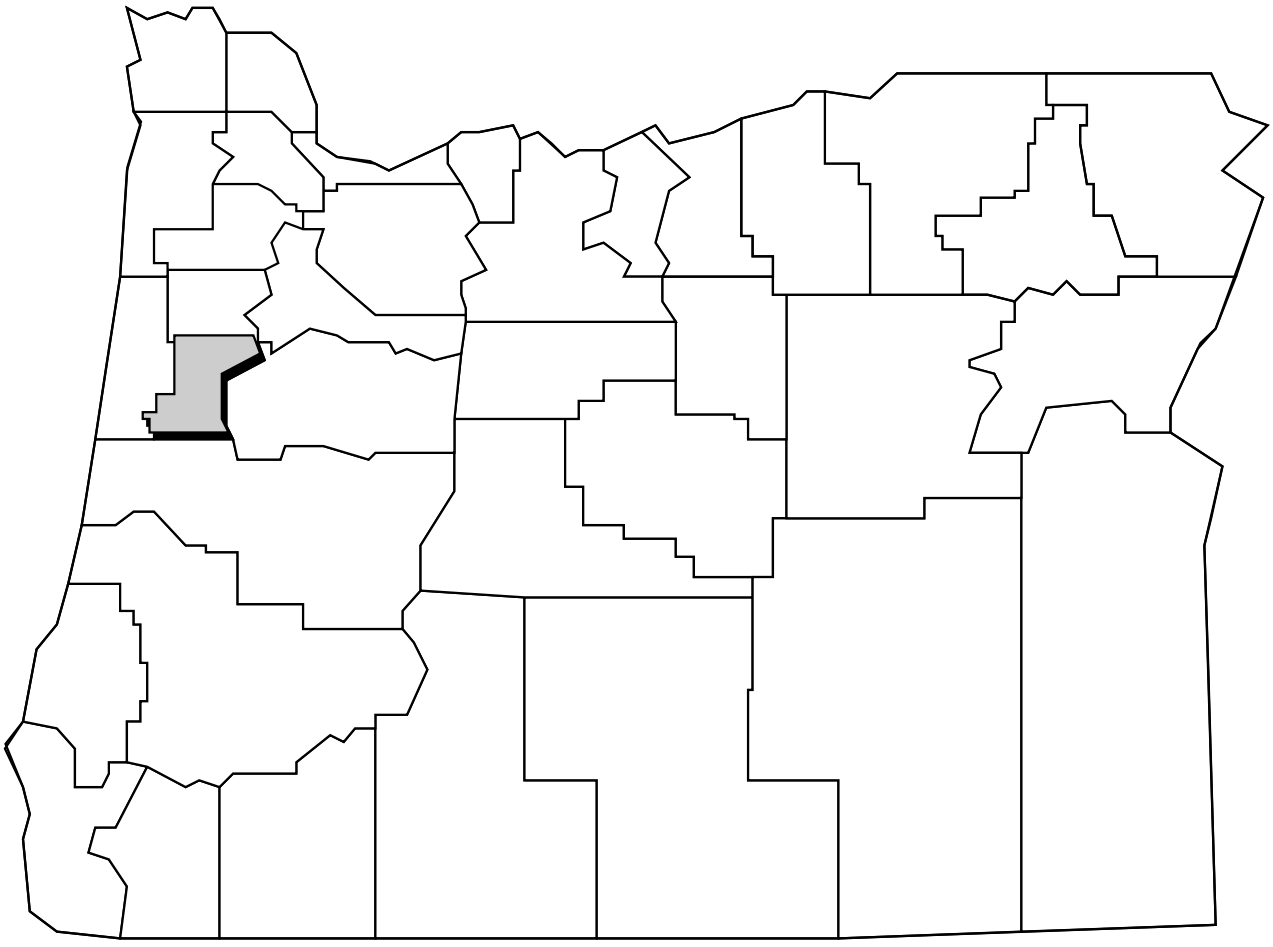
Special Report 1034
January 2002

Economic Diversity in Benton County:
An Input-Output Analysis



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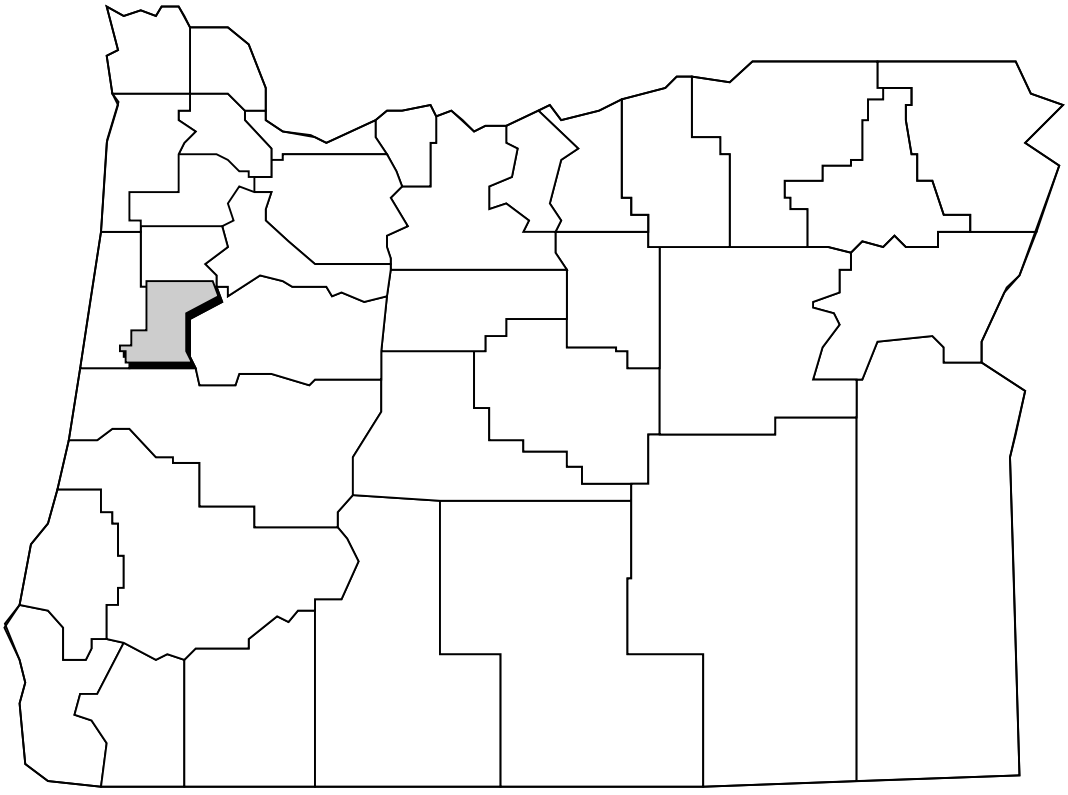

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Economic Diversity in Benton County: An Input-Output Analysis

Bruce Weber, Bruce Sorte, and David Holland

"From the date of the first white settlements on the banks of the 'Oregon' and its tributaries, the great bane of the State has been, and still continues to be, that the imports exceed the exports, and that money is being continually sent abroad for articles that should be produced and manufactured at home. To-day even, farmers are eating butter and bacon shipped from other States; are wearing fabrics from abroad, while, cows, hogs and sheep are running at large, by the hundred, without particular care or attention. Fine farms are tenantless and cannot be made to pay; splendid water powers are useless and vast forests are rotting all around; to say nothing of the untold wealth that yet remains undeveloped in the bowels of the earth—and yet we find croakers—happily they are few—in every community, and hearty able-bodied men hanging around the street corners, or lazily lounging about the saloons, talking of 'hard times' instead of pulling off their coats, rolling up their sleeves and going to work like true men."

(David Fagan, 1885, *History of Benton County*)

Introduction

Benton County has considered ways to strengthen and broaden its economic base for many years. At a glance, the County is economically very healthy. Its median income for a family of four is among the highest in Oregon, and the County's unemployment rate is often the lowest in Oregon. However, Benton County's economic base could be more diverse. It relies on three employers, each with more than a thousand employees—Oregon State University (OSU), Hewlett-Packard Corporation (H-P), and Samaritan Health Services—for approximately 30 percent of its direct employment. This lack of economic diversity may leave the County vulnerable to swings in the national and global economies. Yet, there are 18 employers in Benton County that have more than 100 employees, and there are many other employers that may have the potential to expand and diversify the economy.

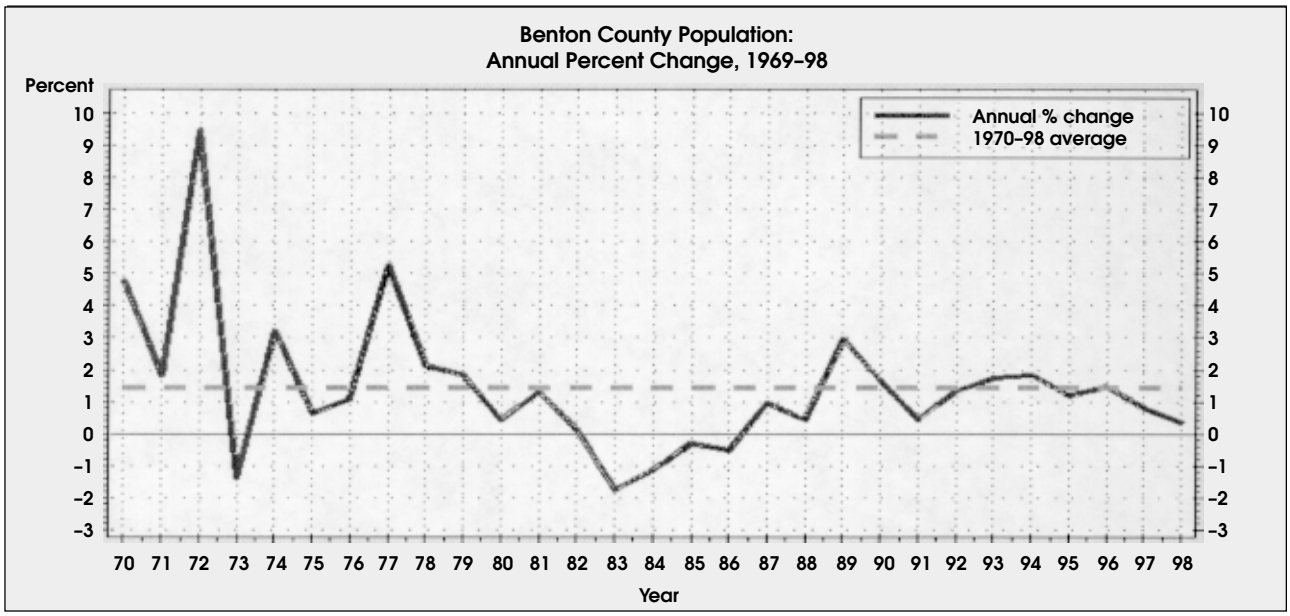
The Corvallis-Benton County Economic Development Partnership (EDP) recognized this vulnerability and potential and initiated an Economic Diversification Project in February 2000. The project built on a collaboration with OSU that began as a class project in 1999. The goal of this project has been to develop a Benton County Economic Input-Output Model (I-O), demonstrate how it can be used, and provide suggestions as to how the County's economy might be diversified based on information gained while building and testing the model.

