Engineering—Architectural Services	0.000635	0.040000	0.792700	0.000503	0.030000
509	Research—Development & Testing Services	0.000505	0.030000	0.756000	0.000382	0.020000
513	U.S. Postal Service	0.000744	0.050000	0.749900	0.000558	0.030000
	Total Commodity Demand	0.613127	37.401000		0.335951	20.490000
Value Added		Coefficient	Value Added			
	Employee Compensation	0.145163	8.855000			
	Proprietary Income	0.000142	0.009000			
	Other Property Income	0.232527	14.184000			
	Indirect Business Taxes	0.009042	0.552000			
	Total Value Added	0.386873	23.600000			

NOTE: The 1996 data presented for inputs in the table are expressed in millions of dollars. They have been obtained by the use of IMPLAN Pro 2.0.

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. Furthermore, it is assumed that potato waste from potato processing drives 45% of the output (production) of the cattle feeding industry. The analysis does not include the impact of cattle slaughter although there is no question that some portion of the meat packing industry depends on cattle that are fattened on potato waste.

Impact Results

Direct Effects—Impacts on Output

As previously mentioned, the direct effects show the deliveries to final demand ($million of sales) for the directly impacted industries. Of course, the major direct effect belongs to the frozen potato products industry (36) with $881 million (Table 7).[7] 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. Other important potato processing industries as well as cattle feedlots are also represented in the direct effects (Table 7). Estimates of the transportation and marketing business that stem from potato production, potato processing, and cattle feeding are also included in the direct effects portion of Table 7. The industries involved are: railroads and related services, motor freight transport and warehousing, water transportation, air 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). More that $197 million in direct sales in these industries is estimated to derive from potato production and processing. Total direct effects sum to $1,503 million or $1.5 billion.

Indirect Effect

Much of the indirect effect is concentrated on the Potato sector (10)—$468 million dollars. Deliveries to final demand by potato processing create demand for the potato input which is reflected in the indirect effects column. The other major components of the indirect effects likewise stem from the input demand. Agricultural Services (26), Construction (48), Pulp and Paper (161), Chemical and Allied (186), Petroleum (210), Utilities (443), Real Estate (461), and Business and Personnel Services (469) all stand out as industries with major impacts.

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 output is estimated to be $96.7 million; the wholesale trade sector is estimated to be $94.4 million. Government services are estimated to be $52.9 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 $1,111.4 million or $1.1 billion.

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[7]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 unaggregated 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.

Induced Effect

The induced impact is 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 and Other Food Processing (58) reflecting processed food.[8] The major induced impacts are $69 million on Retail Trade (448), $57 million on Real Estate (461), $51 million on Health Services (490), and $32 million on Banking and Insurance. Total induced output impact is estimated to be $385.4 million.

The total economic impact of the potato industry is estimated to be $3,014.4 million (Table 7) on the Washington economy. In other words, the potato industry directly and indirectly generates $3 billion of sales throughout the Washington economy.

Impacts on Employment

Direct Effect

The more significant direct employment effects were estimated as 3,220 in Frozen Potato Products, 2,734 in Fresh Pack potato, 1,943 in Dehydrated Potato, 1,010 in Cattle Feedlots, 926 in Motor Freight and Warehousing, and 984 in Wholesale Trade (Table 8). The total direct employment impact is estimated to be 11,315 jobs. This is a simple jobs count in the directly affected industries. It includes full-time and part-time employment.

Indirect Effect

Indirect employment is 3,518 in potato production, 2,231 in the Agricultural Services sector, 934 in the Motor Freight Transport and Warehousing, and 918 in the Wholesale Trade sector. Total indirect employment impact is estimated to be 10,890 jobs.

Induced Effect

Retail Trade sector is dominant in the induced employment impact with 1,816 jobs out of the induced 5,379 total jobs. The induced employment impact is 746 in Health Services sector, 435 in Business and Personal Services sector, 358 in Education Services sector, and 300 in the Banking and Insurance sector. Total induced employment impact is estimated as 5,379 jobs.

