

**DISTRIBUTION OF THE EFFECTS OF CHANGES IN POTATO  
EXPORTS ON PACIFIC NORTHWEST PRODUCER'S INCOME  
AND THEIR COMMUNITIES**

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## SUMMARY

All sectors of the Pacific Northwest's economy are affected by changes in the demand for US potato exports. The reason all are affected is through linkages of agriculture and potato production to other sectors of the economy. Changes in demand or supply for agricultural products cause changes in commodity prices. This analysis of the effect of changes in supply on the domestic price is based on the assumption that if import demand from countries outside the United States declines, the product will then be available on the domestic market. This increased supply for domestic use will then depress domestic prices. Conversely, increased import demand will reduce supplies available for domestic consumers and strengthen domestic prices. The example used here of the national fresh potato industry demonstrates the magnitude and distribution of changes in import demand.

The analysis shows only about one third of the income and employment effects of price changes occur on the farm. The other two thirds of effects occur in sectors linked to production agriculture or in sectors which have activity levels effected by changes in agriculture.

## INTRODUCTION

Expansions in demand such as those which occurred through increases in grain export demand in the mid 1970s raised prices domestically and world wide. Contractions in demand, such as those which occurred in the early 1980s for grains, had price depressing effects in the United States. Reductions in domestic supply caused the Soviets and Chinese to buy more grains on the world market in the 1970's. The droughts of the late 1980's did a lot to strengthen prices for agricultural commodities in the last few years of the decade. The term used to refer to these phenomenon which affect prices is elasticity.

Elasticity of demand for imports relates to the change in the price paid for a US commodity as a result of changes in demand by non-US costumers for US products. Changed purchases can result in movement along a demand curve D1 (moving from point A to point D in Figure 1) or in a shift to another demand curve D2 (movement from point A to point B in Figure 1). Both movements result in a change in price received for the product. If the incentives are sufficiently strong, US producers will expand production creating a new supply curve, S2 or this can be done through movement along an existing supply curve, S1 (move from point A to B in Figure 1 ) or through making new investments and moving to a new supply curve S2 (Point A to C). The net result almost always is a change in the price received for a product. When demand declines, such as occurred for US grain exports in the mid-1980, a new demand function with the previous supply function will generally result in shifting to a lowers price as in point D of Figure 1. Price actually declines to P4 Demand and supply interactions are dynamic and changes in one affect the other.

Supply elasticity is the relationship between price and the quantity supplied. A change in the quantity supplied will decrease if the price of the item decreases. Contrarily, a rise in price will cause suppliers to increase the quantity available on the market. An item or service is said to be inelastic if the quantity supplied is unresponsive to price changes. It is elastic if the quantity supplied is highly sensitive to price.

#### PNW Example for Potatoes

Research on the price elasticity of supply conducted at the University of Idaho by J. Guenther, shows that for every 1% change in US potato supply, farm gate prices vary from 2.5% to 5%. In 1987 a net 3.2% of US potatoes were exported (that is exports after adjustments for imports). That means there was a 3.2% US supply reduction because the commodities were exported. There are two results from this action: first, price was strengthened because supply was removed from the domestic market and second, extra quantities were sold at that price because part of production went into the world

Figure 1

Effect of Shifts in Supply and Demand for Potatoes on Prices and Quantity Demanded.