This report begins with a general profile of the Benton County population and economic trends. This is followed by a discussion of some economic diversification strategies. Next, the report examines the County's economic base and pattern of employment growth. The next section of the report provides an overview of the Benton County Input-Output Model, and a few representative economic impacts are run through the Model. The final section of the report discusses the implications for strengthening and diversifying the Benton County economy.

Demographic and economic trends

The County's annual population growth rate since 1969 has been variable and moderate at 1.46 percent. It has exceeded the U.S. annual growth rate of 1.02 percent and has been less than Oregon's annual rate of 1.62 percent. During 5 years over that period, the County has lost population (Figure 1).

Figure 1

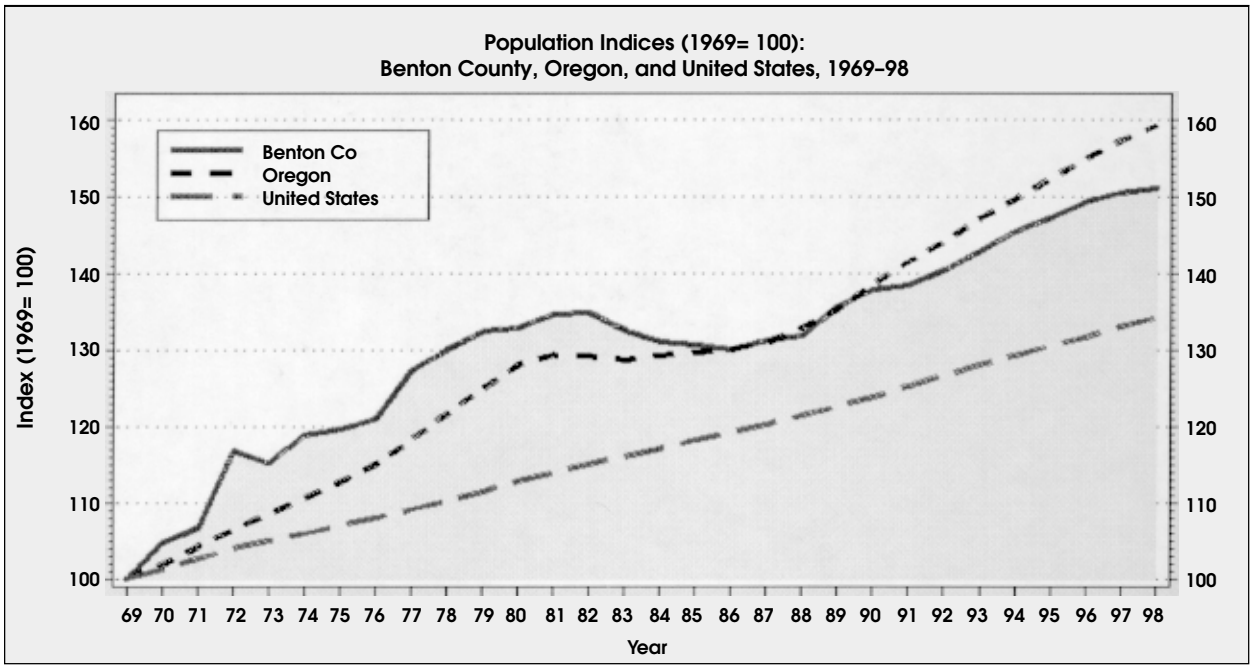


Source: Smith, Gary W. 2001. Northwest Income Indicators Project (NIIP) Web page. http://niip.wsu.edu.

Total population growth for Benton County over the period was 51 percent compared to Oregon at 59.2 percent and the U.S. at 34.3 percent. Fourteen of 36 Oregon counties exceeded the County's growth rate. They were primarily in the I-5 corridor, with some notable exceptions (Deschutes County).

Economic conditions often have played a major role in population changes within Benton County (Figure 2). Until recently, Benton County was a natural resource based economy (hunter-gatherer, agriculture, and agriculture/timber). In the mid-1950s, and reinforced in the 1960s by the baby-boomers reaching college age, enrollments at OSU began an increase that lasted until 1982 (Mathany and Barnhouse et al., 1997; 35); and, in the mid-1970s, H-P started development of a manufacturing facility north of Corvallis, which has grown to become the largest single private employer in the County.

Figure 2

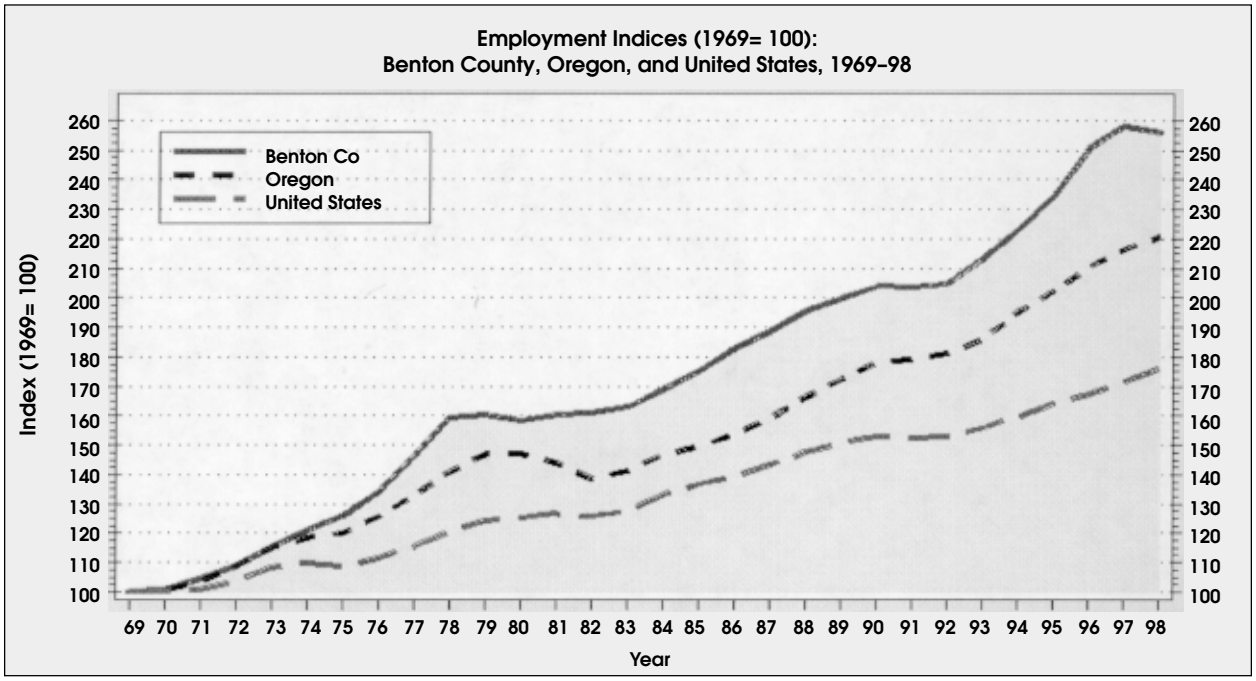


Source: Smith, Gary W. 2001. Northwest Income Indicators Project (NIIP) Web page. http://niip.wsu.edu.

The growth of OSU and the development and growth of H-P and other industries have pushed Benton County employment ahead of Oregon and the U.S., and pushed Benton County average earnings per job ahead of Oregon (Figures 3 and 4).

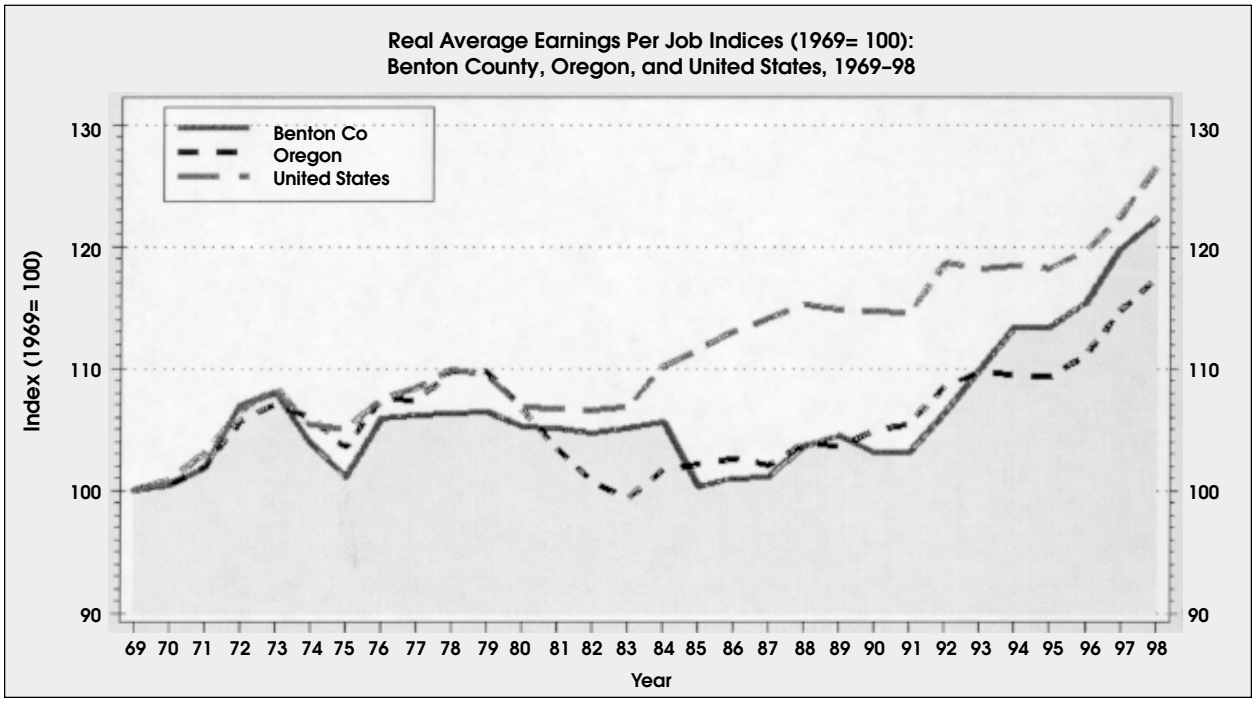
The job growth of the 1990s appears to have been in high paying jobs, as average earnings per job increased faster in Benton County than in the State or nation. It is worth noting, however, that during the 1990s, Benton County's employment grew faster than State employment (Figure 3), but county population grew more slowly (Figure 2). This suggests that many new jobs may have been filled by workers outside the County who commute to work.