The total employment in Washington estimated to be driven by potato production and potato processing totals 27,600 jobs when indirect and induced effects are considered.

[8]Induced consumption of processed potato products is included in Other Food Processing.

Table 7. Output Impact (measured in $ sales).

Sector #	Industry	Direct	Indirect	Induced	Total
1	Other Agriculture (AGG)	0	11,410,945	2,519,861	13,930,805
5	Cattle Feedlots	176,220,000	22,978,128	746,260	199,944,384
10	Potato	23,141,000	468,074,720	2,701	491,218,400
15	Fresh Pack	106,046,000	176,104	2,136	106,224,240
18	Vegetables	0	58,728	483,784	942,512
19	Dehydrated Potato	41,119,000	60,616	1,494	41,181,112
25	Commercial Fishing	0	1,033	12,362	13,396
26	Ag Services (AGG)	0	48,829,468	679,091	49,508,556
28	Other Mining (AGG)	0	1,160,401	225,993	1,386,394
36	Frozen Potato Products	881,483,008	2,816	813	881,486,656
48	Construction (AGG)	0	21,059,010	7,689,733	28,748,742
58	Other Food Processing (AGG)	0	24,378,486	10,550,819	34,929,304
86	Potato Chips	48,735,000	576,684	5,636	49,317,320
108	Textiles and Apparel (AGG)	0	399,246	1,269,397	1,668,644
133	Wood Products (AGG)	0	1,750,975	770,493	2,521,468
148	Furniture (AGG)	0	6,643	677,424	684,067
161	Pulp and Paper (AGG)	0	33,529,106	614,110	34,143,212
174	Printing and Publishing (AGG)	0	4,160,353	2,978,994	7,139,347
186	Chemicals and Allied (AGG)	0	20,088,398	2,297,026	22,385,422
210	Petroleum Products (AGG)	0	16,314,338	5,380,005	21,694,342
215	Rubber Products (AGG)	0	241,535	27,068	268,603
221	Leather Products (AGG)	0	9,556	133,433	142,989
230	Stone, Glass, and Clay (AGG)	0	503,556	406,903	910,459
254	Primary Metals (AGG)	0	144,371	24,969	169,341
273	Fabricated Metal (AGG)	0	481,331	199,669	681,000
307	Industry Machinery (AGG)	0	4,327,969	738,671	5,066,640
355	Electrical Equipment (AGG)	0	1,244,333	1,226,273	2,470,607
384	Transportation Equipment (AGG)	0	455,361	1,369,063	1,824,424
400	Scientific Instruments (AGG)	0	175,140	495,488	670,628
415	Miscellaneous Mfg. (AGG)	0	176,338	1,008,914	1,185,252
433	Railroads and Related Services	29,098,012	8,577,572	632,044	38,307,628
434	Other Transportation (AGG)	636,143	4,435,041	3,696,624	8,767,808
435	Motor Freight Transport and Warehousing	95,871,328	96,709,616	5,694,337	198,275,280
439	Transportation Services (AGG)	0	8,741,936	874,247	9,616,183
441	Communications (AGG)	0	7,473,889	9,527,564	17,001,452
443	Utilities (AGG)	0	36,034,604	6,160,517	42,195,124
447	Wholesale Trade	101,264,608	94,405,296	23,124,534	218,794,432
448	Retail Trade (AGG)	0	4,702,436	69,515,840	74,218,280
456	Banking and Insurance (AGG)	0	20,290,812	32,513,026	52,803,840
461	Real Estate (AGG)	0	33,700,632	57,046,552	90,747,184
463	Hotels and Lodging Places	0	3,781,218	4,509,295	8,290,513
464	Personal Services (AGG)	0	791,213	5,900,231	6,691,445
469	Business and Personal Services (AGG)	0	36,598,208	23,908,378	60,506,584
477	Automotive Services (AGG)	0	8,612,498	6,235,531	14,848,029
480	Repair Services (AGG)	0	2,464,755	1,353,417	3,818,172
484	Recreation Services (AGG)	0	1,891,375	8,819,827	10,711,202
490	Health Services (AGG)	0	1,565,196	51,224,248	52,789,444
495	Education Services (AGG)	0	105,737	11,737,054	11,842,791
502	Non-profit Organizations (AGG)	0	4,412,543	4,954,235	9,366,778
510	Government (AGG)	0	52,938,764	15,447,159	68,535,920
	Total	1,503,614,099	1,111,409,030	385,413,240	3,014,432,357