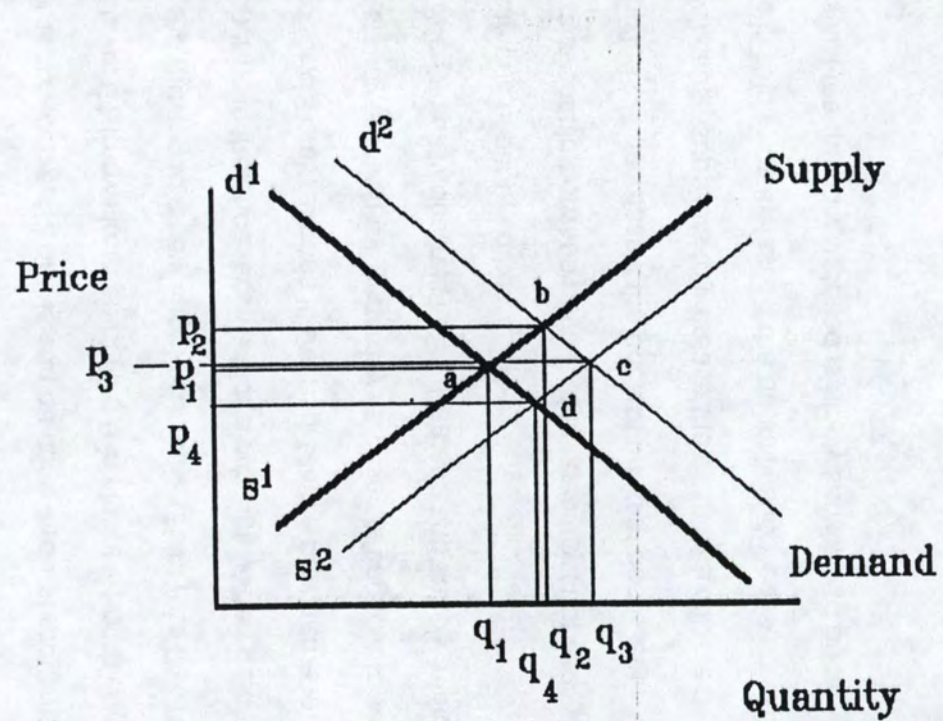


Table 1  
PNW effect of 3% change in Potato Net Exports

State	3 Year Production Average 1000 Cut	1987 Price Average	Change	
			2.5%	4.0%
Oregon	23,322	\$3.45/cwt	\$.26/cwt	\$.52/cwt
Washington	64,840	\$3.65/cwt	\$.27/cwt	\$.55/cwt
Idaho	101,598	\$3.50/cwt	\$.26/cwt	\$.53/cwt
US	189,760	\$4.35/cwt		

Table 2  
Net Change on PNW Producer Income\* of Potato Price Changes

State	cwt	Minimum Effect	Maximum
		2.5%	4.0%
Oregon	23,322,000	\$ 6,063,720	\$12,127,440
Washington	64,840,000	\$17,506,000	\$35,662,000
Idaho	101,598,000	\$26,415,480	\$53,846,940

Total PNW Producer Income Change \$49,985,200 \$101,636,380

\*PNW farmgate potato income change from loss or doubling 3% exports

market. Potato exports for 1987 imply a change of between 8% and 16% in the price received for product as the result of US product being removed from the US market through exports. Table 1 shows 1987 prices and the effect of a 3% export change on average prices. Table 2 shows the net change in Pacific Northwest producers' income from potatoes as the result of a 3 percent increase or decrease in producer output.

To determine the distribution of these impacts throughout the PNW economy, the effect of these changes were analyzed using IMPLAN. IMPLAN is an input/output (I/O) model developed by the USDA Forest Service which can be used to evaluate US regions as small as a county. The model uses coefficients from the national (I/O) model to estimate impacts and linkages to other sectors of the economy. Idaho, Oregon and Washington were defined as the regional economy for this analysis. In addition to the direct effects which are the change in producers' incomes, there are also indirect and induced effects. Indirect effects are the increase or decrease in spending associated with changes in producers incomes. This would include labor hired, fertilizer and pesticides purchased, irrigation power purchased and farm equipment supplies and parts. Induced effects are those which occur as a result of changes in spending resulting from direct and indirect effects. The most important item here is how and where employees spend their income. Extra income has positive effects on the local economy and declines in income reduce overall spending.

The distribution of the impacts of the potato price changes resulting from export demand change are shown in Tables 3,4,5 & 6. Table 3 shows the impact of a 3% reduction in the vegetable sector with a 2.5% supply price elasticity. Table 4 shows the same with a 4% supply price elasticity. Both tables show the distribution of direct, indirect and induced income effects. Tables 5 and 6 show the same scenarios with direct, indirect and induced employment effects. A caution in using this data: the analysis uses national coefficients which may be different from individual states or regions. The problem with fixed coefficients is that a reduction in price is treated in the

same manner as a reduction in quantity. Therefore a price reduction could still result in the same physical quantity being processed and requiring the same processing inputs. In other words, a producer price and income change would show as a change in direct effects. However indirect and induced effects would not be effected as strongly. In this case the model would give an over-estimation of the effects of price changes.