Figure 3



Source: Smith, Gary W. 2001. Northwest Income Indicators Project (NIIP) Web page. http://niip.wsu.edu.

Figure 4

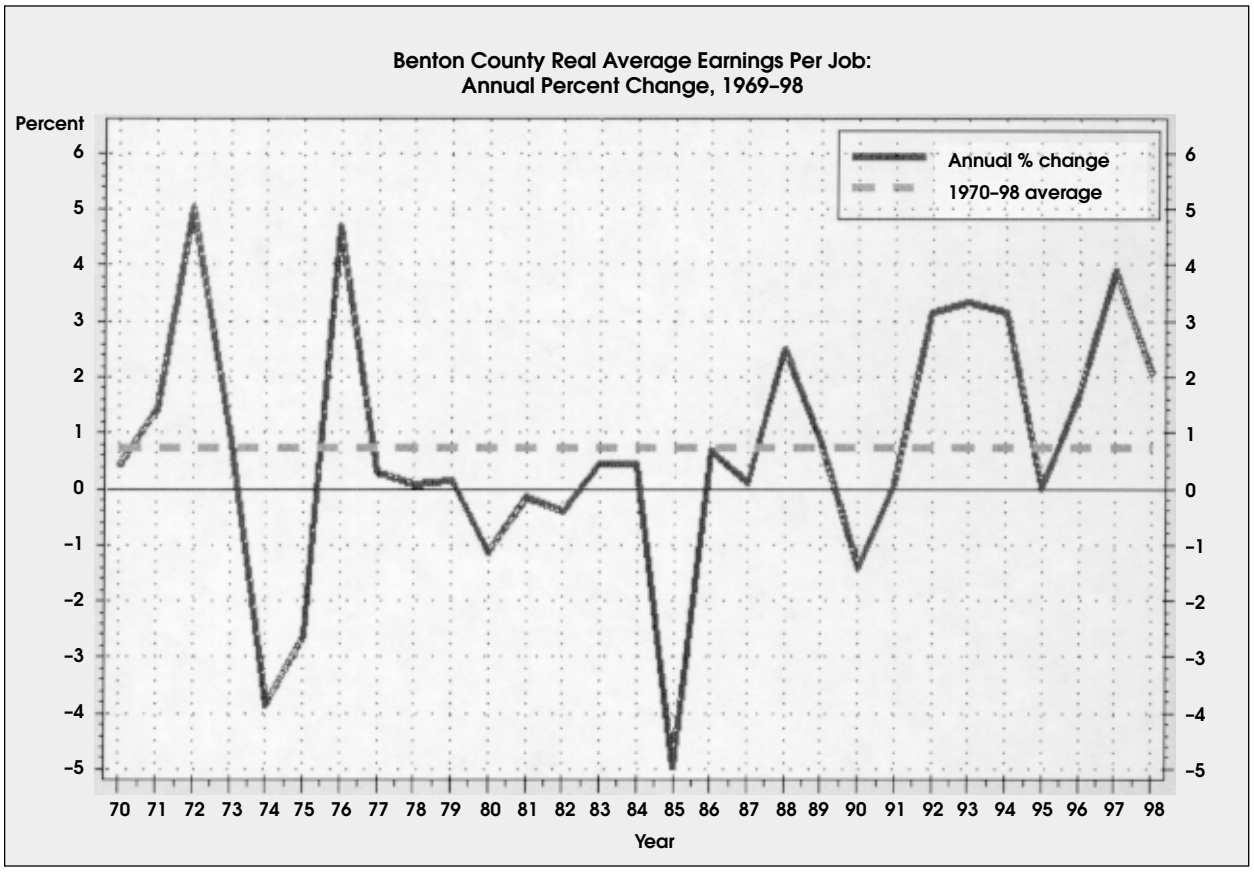


Source: Smith, Gary W. 2001. Northwest Income Indicators Project (NIIP) Web page. http://niip.wsu.edu.

This picture of economic health has been sustained by the strength of the two and now three major employers, and by the high mobility of the labor force. Since unemployed workers often leave the County quickly, the economic indicators typically look good. However, the indicators do not fully reflect the changes that are taking place within the community. Business cycle changes have been particularly disruptive to private, professional, and community relationships. Benton County has had periods of very low growth rates or net losses of population and per capita income, as shown in Figures 1 and 5.

Economic diversity can help cushion the impacts of downturns in the local or national and global economies. Achieving a greater measure of diversity can help people enjoy a higher level of stability in their professional and personal lives and remain in Benton County.

Figure 5



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Economic diversification strategies

Export base expansion

According to the export base theory of economic development, the key to regional economic growth is to identify those industries with export potential, encourage private decisions, and pursue public policies that assist expansion of those industries. Goods and services that experience sustained rates of export growth are generally of interest, because they are likely candidates for future expansion. If certain commodities have negative or no growth, but they are an important part of the existing export base, they may be candidates for business retention efforts.

Export base theory may be used in conjunction with information gathered from historical and projected industry trends to identify economic sectors with job creation potential. It is important to note, however, that an export base analysis considers only one aspect of economic development opportunities. Potential opportunities for export expansion must be considered along with the other factors to determine if there is an adequate natural and financial resource base, skilled labor pool, and positive business environment to attract and support new firms in the growth industries, and/or to promote growth within existing local firms.

Import substitution

When a firm is unable to obtain a particular input at a competitive cost locally, it will import it from elsewhere, resulting in an economic leakage. The other region will reap the benefits from the sale of the input. Import substitution involves promoting local growth in those sectors from which local industries are currently importing, thereby replacing imported goods and services with local goods and services. An economic development strategy based on import substitution and building interindustry linkages allows a region to reduce some of its economic leakages, thereby strengthening its own economic base and gaining the ripple effects of increased production.

Growth, stability, and economic diversity

Traditionally, economists have suggested "that growth should be derived from economic specialization based on comparative advantage. Theory also suggests that stability is achieved through diversity by spreading risk (or opportunities) over many activities. Theory, therefore, seems to suggest that regional policymakers are forced to choose between two polar goals of growth and stability, and the corresponding set of policy options" (Wagner and Deller, 1998; 542).

However, pursuing both goals simultaneously is not only possible (ibid., 555), but it may be essential to the long-term health of an economy. Through economic diversity, we expect that "[e]mployment gains in some industries mitigate employment losses in other industries and, as a result, reduce unemployment and stabilize the regional economy" (Malizia and Ke, 1993; 222). Those employment gains will endure, however, only if the respective industries are competitive. Competitiveness is critical for diversity to be effective, and the linkages and agglomerations in a diverse economy are just what competitive firms seek.

As we use the term, economic diversity is the presence of multiple specializations and extensive interindustry linkages within an area's economic base. This concept of diversity captures both the need for specialization in exports and the importance of interconnectedness and import substitution.

Businesses will tend to cluster to develop linkages and gain the benefits of agglomeration economies. Interindustry agglomeration may involve forward or backward linkages. Industries may have a number of backward linkages, in which buyers attract suppliers, and forward linkages, in which suppliers attract businesses that use the suppliers' products as intermediate goods to produce their own goods and services (Blair, 1995; 96). Clustering of buyers allows

suppliers to expand and reduce their costs through economies of scale in production and transportation. Businesses also can benefit from labor-market pooling and knowledge spillovers, as ideas are shared formally and informally throughout the area. Jane Jacobs has stressed that as economies grow and urban areas develop, they contain people with diverse backgrounds and interests, which leads to innovation (O'Sullivan, 2000; 26-32).

Benton County's economic base and growth industries

To explain the structure of an economy and recommend policies for economic development, it is important to understand what drives a regional economy like Benton County's. Many economists believe that "central to the study of regional economies is a region's economic base, commonly represented by its exports to markets outside the region" (Maki and Lichty, 2000; 15). The term "exports" is used here to include any activities that bring dollars into the County economy, which means items like tourism and federal transfer payments are considered part of the export base.

Export Base

Benton County is now primarily a knowledge-based economy, still with a strong natural resource base component. Tables 1 and 2 provide an overview of some of the employment changes in Benton County over the last half century, and use location quotients (LQ) to compare the structure of the County's employment with Oregon and the U.S. "…[C]hanges in location quotient values over time represent changes in a defined industry's importance to an area. As such, location quotients are quite useful as rough approximations of the local economic base" (Maki and Lichty, 2000; 198).

A location quotient is calculated by dividing the local share of employment in a particular industry by the national share of employment in that same industry. Algebraically,

$$LQ = \frac{\frac{\text{local employment in the industry}}{\text{total local employment}}}{\frac{\text{State or national employment in the industry}}{\text{total State or national employment}}}$$

The sectors with LQs greater than 1.0 are ones in which the County is specialized. When the LQ for a given sector is greater than 1.0, the relative concentration of employment in that sector in Benton County is greater than in Oregon or in the national economy. In Tables 1 and 2, Oregon State University (the major employer in the government sector) is revealed to be a major part of the County's economic base in 1950 (LQ = 3.17). With the most recent data (1997), OSU continues to be identified as an important part of the economic base, and, in addition, manufacturing emerges as significant with an LQ = 1.39.

LQs can be used as an indicator of economic diversity; having several sectors with LQs greater than 1.0 indicates multiple specializations that are the key to economic diversity.

From Tables 1 and 2, it is clear that Benton County has become more diverse since 1950. The combined sector of Agriculture and Forestry (sector aggregations were necessary to reconcile the 1950 and 1997 data formats) has become relatively more important as a basic industry in Oregon and Benton County, probably due to the decline of that sector nationally, while Benton County's natural resource base has remained relatively stable. Manufacturing has increased its share of employment. This broadening of the economic base has reduced the relative importance of the Government without Military sector. The smaller location quotient for the Government without Military sector, which is to a large extent comprised of OSU, suggests that even though more jobs are currently dependent on OSU, the County's employment base is relatively less reliant on OSU than it was in 1950.

Table 1. Benton County compared to Oregon—employment location quotients. Standard Industrial Classification one-digit level.

	1950			1997			
	Benton County Employment	Oregon Employment	LQ	Benton County Employment	Oregon Employment	LQ	1950/1997 LQ % Change
Farm Employment				1,245	64,446	0.77	
Ag. Serv., Forestry, Fishing and Hunting				1,409	38,307	1.47	
Subtotal Agriculture, Forestry, etc.	1,384	73,205	0.98	2,654	102,753	1.03	5
Mining	26	1,650	0.82	43	3,140	0.55	-49
Construction	565	42,927	0.68	1,741	115,006	0.60	-13
Manufacturing	2,060	130,609	0.82	9,132	262,933	1.39	41
Transportation and Public Utilities	509	49,605	0.53	1,150	89,921	0.51	-4
Wholesale Trade	169	23,760	0.37	724	101,384	0.29	-29
Retail Trade	1,531	94,628	0.84	6,810	353,847	0.77	-9
Finance, Insurance, and Real Estate	252	19,573	0.67	1,839	132,250	0.56	-20
Other Services	1,867	89,817	1.08	14,152	587,046	0.96	-12
Federal, Civilian				660	29,853	0.88	
Military				354	13,423	1.05	
State and Local Government				10,861	209,332	2.07	
Subtotal Government w/o Military	2,626	42,870	3.17	11,521	239,185	1.92	-65
Industry Not Reported	138	7,866	0.91				
Total	11,127	576,510		50,120	2,000,888		

Sources: Regional Economic Information Service and the U.S. Bureau of the Census
Note: I/O Construction Agency Forces Adjustment Made in 1997 Construction and Trans. & Util. Sectors

Table 2. Benton County compared to the United States—employment location quotients. Standard Industrial Classification one-digit level.