(AGG) means 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)	0.0	193.3	32.0	225.3
5	Cattle Feedlots	1,009.6	131.6	4.3	1,145.5
10	Potato	174.0	3,518.6	0.0	3,692.6
15	Fresh Pack	2,733.5	4.5	0.1	2,738.1
18	Vegetables	0.0	3.4	3.6	7.1
19	Dehydrated Potato	1,943.2	2.9	0.1	1,946.2
25	Commercial Fishing	0.0	0.0	0.1	0.1
26	Ag Services (AGG)	0.0	2,230.5	28.8	2,259.3
28	Other Mining (AGG)	0.0	4.9	1.0	5.9
36	Frozen Potato Products	3,220.8	0.0	0.0	3,220.8
48	Construction (AGG)	0.0	287.1	98.8	385.8
58	Other Food Processing (AGG)	0.0	69.1	44.9	114.0
86	Potato Chips	167.0	2.0	0.0	169.0
108	Textiles and Apparel (AGG)	0.0	5.3	14.9	20.2
133	Wood Products (AGG)	0.0	15.7	7.0	22.6
148	Furniture (AGG)	0.0	0.1	7.5	7.6
161	Pulp and Paper (AGG)	0.0	181.9	3.2	185.1
174	Printing and Publishing (AGG)	0.0	45.9	31.2	77.1
186	Chemicals and Allied (AGG)	0.0	61.9	7.4	69.3
210	Petroleum Products (AGG)	0.0	10.3	3.4	13.8
215	Rubber Products (AGG)	0.0	1.6	0.2	1.7
221	Leather Products (AGG)	0.0	0.2	3.0	3.2
230	Stone, Glass, and Clay (AGG)	0.0	4.0	3.8	7.8
254	Primary Metals (AGG)	0.0	0.5	0.1	0.6
273	Fabricated Metal (AGG)	0.0	3.1	1.5	4.6
307	Industry Machinery (AGG)	0.0	23.4	3.2	26.6
355	Electrical Equipment (AGG)	0.0	6.3	7.1	13.4
384	Transportation Equipment (AGG)	0.0	2.4	3.8	6.2
400	Scientific Instruments (AGG)	0.0	1.0	3.1	4.1
415	Miscellaneous Mfg. (AGG)	0.0	2.1	9.9	11.9
433	Railroads and Related Services	153.7	45.3	3.3	202.4
434	Other Transportation (AGG)	3.3	33.7	38.8	75.8
435	Motor Freight Transport and Warehousing	925.7	933.8	55.0	1,914.5
439	Transportation Services (AGG)	0.0	102.3	13.7	115.9
441	Communications (AGG)	0.0	26.2	29.5	55.7
443	Utilities (AGG)	0.0	91.4	15.2	106.7
447	Wholesale Trade	984.3	917.6	224.8	2,126.7
448	Retail Trade (AGG)	0.0	123.4	1,816.0	1,939.5
456	Banking and Insurance (AGG)	0.0	222.3	300.2	522.5
461	Real Estate (AGG)	0.0	215.7	134.8	350.5
463	Hotels and Lodging Places	0.0	70.7	84.3	154.9
464	Personal Services (AGG)	0.0	23.9	178.7	202.7
469	Business and Personal Services (AGG)	0.0	733.9	434.5	1,168.3
477	Automotive Services (AGG)	0.0	101.4	84.8	186.2
480	Repair Services (AGG)	0.0	34.2	18.9	53.1
484	Recreation Services (AGG)	0.0	28.8	195.8	224.6
490	Health Services (AGG)	0.0	28.0	745.8	773.7
495	Education Services (AGG)	0.0	3.1	357.5	360.6
502	Non-profit Organizations (AGG)	0.0	120.4	140.2	260.7
510	Government (AGG)	0.0	219.6	183.1	402.7
	Total	11,315.1	10,889.5	5,378.8	27,583.4