Analysis of the impact on total income (Tables 3 & 4) shows the distribution of impacts among various sectors. Clearly, food processing is strongly related to vegetable crop production in the Pacific Northwest because 55% of the potato crop is processed. Other sectors that would strongly feel the effects are trade, real estate, orchard crops, motor freight, eating and drinking places, and medical services. Direct effects are the immediate losses or gains of income to the producing sector. Indirect effects are the changes which occur in the economy as a result of the direct effects. Induced effects are the changes in on other sectors of adjusting to direct and indirect effects. The total effect is the summation of all 3 types of effects. In the example shown here the total income effect is slightly more than 3 times the direct effects and is widely distributed throughout the economy. Tables 3 and 4 show the direct, indirect and induced effects of a 3 percent reduction in vegetable sector output with elasticities of 2.5% and 4%. The largest direct income effects occur in the food processing sectors. This is likely the result of the value added activities that occur in processing and preparing potatoes for export. Remaining effects are distributed throughout other sectors of the economy. The loss of export markets will very likely have the price depressing effects shown in the income Tables 3 and 4.

Employment impacts are also widely distributed throughout the economy (Tables 5 & 6). An important point here is a large part of total employment impact is on vegetable crops and processing. It amounts to 117 jobs out of 663 or 18 percent from Table 5 and or 397 jobs of the 1071 jobs or 37 per cent employment change as shown in Table 6.

TABLE 3

Impact on Total Income<sup>1</sup> in a 3% Reduction of Vegetable Sector Output in the Northwest Economy  
Minimum Impact - 2.5% supply elasticity

SECTOR	TOTAL INCOME (MM\$)			Total	% of Total
	Direct	Indirect	Induced		
1 Food Processing	-4.4996	-0.3221	-0.1966	-5.0187	30.1%
2 Vegetable Crops	-0.5961	-0.9417	-0.0274	-1.5652	9.4%
3 OWNER-OCCUPIED DWELLINGS	0	0	-1.0924	-1.0924	6.6%
4 RETAIL TRADE	0	-0.0206	-0.7789	-0.7995	4.8%
5 REAL ESTATE	0	-0.2358	-0.5256	-0.7613	4.6%
6 Orchard Crops	0	-0.5569	-0.0145	-0.5713	3.4%
7 MOTOR FREIGHT TRANSPORT	0	-0.4527	-0.0892	-0.5418	3.3%
8 EATING AND DRINKING PLAC	-0.1174	-0.0432	-0.2934	-0.454	2.7%
9 DOCTORS AND DENTISTS	0	-0.0009	-0.4021	-0.4031	2.4%
10 BANKING	0	-0.058	-0.1898	-0.2478	1.5%
11 COMMUNICATIONS, EXCEPT R	0	-0.0573	-0.1849	-0.2422	1.5%
12 HOSPITALS	-0.0117	0	-0.2286	-0.2402	1.4%
13 Forest & Hort. Crops	0	-0.1547	-0.0283	-0.1829	1.1%
14 PAPERBOARD CONTAINERS AN	0	-0.1719	-0.008	-0.1799	1.1%
15 ELECTRIC SERVICES	0	-0.0761	-0.081	-0.1571	0.9%
16 AUTOMOBILE REPAIR AND SE	0	-0.0414	-0.1141	-0.1555	0.9%
17 LEGAL SERVICES	0	-0.0268	-0.1234	-0.1502	0.9%
18 RADIO AND TV BROADCASTIN	0	-0.1192	-0.0257	-0.145	0.9%
19 RAILROADS AND RELATED SE	0	-0.1106	-0.0319	-0.1425	0.9%
20 NEWSPAPERS	0	-0.1057	-0.031	-0.1367	0.8%
Rest of the Economy (416 Sectors)	-0.1552	-1.5427	-1.7716	-3.4703	20.8%
<b>Total Impact</b>	<b>-5.38</b>	<b>-5.0383</b>	<b>-6.2384</b>	<b>-16.6576</b>	

1. Total Income equals wages and salaries, proprietor income, and returns to capital.  
Source: IMPLAN, United States Forest Service