	1950			1997			
Industry	Benton County Employment	United States Employment	LQ	Benton County Employment	United States Employment	LQ	1950/1997 LQ % Change
Farm Employment				1,245	2,954,000	1.32	
Ag. Serv., Forestry, Fishing and Hunting				1,409	1,972,400	2.23	
Subtotal Agriculture, Forestry, etc.	1,384	6,996,159	1.00	2,654	4,926,400	1.68	68
Mining	26	929,464	0.14	43	832,500	0.16	14
Construction	565	3,440,690	0.83	1,741	8,365,700	0.65	-22
Manufacturing	2,060	14,570,751	0.71	9,132	19,415,800	1.47	105
Transportation and Public Utilities	509	4,368,943	0.59	1,168	7,550,200	0.48	-18
Wholesale Trade	169	1,980,244	0.43	724	7,177,800	0.31	-27
Retail Trade	1,531	8,569,760	0.90	6,810	26,355,900	0.81	-11
Finance, Insurance and Real Estate	252	1,915,120	0.66	1,839	11,778,300	0.49	-27
Services	1,867	9,180,677	1.03	14,152	48,227,800	0.92	-11
Federal, Civilian		1,463,639		660	2,814,000	0.73	
Military				354	2,165,000	0.51	
State and Local Government		1,968,989		10,843	16,801,000	2.01	
Subtotal Government w/o Military	2,626	3,432,628	3.87	11,503	19,615,000	1.83	-53
Industry Not Reported	138	840,904					
Total	11,127	56,225,340		50,120	156,410,400		

Sources: Regional Economic Information Service and the U.S. Bureau of the Census
Note: I/O Construction Agency Forces Adjustment Made in 1997 Construction and Trans. & Util. Sectors

Economic growth performance

Shift-share analysis is a technique for identifying industries that are growing locally faster than they are nationally. Table 3 presents a shift-share analysis of Benton County for 1987-97. The "regional shift" in column 3 of the table is a key indicator: a positive "regional shift" for an industry indicates that industry employment is growing faster in Benton County than it is growing nationally.

Employment in the manufacturing sector declined by 1 percent nationally over this period. (National employment in all industries grew by 20 percent, while national manufacturing employment grew 21 percent less than national employment in all industries.) Employment in the manufacturing sector in Benton County grew 77 percent over the 1987–97 period. The "regional shift" for manufacturing in Benton County is thus 0.78.

How should one interpret the "regional shift"? The regional shift (sometimes called the "local effect") is "sometimes interpreted as a change in an area's competitive advantage, but this oversimplifies... It is better to conceive of the local effect as resulting from factors that distinguish the local economy from other areas and that bear further investigation. Generally, however, negative local shifts indicate problems in the local economy" (McLean and Voytek, page 69).

Sectors of particular interest are those whose "regional shift" is greater than the growth in overall local employment (17 percent); that is, whose regional shift is greater than 0.17. These are the sectors with positive "competitive position" coefficients in the last column. These sectors are growing faster than their national counterparts and faster than the rest of the local economy: they are sectors in which the local economy may be gaining national "market share" and in which the local economy is becoming more specialized. For Benton County during the past decade, the sectors that meet these criteria are **farming, agricultural services, construction, and manufacturing.**

Industrial targeting?

"Many, if not most, States and large municipalities with economic development programs have attempted to focus their efforts through the selection of target industries. It is difficult to resist the temptation to select target industries, because, once selected, those industries give guidance to decisions about policy—from selection of trade journals for ad campaigns to worker training programs to the focus of business assistance centers. But what is the theory behind the selection of target industries? After all, some have questioned the usefulness of target industries, because forecasts for individual industries for an urban area are subject to large errors. Furthermore, focusing attention on a short list of industries may cause policymakers to neglect the more basic conditions for general economic growth and development. Policymakers must be sensitive to these problems. With these points made, it still may be that the industries that represent the economic future of the urban area can be identified and targeted" (McDonald, pp. 422-423).

The broad 1-digit industry LQ and shift-share analysis of Tables 2 and 3 can be used to do some preliminary screening of sectors for industrial targeting. Candidates for further investigation as targets for retention and expansion efforts include industries in which the economy is specialized locally and whose recent growth performance indicates increasing competitiveness nationally and locally.

McLean and Voytek note that both LQs and shift-share analysis are highly sensitive to the level of industrial aggregation in the analysis. Location quotient analysis at the 1-digit industry level (as in Tables 1 and 2) is not able to discern very precisely export base specialization in broad industry groups. Shift-share analysis at the 1-digit industry level (as in Table 3) overestimates the "regional shift." This implies that the preliminary screening in this report needs to be refined in future studies conducted at a higher level of disaggregation before selecting sectors for industrial targeting.

Table 3. Benton County place adjusted shift-share analysis for 1987–1997 (May 2001).

Industry	Conventional Shift-Share				Competitive
	National	Industry	Regional	Total	Position
Total full- and part-time employment	0.20	0.00	0.17	0.37	0.00
Wage and salary employment	0.20	-0.02	0.23	0.41	0.05
Proprietors' employment	0.20	0.09	-0.07	0.21	-0.24
Farm proprietors' employment	0.20	-0.24	0.12	0.07	-0.05
Nonfarm proprietors' employment	0.20	0.13	-0.10	0.23	-0.27
Farm employment	0.20	-0.26	0.20	0.14	0.03
Nonfarm employment	0.20	0.01	0.17	0.38	0.00
Private employment	0.20	0.03	0.28	0.51	0.11
Ag. serv., forestry, fishing, and other	0.20	0.31	0.37	0.88	0.20
Mining	0.20	-0.42	-0.07	-0.29	-0.24
Construction	0.20	0.01	0.78	0.99	0.61
Manufacturing	0.20	-0.21	0.78	0.77	0.61
Transportation and public utilities	0.20	0.02	0.09	0.30	-0.08
Wholesale trade	0.20	-0.06	0.00	0.14	-0.17
Retail trade	0.20	0.02	0.07	0.29	-0.10
Finance, insurance, and real estate	0.20	-0.07	0.08	0.21	-0.09
Services	0.20	0.22	0.11	0.53	-0.06
Government and government enterprises	0.20	-0.11	-0.02	0.07	-0.19
Federal, civilian	0.20	-0.28	0.08	0.00	-0.09
Military	0.20	-0.43	0.08	-0.16	-0.09
State and local	0.20	-0.01	-0.10	0.09	-0.28
State	0.20	-0.03	-0.07	0.09	-0.24
Local	0.20	0.00	-0.14	0.07	-0.31

Benton County's export base: a closer look

Since expanding the specializations or export base of the economy is such an important feature of strengthening diversity, we consider the County's export base in more detail. Then, we estimate the extent to which all the jobs in the County are dependent on the export base.

Economic specialization: location quotient analysis

In Table 2, we used the broad 1-digit Standard Industrial Code classification to identify industries in which Benton County is specialized. As noted, such a categorization is too broad to capture specific industries that constitute the region's base. Recall that analysis found four sectors in which Benton County is specialized: farming, agricultural services, manufacturing, and State and local government**.** In Table 4, we present a somewhat more disaggregated LQ analysis, using the North American Industrial Classification System (NAICS).

Table 4, using this more informative aggregation system, indicates that the sectors in which Benton County is most specialized are **high tech manufacturing, forestry and logging, and education services**. Descriptions of each sector are provided in Appendix A. A number of sectors, in addition to these, have national LQs that exceed or approach 1.0 and could be candidates for further development as specialized sectors. These include information services, health care, agriculture, wood products manufacturing, and public administration (including federal and State agency offices). In addition, those sectors that have backward or forward linkages to these export base sectors could warrant a more in-depth consideration for import substitution opportunities.

Table 4. Benton County employment location quotients.
North American Industrial Classification System aggregation of IMPLAN sectors.

Sectors/County – State – U.S.	1997 County Jobs	%	OR LQ	U.S. LQ
Agriculture, Fishing and Related	1,645	3.28	0.76	1.15
Forestry and Logging	1,008	2.01	4.08	32.20
Mining	65	0.13	0.94	0.26
Construction	1,719	3.43	0.53	0.54
Manufacturing—Food, Beverages, and Related	477	0.95	0.61	0.45
Manufacturing—Wood Products, Paper, Furniture	1,197	2.39	0.68	1.86
Manufacturing—High Tech. & Related	6,196	12.36	6.25	14.01
Manufacturing—Other	1,052	2.10	0.37	0.28
Transportation and Warehousing	810	1.62	0.44	0.43
Utilities	266	0.53	0.61	0.58
Wholesale Trade	722	1.44	0.29	0.32
Retail Trade	4,172	8.32	0.69	0.72
Accommodation and Food Services	2,956	5.90	0.86	0.91
Finance and Insurance	1,060	2.12	0.51	0.44
Real Estate and Rental and Leasing	883	1.76	0.72	0.65
Other Services	3,130	6.25	1.01	0.98
Information	2,354	4.70	1.79	1.54
Administrative, Support, and Remediation Services	1,547	3.09	0.67	0.70
Arts, Entertainment and Recreation	444	0.89	0.52	0.56
Health Care and Social Assistance	4,275	8.53	1.07	0.98
Professional, Scientific, and Technical Services	2,146	4.28	0.98	0.95
Educational Services	7,660	15.28	2.24	2.07
Public Administration	4,334	8.65	1.30	1.12
Total	50,120	100.0		

Note: Percentage may not sum to 100 because of rounding.

Export base employment: input-output analysis

As indicated above, location quotients are imperfect indicators of the economic base. The economic base of a region is better captured with an input-output model, which directly estimates exports from each industry and, using the multipliers for each sector, generates estimates of the dependence of a regional economy on exports from each sector. A sector's contribution to a regional economy is determined by the outside demand for that sector's goods and services and the subsequent respending associated with meeting that demand. The contribution of that industry to the region's employment is the number of employees in all industries whose jobs are dependent, directly or indirectly (through interindustry linkages), on the exports of that industry (Cornelius et al., 2000; 14).