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

Summary

To put the economic impact calculations in perspective, it may be useful to consider the combined regional economy of Umatilla, Adams, Benton, Franklin, Grant, Walla Walla, and Yakima counties. This is the region where much of the potato production and potato processing takes place in eastern Washington and eastern Oregon, and it is the area where much of the economic impact in this study is located.[9]

Total regional employment for 1996 in this economy was 322,400 jobs; 1996 total regional output was $24,320 million or $24.3 billion (IMPLAN database). Dividing total jobs due to potato production estimated from this study by total jobs in the regional economy gives a percentage of 8.5%. Allowing for the fact that some of the indirect and induced jobs are outside the region, but still in Washington, a rough guess is that about 8% or roughly 1 out of 11 jobs in the region stem from potato production and potato processing. Conducting the same calculation for sales, the figure is 12.4%. So it would appear that roughly 12% of all sales in the region are from potato production and processing.

This is the first study of the economic interdependencies between potato production and the complex of industries that use potatoes as a major input into their production process. As a result of this study, it is now possible to have an idea of the economic contribution that is made by potatoes from the production in the ground to the peelings being used as input into cattle feeding.

As with any study of this kind that is based on discussions with individuals from selected firms, the estimates those individuals make of variables for the total industry are subject to some degree of uncertainty. This is true for this study as well. Representatives from firms in those industries base the estimates of total industry sales for the potato processing industries on their credible judgment and expertise. There is no official source for total county or state production for these processing industries as there is in the case of agricultural commodities.

The best evidence for believing that the production functions and sales figures presented in this study for the processing industries are correct comes from the impact analysis. The total demand for potatoes from the impact analysis is very close (Table 7, Potato row total) to the independently estimated total potato production ($495 million) obtained from Oregon and Washington Agricultural Statistics Services. If either the estimated sales or potato input requirements for the processing industries were in significant error, the results of the impact analysis would indicate a potato demand that is different from the relatively known with certainty potato supply ($495 million). The fact that the impact analysis result (demand) matches this figure (potato supply) lends credence to the depiction of the potato processing industries presented in this publication.

[9]In western Washington, the major potato production area is in Skagit County.

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U.S. Department of Agriculture, National Agricultural Statistics Service, home page.

http://www.oda.state.or.us/oass/oass.html
U.S. Department of Agriculture, Oregon Agricultural Statistics Service, home page.

http://www.nass.usda.gov/wa/
U.S. Department of Agriculture, Washington Agricultural Statistics Service, home page.

Appendix Aggregation Template

Template for Potato Impact Study

Aggregated Sector Name	Composed of
1 Other Agriculture	1 2 3 4 6 7 8 9 11 12 13 14 16 17 20 21 22 23 24
5 Cattle Feedlots	5
10 Potato	10
15 Fresh Pack Potato	15
18 Other Vegetables	18
19 Dehydrated Potato Products	19
25 Commercial Fishing	25
26 Ag Services	26 27
28 Other Mining	28 29 30 31 32 33 34 35 37 38 39 40 41 42 43 44 45 46 47 57
36 Frozen Potato Products	36
48 Construction	48 49 50 51 52 53 54 55 56
58 Other 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 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107
86 Potato Chips	86
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

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

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

484 Recreation Services
483 484 485 486 487 488 489

490 Health Services
491 492 493

495 Education Services
495 496 497 498 499 500 501

502 Non-profit Organizations
502 503 504 505

510 Government
510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528

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