TABLE 4

Impact on Total Income in a 3% Reduction of Vegetable Sector Output in the Northwest Economy  
Maximum Impact -4% supply elasticity

SECTOR	TOTAL INCOME (MMS)			Total	% of Total
	Direct	Indirect	Induced		
Food Processing	-7.2702	-0.5202	-0.3169	-8.1069	48.7%
2Vegetable Crops	-0.9631	-1.5215	-0.0443	-2.5289	15.2%
3 OWNER-OCCUPIED DWELLINGS	0	0	-1.7651	-1.7651	10.6%
4 OTHER RETAIL TRADE	0	-0.0334	-1.2585	-1.2918	7.8%
5 REAL ESTATE	0	-0.3809	-0.8492	-1.2301	7.4%
6 Orchard Crops	0	-0.8997	-0.0235	-0.9231	5.5%
7 MOTOR FREIGHT TRANSPORT	0	-0.7314	-0.1441	-0.8754	5.3%
8 EATING AND DRINKING PLAC	-0.1897	-0.0698	-0.4741	-0.7335	4.4%
9 DOCTORS AND DENTISTS	0	-0.0015	-0.6498	-0.6513	3.9%
10 BANKING	0	-0.0938	-0.3067	-0.4004	2.4%
11 COMMUNICATIONS, EXCEPT R	0	-0.0925	-0.2988	-0.3913	2.3%
12 HOSPITALS	-0.0188	0	-0.3693	-0.3881	2.3%
13 Forest & Hort. Crops	0	-0.2499	-0.0459	-0.2956	1.8%
14 PAPERBOARD CONTAINERS AN	0	-0.2777	-0.0129	-0.2907	1.7%
15 ELECTRIC SERVICES	0	-0.1229	-0.1309	-0.2538	1.5%
16 AUTOMOBILE REPAIR AND SE	0	-0.0669	-0.1844	-0.2513	1.5%
17 LEGAL SERVICES	0	-0.0433	-0.1994	-0.2427	1.5%
18 RADIO AND TV BROADCASTIN	0	-0.1927	-0.0416	-0.2342	1.4%
19 RAILROADS AND RELATED SE	0	-0.1787	-0.0516	-0.2303	1.4%
20 NEWSPAPERS	0	-0.1708	-0.0501	-0.2209	1.3%
Rest of the Economy (416 Sectors remaining)	-0.251	-2.4936	-2.8622	-5.6081	33.7%
Total Impact	-8.6928	-8.1412	-10.0793	-26.9135	

1. Total Income equals wages and salaries, proprietor income, and returns to capital.  
Source: IMPLAN, United States Forest Service

TABLE 5

Impact on Employment in a 3% Reduction of Vegetable Sector Output in the Northwest Economy  
Minimum Impact - 2.5% supply elasticity

SECTOR	TOTAL INCOME (MMS)			% of		
	Direct	Indirect	Induced	Total	Total	
1 Food Processing	-162.41	-11.49	-5.49	-179.42		27.1
%						
2 Vegetable Crops	-25.35	-40.06	-1.17	-66.58	10.0%	
3 Orchard Crops	0	-49.19	-1.27	-50.46	7.6%	
4 OTHER RETAIL TRADE	0	-1.27	-47.93	-49.2	7.4%	
5 EATING AND DRINKING PLAC	-11.1	-4.08	-27.74	-42.92	6.5%	
6 Forest & Hort. Crops	0	-20.17	-2.77	-22.93	3.5%	
7 MOTOR FREIGHT TRANSPORT	0	-14.3	-2.82	-17.12	2.6%	
8 HOSPITALS	-0.7	0	-13.81	-14.51	2.2%	
9 DOCTORS AND DENTISTS	0	-0.02	-8.59	-8.61	1.3%	
10 OTHER WHOLESALE TRADE	0	-6.15	-2.06	-8.21	1.2%	
11 BANKING	0	-1.9	-6.21	-8.11	1.2%	
12 Ag., For., Fish., Serv.	0	-6.81	-1.14	-7.95	1.2%	
13 Livestock	-1.26	-2.68	-3.03	-6.97	1.1%	
14 REAL ESTATE	0	-2.14	-4.76	-6.9	1.0%	
15 INSURANCE CARRIERS	0	-1.4	-5.08	-6.47	1.0%	
16 NURSING AND PROTECTIVE C	-2.84	0	-3.3	-6.14	0.9%	
17 HOTELS AND LODGING PLACE	-0.57	-1.07	-4.2	-5.84	0.9%	
18 RESIDENTIAL CARE	-2.82	0	-2.23	-5.05	0.8%	
19 NEWSPAPERS	0	-3.85	-1.13	-4.98	0.8%	
20 SOCIAL SERVICES, N.E.C.	-0.4	-0.02	-4.24	-4.66	0.7%	
Rest of the Economy	-4.01	-58.35	-77.17	-139.9	21.1%	
Total Impact	-211.46	-224.95	-226.14	-662.89		