Table 5 summarizes the contribution of each sector to total County employment, based on an analysis using the Benton County I-O Model. The procedure used to derive the estimates in Table 5 is described in Waters et al. (1999). The table compares the employment *in* a sector with employment *dependent* on a sector's production that is exported outside the County. The jobs under the Sectoral Employment columns are jobs in the given sector. The jobs in the Export-Dependent columns are jobs from *all* sectors that are dependent on the exports from the given sector.

As an example, there are 1,008 jobs *in* the Forestry and Logging sector. However, there are 2,030 jobs *dependent* on Forestry and Logging's exports. These 2,030 jobs are in many different sectors: there are 509 Agricultural jobs, 925 Forestry and Logging jobs, 1 Mining job, 35 Construction jobs, and so on, that depend on Forestry and Logging exports. The money that is brought into the County by Forestry and Logging exports is respent in ways that generate these 2,030 jobs.

What is most striking in Table 5 is the dependence of the Benton County economy on two sectors:

- **Manufacturing—High Tech. and Related** drives an estimated 26 percent of all jobs in the economy.
- The **Educational Services** sector (of which OSU is a dominant part) drives an estimated 21 percent of all jobs in the economy.[1]

This dependence on only two sectors for almost half of the County's jobs underscores the lack of diversity in the Benton County economy.

The other important finding from Table 5 is the major role of **income to households from outside the County** in the County economy. Government transfer payments (e.g., Social Security), pensions, dividends, commuters' income, rental payments, and other sources of income originating outside the County are an important part of the export base. Using the Benton County I-O Model, we found that 7,832 jobs (or 15.6 percent of the jobs in the County) in 1997 were dependent on those payments to households from outside the County. Table 6 gives an estimate of the jobs in each of the 23 sectors that are dependent on the transfer payments to households. Over half of the approximately 7,800 jobs in the County dependent on these transfers are in three sectors: health care and social assistance, retail trade, and educational services. That proportion could increase depending on the future direction of federal and State transfer programs and the degree to which Benton County is successful in attracting retirees.

Table 5. Benton County's export-base-dependent employment, 1997.

	Sectoral Employment		Export-Dependent Employment	
Sector	Number of Jobs	Share (%)	Number of Jobs	Dependency Index (%)
Agriculture, Fishing, and Related	1,645	3.3	833	1.7
Forestry and Logging	1,008	2.0	2,030	4.1
Mining	65	0.1	5	0.0
Construction	1,719	3.4	1,877	3.7
Manufacturing—Food, Beverages, and Related	477	1.0	1,074	2.1
Manufacturing—Wood Products, Paper, Furniture	1,197	2.4	1,371	2.7
Manufacturing—High Tech. and Related	6,196	12.4	12,810	25.6
Manufacturing—Other	1,052	2.1	1,705	3.4
Transportation and Warehousing	810	1.6	142	0.3
Utilities	266	0.5	53	0.1
Wholesale Trade	722	1.4	147	0.3
Retail Trade	4,172	8.3	254	0.5
Accommodation and Food Services	2,956	5.9	75	0.1
Finance and Insurance	1,060	2.1	77	0.2
Real Estate and Rental and Leasing	883	1.8	196	0.4
Other Services	3,130	6.2	940	1.9
Information	2,354	4.7	1,634	3.3
Administrative and Support Services, etc.	1,547	3.1	111	0.2
Arts, Entertainment, and Recreation	444	0.9	3	0.0
Health Care and Social Assistance	4,275	8.5	891	1.8
Professional, Scientific, and Technical Services	2,146	4.3	725	1.4
Educational Services	7,660	15.3	10,481	20.9
Public Administration	4,334	8.6	2,537	5.1
Households			7,832	15.6
State and Local—Federal Government Revenues			2,316	4.6
Total	50,120	100.0	50,120	100.0

Note: Percentages may not sum to 100 because of rounding.

[1]The 1997 report *Oregon State University: Economic Impacts of an Institution of Higher Education* (Cheek et al.) provides a careful analysis of the university portion of the Educational Services sector. We used that report to calibrate our estimates.

Table 6. Household transfer payments export-base-dependent employment, 1997.

Agriculture, Fishing, and Related	53.7
Forestry and Logging	1.9
Mining	5.9
Construction	78.4
Manufacturing—Food, Beverages, and Related	1.7
Manufacturing—Wood Products, Paper, Furniture	49.2
Manufacturing—High Tech. and Related	23.3
Manufacturing—Other	4.0
Transportation and Warehousing	143.0
Utilities	79.1
Wholesale Trade	67.4
Retail Trade	1,314.7
Accommodations and Food Services	893.8
Finance and Insurance	247.2
Real Estate and Rental and Leasing	273.5
Other Services	497.4
Information	311.8
Administrative and Support Services, etc.	273.1
Arts, Entertainment, and Recreation	130.9
Health Care and Social Assistance	1,853.4
Professional, Scientific, and Technical Services	421.6
Educational Services	1,107.2
Public Administration	0.0
Total	7,832.2

Impacts of possible economic changes

Input-output models

An input-output (I-O) model accounts for the flow of goods and services to producers, among producers, and finally to consumers. In building the model, we create a table that shows the interdependence of the different parts of the economy. Once built, the model can estimate the multiplied effects or impacts of a change within one or many sectors of that economy.

When a dollar enters the economy from the sale of an exported good, service, or transfer payment, the dollar or a portion of it is respent many times before leaking out of the economy through the purchase of imports. The accumulated dollar value of this respending is the multiplier effect. Specifically, a sectoral multiplier is a measure of the total effect throughout the economy stemming from an initial change in one sector.

The Type I output or sales multiplier is (Johnson et al., 1994; 4):

$$M_I = \frac{\text{Direct Effects + Indirect Effects}}{\text{Direct Effects}}$$

The Type II or Social Accounting Matrix (SAM) output or sales multiplier is:

$$M_{II} = \frac{\text{Direct Effects + Indirect Effects + Induced Effects}}{\text{Direct Effects}}$$

"Direct effects are the changes in the industries to which a final demand change was made. Indirect effects are the changes in inter-industry purchases as they respond to the new demand of the directly affected industries.

Induced effects typically reflect changes in spending from households as income increases or decreases due to the changes in production" (Minnesota IMPLAN Group, Inc. 1999; 102).

Note that multipliers are applied only to economic activities that bring income into the community from the outside, such as sales of goods to some firm or person outside the region. Multipliers are not appropriately applied to sales by a local business to another local business. Such transactions are captured in the multiplier of the other local business when it exports its products or services.

The size of the multiplier depends on the amount of respending that occurs in an economy. Larger economies generally have larger multipliers because businesses and households can make a larger share of their purchases in the local economy. In small economies, businesses and households cannot purchase as much of what they need locally, so more spending "leaks out" of the economy, resulting in a smaller multiplier. Thus, multi-county models will have larger multipliers than those of the individual counties that make up the multi-county region.

Multipliers for rural Oregon counties may be getting smaller over time. Oregon State University constructed about a dozen input-output models in the 1960s and 1970s for rural counties. The average of the output multipliers for these models (based on an 11-sector model) was around 2.0 (1.97). More recent models of rural counties built with IMPLAN have smaller multipliers. The average IMPLAN output multiplier for four rural Oregon counties in 1998 was 1.37, for example. The average output multiplier in the 168-sector Benton County I-O model is 1.38. As local economies have become more national and global in their access or reach, there are more opportunities for leakages, which reduce the multipliers.

An I-O model has some limitations. It is static and does not deal well with major changes in markets and technological conditions. It assumes that how industries produce goods and services remains constant no matter how the quantity of the goods or services, production processes, or prices change.

A good strategy for dealing with the rigidity of the model is to construct scenarios that anticipate the responses of firms and workers to some hypothesized shock. In this report, we add a short-run dynamic element to the I-O model by creating scenarios that project the primary and secondary reactions to an economic shock. Typically, the primary event or group of events is used to shock the model and estimate the impacts. We have extended that type of analysis by asking experts to anticipate how businesses and people may adjust to the initial shock and run those scenarios along with the primary event through the model to develop a *net impact*. For example, an I-O model can indicate which industries will lose jobs and how many jobs will be lost due to a negative economic shock. The I-O model is not designed to predict and analyze a series of compensating actions that the laid-off workers might take (e.g., early retirement, start their own businesses). By identifying those secondary responses and running them through the model, we can estimate the net impact of the economic shock.

Until recently, these Input-Output models were very labor intensive to develop, because researchers often needed to gather detailed data from individual businesses within the area that was being modeled. The resulting models were not comprehensive and could become outdated quickly. Beginning in the 1970s, the Forest Service, in cooperation with FEMA, BLM, the University of Minnesota, and eventually a private company, the Minnesota IMPLAN Group, created and refined a computer program to synthesize more than 30 primarily federal data bases and produce an Input-Output model. The software now is called "IMPLAN Professional" and comes with a number of data base options that can be used to model economies.

The software and database are being tested regularly and improved. Still, to be reasonably confident that the model accurately characterizes the Benton County economy, we needed to customize the IMPLAN model for Benton County. This involved creating a special aggregation of the model and "ground-truthing" the model as described in Appendix B.

Economic impact scenarios

Benton County's Input-Output model can be used to estimate the impact of actual or anticipated economic changes, both negative and positive. These shocks are the result of an increase or decrease in the export demand for goods or services produced in the County or for goods or services elsewhere that would warrant an expansion into this County. We distinguish here between a shock, which is the initial, often external, change that affects the County, and the reaction to the change that often dampens the impacts of the shock.

Once community members develop a scenario or set of events that may occur due to the shock, we can use the model to describe the economic impacts, in a fairly detailed way, if the economy works in the future like it has worked in the past. Community members do the predicting by building the scenarios of events that follow the initial shock or change, and we use the initial shock, together with anticipated reactions to that shock, process them through the model, and analyze the results.

The scenario building processes can be very useful for the community, as thinking "through the details of the event (or shock) under consideration helps citizens better understand the dynamics of the local economy. In some instances, the process of describing the scenario steers the community in certain directions that it may not have considered otherwise... and... [B]y discussing in detail the scenario to be considered, the patterns underlying the model-generated baseline, as well as the impact results themselves, give the community the opportunity to slow down and more carefully consider its options" (Deller and Shields, 1998; 87 and 91).

To illustrate how the model works, we have brainstormed with the EDP one negative and two positive shocks, the accompanying business and worker reactions, and the economic impacts.

Scenario 1—Slowdown in high-tech

Over the last 25 years, the Benton County high technology industry has grown rapidly with a few slowdowns along the way. The first shock we consider is a 10 percent reduction in the Manufacturing—High Tech. and Related sector employment. This would mean a decline of 620 jobs, using 1997 data, within that sector. We assume that the reactions to the shock would be:

1. Forty percent of those laid off would be commuters, and, though the regional economy would feel the full shock, the Benton County impact would be related primarily to its residents or the 60 percent of the jobs that were held by Benton County residents.
2. Of the 372 high-tech jobs that would be lost by residents, 25 percent of the laid-off workers would pursue and quickly find employment in the County (which we split between the Manufacturing—Other and Information sectors).
3. Ten percent of those people would seek early retirement and receive an average income of $3,000 per month.
4. Five percent of the laid-off workers would start their own or partner with other businesses, which we split between the Retail Trade and Other Services sectors, planning on each business to hire two employees in addition to the owner.
5. Ten percent would remain in Benton County and utilize public resources (e.g., unemployment compensation) in the amount of $1,200 per month, while they experienced an extended search for another job.
6. Fifty percent of the laid-off workers would leave the County in pursuit of employment elsewhere.

The economic shock and reactions are summarized in Table 7.

Table 7. Scenario 1—Slowdown in the high-tech industry.

Initial Economic Shock and Reactions	Employment—Full and Part-Time Jobs	
	Residents (60%)	Commuters (40%)
Shock:		
High Tech RIF (6,196 X 10%)	-372	-248
How laid-off resident workers respond in the first 6–12 months		
Find new local job (372 x 25%)	93	
Manufacturing—Other	47	
Information	46	
Early retirement (372 x 10%)	37	
Business start-up (372 x 5% x 3)	57	
Retail	28	
Other services	29	
Receive unemployment payments (372 x 10%)	37	
Move out of county (372 x 50%)	186	

The effects of the slowdown can be seen in Table 8. Even with the mitigating reactions included, the direct resident job losses in high technology are almost doubled as the shock rumbles throughout the economy.

Table 8. Scenario 1—Slowdown in the high-tech industry, Benton County, Oregon.
Manufacturing—High tech. and Related.
Impact analysis of reduction of 372 resident jobs.

Industry	Direct*	Indirect*	Induced*	Total*
Agriculture, Fishing, and Related	0.1	(0.9)	(1.6)	(2.4)
Forestry and Logging	0.0	(0.1)	(0.1)	(0.2)
Mining	0.0	1.1	(0.2)	1.0
Construction	0.0	(14.5)	(2.6)	(17.0)
Manufacturing—Food, Beverages, and Related	0.0	(0.0)	(0.1)	(0.1)
Manufacturing—Wood Products, Paper, Furniture and Related	0.1	(5.3)	(1.8)	(7.0)
Manufacturing—High Tech. and Related	(372.0)	(82.6)	(0.8)	(455.4)
Manufacturing—Other	47.0	(0.5)	(0.2)	46.3
Transportation and Warehousing	0.2	(9.7)	(5.2)	(14.6)
Utilities	0.2	(2.5)	(2.2)	(4.5)
Wholesale Trade	0.1	(23.4)	(2.4)	(25.7)
Retail Trade	31.3	(2.2)	(53.1)	(23.9)
Accommodations and Food Services	2.1	(29.3)	(32.6)	(59.7)
Finance and Insurance	0.5	(9.6)	(10.8)	(19.9)
Real Estate and Rental and Leasing	0.6	(4.5)	(8.8)	(12.7)
Other Services	29.8	(38.2)	(19.8)	(28.2)
Information	46.5	(19.7)	(10.4)	16.4
Administrative and Support Services, etc.	0.2	(26.2)	(11.7)	(37.7)
Arts, Entertainment, and Recreation	0.3	(1.0)	(5.7)	(6.4)
Health Care and Social Assistance	5.2	0.0	(47.3)	(42.1)
Professional, Scientific, and Technical Services	0.7	(4.0)	(39.9)	(43.3)
Educational Services	3.3	0.0	(22.8)	(19.5)
Public Administration	0.0	0.0	0.0	0.0
Total	(203.6)	(273.2)	(280.0)	(756.8)

*Number of Jobs

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Scenario 2—New food processing plant

The City of Corvallis is in the process of developing the Airport Industrial Park. Based on the County's continued strength in agriculture and possible opportunities for agglomeration economies related to the County's existing food processor, we estimated the impact of a new food processing plant employing 80 workers for our second scenario. It is summarized in Table 9. A 65,000-square-foot, shell-type facility is estimated to cost $50 per square foot (for a total cost of $3.25 million). The cost includes some basic equipment costs and installation of the specialized equipment in addition to the basic structure. Both the short- and long-term impacts are reduced by the commuter rate, which we have included at 40 percent for all three scenarios. In addition, use of IMPLAN's regional purchase coefficient of 83 percent to estimate local construction purchases has reduced the short term or construction impact further.

As shown in Table 10, the total local construction phase impact of the food processing plant is about 30 jobs. When commuter and contractor leakages are accounted for, only half (17) of the 35 jobs in the construction phase are realized in Benton County. Addition of these 17 jobs for local residents generates 12 additional indirect and induced jobs in the local economy.

Table 9. New food processing plant in the Airport Industrial Park.

Initial Economic Shock and Reactions	Employment—Full and Part-Time Jobs	
	Residents (60%)	Commuters (40%)
Shock:		
Add a food processor (80 jobs)	48	32
Facility construction—$3.25 million	17	12
(35 jobs x 83% local contractors = 29 jobs)		

The ongoing operation of the food processing plant would generate significant ripple effects as a result of its backward linkages to other local industries (see Indirect Jobs column of Table 11). The Type II employment multiplier for the Manufacturing—Food, Beverages, and Related sector is 2.43. The total employment impact is 117 jobs from the direct effect of adding 48 resident food processing jobs.

Table 10. New food processing plant: construction phase, Benton County, Oregon.
Impact analysis of adding 17.5 resident construction jobs during the building phase.

Industry	Direct*	Indirect*	Induced*	Total*
Agriculture, Fishing, and Related	0.0	0.1	0.0	0.1
Forestry and Logging	0.0	0.0	0.0	0.0
Mining	0.0	0.0	0.0	0.1
Construction	17.5	0.1	0.1	17.6
Manufacturing—Food, Beverages, and Related	0.0	0.0	0.0	0.0
Manufacturing—Wood Products, Paper, Furniture, and Related	0.0	0.7	0.0	0.7
Manufacturing—High Tech. and Related	0.0	0.0	0.0	0.0
Manufacturing—Other	0.0	0.0	0.0	0.0
Transportation and Warehousing	0.0	0.3	0.1	0.4
Utilities	0.0	0.0	0.1	0.1
Wholesale Trade	0.0	0.2	0.1	0.2
Retail Trade	0.0	1.4	1.3	2.7
Accommodations and Food Services	0.0	0.2	0.8	1.0
Finance and Insurance	0.0	0.1	0.3	0.4
Real Estate and Rental and Leasing	0.0	0.1	0.2	0.3
Other Services	0.0	0.3	0.5	0.8
Information	0.0	0.2	0.2	0.4
Administrative and Support Services, etc.	0.0	0.5	0.2	0.7
Arts, Entertainment, and Recreation	0.0	0.0	0.1	0.2
Health Care and Social Assistance	0.0	0.0	1.2	1.2
Professional, Scientific, and Technical Services	0.0	1.6	0.5	2.1
Educational Services	0.0	0.0	0.5	0.5
Public Administration	0.0	0.0	0.0	0.0
Total	17.5	5.8	6.4	29.6

*Number of Jobs

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Table 11. Scenario 2—New food processing plant: operations phase, Benton County, Oregon.
Manufacturing—Food, Beverages, Textiles, and Related.
Impact analysis of adding 48 resident continuing food processing jobs.

Industry	Direct*	Indirect*	Induced*	Total*
Agriculture, Fishing, and Related	0.0	17.3	0.1	17.4
Forestry and Logging	0.0	0.1	0.0	0.1
Mining	0.0	0.1	0.0	0.1
Construction	0.0	1.0	0.2	1.2
Manufacturing—Food, Beverages, and Related	48.0	0.1	0.0	48.1
Manufacturing—Wood Products, Paper, Furniture, and Related	0.0	2.2	0.1	2.4
Manufacturing—High Tech. and Related	0.0	0.1	0.1	0.1
Manufacturing—Other	0.0	0.1	0.0	0.1
Transportation and Warehousing	0.0	3.0	0.4	3.4
Utilities	0.0	0.4	0.2	0.6
Wholesale Trade	0.0	2.1	0.2	2.3
Retail Trade	0.0	0.7	4.2	4.8
Accommodations and Food Services	0.0	3.2	2.5	5.7
Finance and Insurance	0.0	1.0	0.8	1.9
Real Estate and Rental and Leasing	0.0	0.5	0.7	1.2
Other Services	0.0	8.9	1.5	10.4
Information	0.0	2.0	0.8	2.8
Administrative and Support Services, etc.	0.0	4.3	0.9	5.1
Arts, Entertainment, and Recreation	0.0	0.2	0.4	0.6
Health Care and Social Assistance	0.0	0.0	3.7	3.7
Professional, Scientific, and Technical Services	0.0	0.3	2.5	2.8
Educational Services	0.0	0.0	1.8	1.8
Public Administration	0.0	0.0	0.0	0.0
Total	48.0	47.7	21.2	116.9

*Number of Jobs

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Scenario 3—Research and Development Park

For a number of years, there has been discussion about building a research park, a public/private effort located on or adjacent to the OSU campus. The third scenario is the construction of an R&D facility, with estimated construction costs of $9.75 million providing 105 construction jobs and 100 jobs in the operating phase (Table 12). We use 65,000 square feet for the size of the facility and project a cost of $150 per square foot. This cost is primarily for office space and does not include laboratories. Because of the use of nonlocal contractors and the commuting of construction workers of local contractors, only half (52) of the construction workers would be Benton County residents. The total job impact of the construction of the R&D facility would be 88 jobs (Table 13).

Table 12. Campus Research and Development Park.

Initial Economic Shock and Reactions	Employment—Full and Part-time Jobs	
	Residents (60%)	Commuters (40%)
Shock:		
New R&D facility on or adjacent to OSU—100 jobs	60	40
Facility construction - $9.75 million (105 jobs x 83% local contractors = 87 jobs)	52	35

Table 13. Campus Research and Development Park: construction phase, Benton County, Oregon. Impact analysis of adding 52 resident construction jobs during the building phase.