Source: IMPLAN, United States Forest Service

TABLE 6

Impact on Employment in a 3% Reduction of Vegetable Sector Output in the Northwest Economy  
Maximum Impact - 4% supply elasticity

SECTOR	EMPLOYMENT (NO. OF JOBS)			% of	
	Direct	Indirect	Induced	Total	Total
1 Food Processing	-262.41	-18.53	-8.94	-289.9	27.1%
2 Vegetable Crops	-40.97	-64.72	-1.89	-107.6	10.0%
3 Orchard Crops	0	-79.47	-2.06	-81.53	7.6%
4 OTHER RETAIL TRADE	0	-2.05	-77.45	-79.5	7.4%
5 EATING AND DRINKING PLAC	-17.93	-6.59	-44.82	-69.35	6.5%
6 Forest & Hort. Crops	0	-32.59	-4.46	-37.06	3.5%
7 MOTOR FREIGHT TRANSPORT	0	-23.11	-4.55	-27.66	2.6%
8 HOSPITALS	-1.14	0	-22.31	-23.44	2.2%
9 DOCTORS AND DENTISTS	0	-0.03	-13.88	-13.91	1.3%
10 OTHER WHOLESALE TRADE	0	-9.94	-3.33	-13.27	1.2%
11 BANKING	0	-3.07	-10.03	-13.1	1.2%
12 Ag., For., Fish., Serv.	0	-11.02	-1.83	-12.85	1.2%
13 Livestock	-2.03	-4.34	-4.88	-11.23	1.0%
14 REAL ESTATE	0	-3.45	-7.69	-11.14	1.0%
15 INSURANCE CARRIERS	0	-2.26	-8.2	-10.46	1.0%
16 NURSING AND PROTECTIVE C	-4.59	0	-5.34	-9.93	0.9%
17 HOTELS AND LODGING PLACE	-0.91	-1.74	-6.79	-9.44	0.9%
18 RESIDENTIAL CARE	-4.55	0	-3.61	-8.16	0.8%
19 NEWSPAPERS	0	-6.22	-1.82	-8.04	0.8%
20 SOCIAL SERVICES, N.E.C.	-0.64	-0.04	-6.86	-7.53	0.7%
Rest of the Economy	-6.47	-94.43	-124.82	-225.9	21.1%
Total Impact	-341.64	-363.6	-365.56	-1070.92	

Source: IMPLAN, United States Forest Service

The remainder of the impact is in other sectors and comes mainly through induced and indirect effects.

In the example shown here, about a third of the effects resulting from adjusting import demand's effects on prices occur directly. The remaining effects are induced or indirect effects. That is true for both income and employment effects. A shift in demand through exports (move from D1 to D2) can increase prices to producers from P1 to P2. The equilibrium point moves from point A to point B in Figure 1. As producers respond to price incentives expanding production and supply, a new aggregate supply curve, S2, is created moving the price to P3 at point C. If export demand declines causing a return to previous demand levels D1, price will now decline to P4 and equilibrium will be at point D. Producers are now supplying more product but anticipated demand has declined resulting in lower prices but greater production.

The important point for analysis concerning rural development is that only about one third of the effect in this example went directly to producers. The remaining effects were either indirect or induced and under normal circumstances occur off the farm. The non-farm members of the community were effected by declines in producer incomes resulting from changes in net export levels for potatoes.