Industry	Direct*	Indirect*	Induced*	Total*
Agriculture, Fishing, and Related	0.0	0.3	0.1	0.4
Forestry and Logging	0.0	0.0	0.0	0.1
Mining	0.0	0.1	0.0	0.2
Construction	52.1	0.2	0.2	52.4
Manufacturing—Food, Beverages, and Related	0.0	0.0	0.0	0.0
Manufacturing—Wood Products, Paper, Furniture, and Related	0.0	2.0	0.1	2.2
Manufacturing—High Tech. and Related	0.0	0.1	0.1	0.1
Manufacturing—Other	0.0	0.0	0.0	0.1
Transportation and Warehousing	0.0	0.9	0.4	1.2
Utilities	0.0	0.1	0.2	0.2
Wholesale Trade	0.0	0.5	0.2	0.7
Retail Trade	0.0	4.1	4.0	8.1
Accommodations and Food Services	0.0	0.6	2.4	3.0
Finance and Insurance	0.0	0.4	0.8	1.2
Real Estate and Rental and Leasing	0.0	0.2	0.6	0.9
Other Services	0.0	1.0	1.5	2.4
Information	0.0	0.6	0.7	1.3
Administrative and Support Services, etc.	0.0	1.5	0.6	2.1
Arts, Entertainment, and Recreation	0.0	0.0	0.4	0.5
Health Care and Social Assistance	0.0	0.0	3.5	3.5
Professional, Scientific, and Technical Services	0.0	5.6	0.6	6.2
Educational Services	0.0	0.1	1.2	1.2
Public Administration	0.0	0.0	0.0	0.0
Total	52.1	18.3	17.6	88.0

*Number of Jobs

The addition of 60 resident jobs in the R&D Park during the operations phase would generate an additional 42 indirect and induced jobs for a total of 102 resident jobs. The Type II employment multiplier for the Professional, Scientific, and Technical Services sector is 1.70. The job impact is not as great as the previous food-processing example, because the indirect impact of the R&D is smaller than the indirect impact of food processing. Most of the indirect effect of the R&D sector is in the Information Sector: 60 resident R&D jobs generate 6 Information Sector jobs (Table 14). For food processing, by contrast, 48 resident food processing jobs generate 17 new jobs in agriculture (see Table 11).

However, the salary levels in the Professional, Scientific, and Technical Services sector are typically higher than in the Manufacturing—Food, Beverages, and Related sector. Also, the two sectors require different skill sets for the jobs. Both sectors could be part of that group that makes up the multiple specializations, and they both have potential for establishing extensive linkages.

Table 14. Scenario 3—Campus Research and Development Park: operations phase, Benton County, Oregon.
Professional, Scientific, and Technical Services.
Impact analysis of adding 60 resident continuing R&D jobs.

Industry	Direct*	Indirect*	Induced*	Total*
Agriculture, Fishing, and Related	0.0	0.0	0.1	0.2
Forestry and Logging	0.0	0.0	0.0	0.0
Mining	0.0	0.0	0.0	0.0
Construction	0.0	0.2	0.2	0.4
Manufacturing—Food, Beverages, and Related	0.0	0.0	0.0	0.0
Manufacturing—Wood Products, Paper, Furniture, and Related	0.0	0.1	0.1	0.3
Manufacturing—High Tech. and Related	0.0	0.2	0.1	0.3
Manufacturing—Other	0.0	0.0	0.0	0.0
Transportation and Warehousing	0.0	0.6	0.5	1.1
Utilities	0.0	0.1	0.2	0.2
Wholesale Trade	0.0	0.1	0.2	0.3
Retail Trade	0.0	0.1	3.9	4.0
Accommodations and Food Services	0.0	1.9	2.6	4.5
Finance and Insurance	0.0	0.4	0.8	1.2
Real Estate and Rental and Leasing	0.0	0.5	0.7	1.2
Other Services	0.0	1.1	1.6	2.7
Information	0.0	2.0	1.0	3.0
Administrative and Support Services, etc.	0.0	6.1	1.5	7.6
Arts, Entertainment, and Recreation	0.0	0.1	0.4	0.6
Health Care and Social Assistance	0.0	0.0	3.5	3.5
Professional, Scientific, and Technical Services	60.0	0.1	9.2	69.3
Educational Services	0.0	0.0	1.5	1.5
Public Administration	0.0	0.0	0.0	0.0
Total	60.0	13.7	28.3	102.0

*Number of Jobs

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Implications

Economic diversification is the process of expanding the number of economic activities in which the economy is specialized and deepening the interindustry linkages within the economy. A number of implications emerge from the broad sectoral analysis in this report.

There are several export sectors that may be candidates for expansion. Although identification of "target industries" would require additional study, some preliminary observations can be made based on the examination of the input-output model presented above. In recent years, economists have focused considerable attention on the importance of "agglomerations" (concentrations of businesses and population) and knowledge spillovers in generating self-sustaining growth. The Benton County economy has clusters of businesses in high technology manufacturing sectors, the sectors in which such knowledge spillovers are particularly important.

Three additional export sectors that have some promise are ones in which Corvallis has already built a concentration: higher education, research and development, and food processing.

- The demand for higher education will continue to increase as workers and firms seek lifelong education, and as Oregon State University continues its enrollment expansion.
- Private sector research and development activity, furthermore, is complementary to the basic research conducted at Oregon State University.
- Food processing is an example of a sector in which there are agglomeration economies—it benefits a firm to have other firms in the same sector nearby (Henderson, 1986).

The first two broad sectors—high technology manufacturing and higher education—are the sectors on which Benton County is most dependent: almost half of the employment in the County depends on the exports of these two sectors. So, expansion of these sectors would increase the diversity of the economy if the growth were in "new product lines" or activities that do not have the economic determinants as their current activities. Increased growth in the other sectors would increase the diversity of the economy.

Diversification involves not just expansion of the number of export sectors and/or strengthening the competitiveness of these sectors through agglomeration. As we use the term, it also involves deepening the interindustry linkages through import substitution. The examination of possible sectors with potential for import substitution yielded few promising candidates. While local businesses appear to import a large share of business services (legal, accounting, architectural, for example), these services are ones that tend to concentrate in large urban centers. McDonald (1997), for example, in a summary of the empirical studies of urban growth dynamics, identifies legal and accounting services as the two business services that grew faster in cities in which they had higher base year employment. The only other sector identified as centralizing in larger cities was wholesale trade. This suggests that these three sectors are not good candidates for targeting in an import substitution strategy. On the other hand, there are services (health, higher education) in which the County is specialized that may be candidates for import substitution: There may be ways that the health and higher education sectors can provide services that induce local residents and businesses to buy locally rather than go outside for services.

Diversifying an economy involves both export expansion, so that there are multiple and complementary specializations, and import substitution, so that local firms and households increase their local purchases of goods and services. Table 15 identifies, at the greatest level of sectoral detail available, the estimated major commodity exports in Benton County based on the IMPLAN model. Table 16 identifies the major commodity imports based on the model. There is no systematic collection or

reporting of data on county-level imports and exports. The estimates in these tables are generated within the IMPLAN model. Although they are based on standard economic logic and a carefully constructed data base, they should be treated cautiously, as there is always the potential for error in aggregation or estimation procedure. At the very least, however, these tables bear careful, thoughtful scrutiny as a source of information about regional trade and as possible sources of inspiration about sectors to target for economic diversification.

Table 15. Top Benton County commodity exports.

Commodity Sector	Commodity Name	Exports - *Millions of dollars* -
339	Electronic Computers	790.840
24	Forestry Products	244.667
522	State and Local Government—Education	208.051
378	Electronic Components—N.E.C.	184.581
475	Computer and Data Processing Services	134.309
134	Sawmills and Planing Mills—General	85.632
342	Computer Peripheral Equipment	78.834
523	State and Local Government—Non-Education	75.163
506	Engineering and Architectural Services	64.633
340	Computer Storage Devices	63.723
70	Frozen Fruits, Juices, and Vegetables	61.027
377	Semiconductors and Related Devices	44.878
490	Doctors and Dentists	40.138
220	Miscellaneous Plastics Products	39.270
376	Printed Circuit Boards	38.565
338	General Industrial Machinery—N.E.C	34.124
505	Religious Organizations	33.204
146	Reconstituted Wood Products	30.341
95	Bottled and Canned Soft Drinks & Water	23.851
173	Converted Paper Products—N.E.C	16.936
454	Eating and Drinking	15.298
472	Services to Buildings	15.175
133	Logging Camps and Logging Contractors	14.380
230	Glass and Glass Products, Exc Containers	14.303
18	Vegetables	13.771
14	Grass Seeds	12.182
460	Insurance Agents and Brokers	10.477
139	Veneer and Plywood	10.089
471	Photofinishing, Commercial Photography	9.441
327	Woodworking Machinery	9.200
341	Computer Terminals	8.163
244	Ready-mixed Concrete	7.808
524	Income from the Rest of the World Industry	7.403
518	Used and Secondhand Goods	7.341
78	Prepared Feeds—N.E.C	6.983
285	Sheet Metal Work	6.889
501	Residential Care	6.627
343	Calculating and Accounting Machines	5.705
1	Dairy Farm Products	5.336
462	Real Estate	5.219
447	Wholesale Trade	5.058
509	Research, Development, and Testing Services	5.017
23	Greenhouse and Nursery Products	3.856
373	Radio and TV Communication Equipment	3.851
466	Beauty and Barber Shops	3.624
179	Commercial Printing	3.436
493	Other Medical and Health Services	3.411
233	Brick and Structural Clay Tile	3.309
27	Landscape and Horticultural Services	3.215
446	Sanitary Services and Steam Supply	3.159
492	Hospitals	2.938

Note: Removed imputed rent of owner-occupied dwellings.

Table 16. Top Benton County commodity imports.

Commodity Sector	Commodity Name	Millions of dollars Local Production	Demand Local & Exports	Imports
447	Wholesale Trade	56.247	312.869	256.621
339	Electronic Computers	903.436	1,058.587	155.150
462	Real Estate	134.097	200.464	66.368
456	Banking	41.812	101.257	59.446
459	Insurance Carriers	8.885	66.569	57.684
210	Petroleum Refining	0.000	44.627	44.627
494	Legal Services	6.729	51.331	44.602
26	Agricultural, Forestry, and Fishery Services	12.572	55.046	42.474
220	Miscellaneous Plastics Products	39.322	81.281	41.958
384	Motor Vehicles	0.001	40.272	40.271
441	Communications, Except Radio and TV	42.310	80.369	38.060
378	Electronic Components—N.E.C.	331.386	367.193	35.807
24	Forestry Products	244.735	277.488	32.753
124	Apparel made from Purchased Materials	0.000	29.203	29.203
437	Air Transportation	4.850	34.024	29.174
340	Computer Storage Devices	99.243	126.472	27.229
443	Electric Services	31.903	58.285	26.382
463	Hotels and Lodging Places	12.622	38.470	25.847
338	General Industrial Machinery—N.E.C	34.124	56.891	22.767
469	Advertising	25.566	47.506	21.939
56	Maintenance and Repair Other Facilities	37.120	58.450	21.329
470	Other Business Services	18.287	39.492	21.205
475	Computer and Data Processing Services	198.253	218.891	20.638
458	Security and Commodity Brokers	10.267	30.320	20.053
195	Drugs	6.608	25.994	19.386
507	Accounting, Auditing, and Bookkeeping	9.981	27.467	17.486
444	Gas Production and Distribution	0.864	16.184	15.320
435	Motor Freight Transport and Warehousing	36.769	52.072	15.303
474	Personnel Supply Services	11.482	25.771	14.289
376	Printed Circuit Boards	68.479	82.608	14.129
477	Automobile Rental and Leasing	3.054	17.100	14.045
496	Colleges, Universities, and Schools	15.485	29.256	13.771
377	Semiconductors and Related Devices	194.101	207.607	13.506
164	Paperboard Containers and Boxes	0.213	13.549	13.336
451	Automotive Dealers and Service Stations	32.759	45.953	13.194
295	Plating and Polishing	0.667	13.593	12.926
522	State and Local Government—Education	270.301	282.599	12.298
58	Meat Packing Plants	0.021	12.139	12.118
492	Hospitals	97.321	109.261	11.940
455	Miscellaneous Retail	29.939	40.751	10.812
327	Woodworking Machinery	15.311	26.115	10.804
454	Eating and Drinking	90.577	101.165	10.587
191	Plastics Materials and Resins	0.167	10.676	10.509
450	Food Stores	26.139	36.496	10.357
267	Nonferrous Wire Drawing and Insulating	0.258	10.608	10.350
285	Sheet Metal Work	6.942	16.624	9.682
190	Cyclic Crudes, Interm. and Indus. Organic Chem.	0.098	9.474	9.376
386	Motor Vehicle Parts and Accessories	0.331	9.679	9.349
95	Bottled and Canned Soft Drinks and Water	24.025	32.888	8.863
60	Poultry Processing	1.100	9.595	8.495

Note: Removed noncomparable imports and imputed rent of owner-occupied dwellings.

Economic development strategies often include "the deliberate intervention of a government agency in the process of business growth and change" (Maki and Lichty, 2000; 351). "Growth is an important element of the economic development process. It provides jobs and resources that can support many improvements in the quality of life. Without economic growth, there would be insufficient jobs to support even a slowly growing population. Forced out-migration may result. Economic development implies that the welfare of residents is improving… however, we should not lose sight of the fact that local economic development is part of a larger process of community development" (Blair, 1995; 14-15).

Economic growth and diversification brings with it both benefits and costs. The concern of Benton County's residents over rapid growth may have limited the County's opportunities to capture the benefits of growth and to diversify. Those benefits can include opportunities for friends and relatives to locate in the County, cultural variety, economic and social diversity, resources to support public services (e.g., schools), flexibility in professional pursuits, entrepreneurial options, and the innovation that comes from agglomeration economies. On the other hand, concerns about growth are not unfounded, since some development opportunities may not be consistent with the community's values and may not include clear strategies to mitigate the associated increase in congestion and other costs. Negative externalities due to increased economic activity and population can be mitigated up-front as part of any diversification plan so that the benefits of the diversification can extend across the community and across income groups.

Economic development efforts typically revolve around reducing costs to the sectors that are being encouraged. Those cost reduction strategies can extend through a continuum that includes expedited licensing and building permit processes, deferring infrastructure development costs, and no-cost leases within publicly owned development parks.

The Benton County Economic Input-Output model developed in this project can be used to estimate the economic impacts of various development projects and public policies on specific sectors, governments, and income groups in the County. The model provides a mechanism for evaluating alternatives whose impacts have been difficult to evaluate in the past. It can help the County to assess and mitigate the impacts of strategically utilizing incentives to diversify the economy.

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Appendix A: North American Industry Classification Sector Descriptions

Agriculture, Fishing, and Related: Growing crops, raising animals, harvesting fish and other animals, and services that support natural resource based production.

Forestry and Logging: Farm production of stumpage, pulpwood, fuel wood, Christmas trees, and fence posts. Operation of timber tracts, tree farms, and forest nurseries plus reforestation.

Mining: Establishments that extract naturally occurring mineral solids, such as coal and ores; liquid minerals, such as crude petroleum; and gases, such as natural gas. The term "mining" is used in the broad sense to include quarrying, well operations, beneficiating (e.g., crushing, screening, washing, and flotation), and other preparation customarily performed at the mine site, or as a part of mining activity.

Construction: Construction of buildings and other structures, heavy construction (except buildings), additions, alterations, reconstruction, installation, and maintenance and repairs. Establishments engaged in demolition or wrecking of buildings and other structures, clearing of building sites, and sale of materials from demolished structures are included also. This sector also includes those establishments engaged in blasting, test drilling, landfill, leveling, earthmoving, excavating, land drainage, and other land preparation.

Manufacturing—(Food, Wood Products, High Tech., Other): The mechanical, physical, or chemical transformation of materials, substances, or components into new products. The assembling of component parts of manufactured products is considered manufacturing, except in cases where the activity is appropriately classified in Construction.

Transportation and Warehousing: Providing transportation of passengers and cargo, warehousing and storing goods, scenic and sightseeing transportation, and supporting these activities.

Utilities: Provision of the following utility services: electric power, natural gas, steam supply, water supply, and sewage removal. Within this sector, the specific activities associated with the utility services provided vary by utility: electric power includes generation, transmission, and distribution; natural gas includes distribution; steam supply includes provision and/or distribution; water supply includes treatment and distribution; and sewage removal includes collection, treatment, and disposal of waste through sewer systems and sewage treatment facilities.

Wholesale Trade: Establishments engaged in wholesaling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise.

Retail Trade: Establishments engaged in retailing merchandise, generally without transformation, and rendering services incidental to the sale of merchandise.

Accommodation and Food Services: Lodging and/or prepared meals, snacks, and beverages for immediate consumption.

Finance and Insurance: Firms with payroll primarily engaged in financial transactions (transactions involving the creation, liquidation, or change in ownership of financial assets) and/or in facilitating financial transactions, pooling risk, or underwriting insurance and annuities.

Real Estate and Rental and Leasing: Renting, leasing, or otherwise allowing the use of tangible assets (e.g., real estate and equipment), intangible assets (e.g., patents and trademarks), and establishments providing related services (e.g., establishments primarily engaged in managing real estate for others, selling, renting, and/or buying real estate for others, and appraising real estate).

Other Services: Services not specifically provided for elsewhere in the North American Industry Classification System (NAICS). Establishments in this sector are engaged primarily in activities such as repair and maintenance of equipment and machinery, personal and laundry services, and religious, grant making, civic, professional, and similar organizations. Establishments providing death care services, pet care services, photo finishing services, temporary parking services, and dating services are included also. Private households that employ workers on or about the premises in activities primarily concerned with the operation of the household are included in this sector.

Information: Establishments engaged in the following processes: (1) producing and distributing information and cultural products; (2) providing the means to transmit or distribute these products as well as data or communications; and (3) processing data. The main components of this sector are the publishing industries, including software publishing, the motion picture and sound recording industries, the broadcasting and telecommunications industries, and the information services and data processing services industries.

Administrative and Support Services, etc.: Routine support activities for the day-to-day operations of other organizations. These essential activities often are undertaken in-house by establishments in many sectors of the economy. The establishments in this sector specialize in one or more of these support activities and provide these services to clients in a variety of industries and, in some cases, to households. Activities performed include: office administration, hiring and placing of personnel, document preparation and similar clerical services, solicitation, collection, security and surveillance services, cleaning, and waste disposal services.

Arts, Entertainment, and Recreation: Establishments that operate facilities or provide services to meet varied cultural, entertainment, and recreational interests of their patrons. This sector comprises: (1) establishments that are involved in producing, promoting, or participating in live performances, events, or exhibits intended for public viewing; (2) establishments that preserve and exhibit objects and sites of historical, cultural, or educational interest; and (3) establishments that operate facilities or provide services that enable patrons to participate in recreational activities or pursue amusement, hobby, and leisure time interests.

Health Care and Social Assistance: Providing health care and social assistance for individuals. The services are delivered by trained professionals. All industries in the sector share this commonality of process, namely, labor inputs of health practitioners or social workers with the requisite expertise. Many of the industries in the sector are defined based on the educational degree held by the practitioners included in the industry.

Professional, Scientific, and Technical Services: Establishments that specialize in performing professional, scientific, and technical activities for others. These activities require a high degree of expertise and training. The establishments in this sector specialize according to expertise and provide services to clients in a variety of industries and, in some cases, to households. Activities performed include: legal advice and representation; accounting, bookkeeping, and payroll services; architectural, engineering, and specialized design services; computer services; consulting services; research services; advertising services; photographic services; translation and interpretation

services; veterinary services; and other professional, scientific, and technical services.

Educational Services: Instruction and training in a wide variety of subjects. This instruction and training is provided by specialized establishments, such as schools, colleges, universities, and training centers. These establishments may be privately owned and operated for profit or not for profit, or they may be publicly owned and operated. They also may offer food and accommodation services to their students. Educational services usually are delivered by teachers or instructors who explain, tell, demonstrate, supervise, and direct learning. Instruction is imparted in diverse settings, such as educational institutions, the workplace, or the home through correspondence, television, or other means. It can be adapted to the particular needs of the students; for example, sign language can replace verbal language for teaching students with hearing impairments. All industries in the sector share this commonality of process, namely, labor inputs of instructors with the requisite subject matter expertise and teaching ability.

Public Administration: Administration, management, and oversight of public programs by federal, State, and local governments.

Source: U.S. Executive Office of the President/ Office of Management and Budget (OMB). 1999. *North American Industry Classification System.* Indianapolis: Jist Works, Inc.

Appendix B: Customizing the IMPLAN Model to Benton County

The political environment in Benton County can be intense. Citizens are aware of and often engaged in the politics of local economic development. The public is well informed and interested in evaluating economic analyses. Considering this environment, the model needed to stand a high level of scrutiny. We did not feel we could pull IMPLAN "out-of-the-box," provide a general set of qualifications, and expect the analysis and model to become tools on which the community would rely.

The model's structure needed to reflect the knowledge-based economy, if it was going to be perceived as contemporary and "dynamic" by the decision-makers and general public. The North American Industry Classification System (NAICS) sectoring scheme seemed better suited to explain the County economy (e.g., new Information Sector 51) than the Standard Industrial Classification (SIC).

We also believed that as the conversion currently underway from SIC to NAICS is implemented over the next 5 years, using a NAICS sectoring scheme from the beginning could avoid costly revisions. Our approach was to create a NAICS aggregation for IMPLAN and use that aggregation for many of our explanations and public presentations. That NAICS Bridge or aggregation and a PowerPoint presentation that includes more information about the study (e.g., location quotient 1950/1997 comparison, a copy of the introduction letter, etc.) are available upon request.

Since we anticipated making a number of edits to the initial IMPLAN model, we considered extracting the IMPLAN data and creating a custom data base and model. However, we were concerned that a separate model approach would invest too much knowledge and responsibility in us to run impacts regularly and update the model. We decided that we would work within the IMPLAN model, as much as possible, to maintain some standardization for the EDP and the community.

The IMPLAN database is verified and adjusted to the Regional Economic Information System (REIS) data by the creators of the database. However, IMPLAN gives priority to balancing on the national level; and, in counties that rely on major employers, there can be serious non-disclosure issues at the county level. These issues, and the weaknesses of the various reporting systems for the national databases, can weaken the accuracy of local IMPLAN data. We used Holland et al.'s procedure to reconcile the IMPLAN and REIS data at the county level. We then adjusted the other Study Area variables (e.g., employee compensation) proportionately to the REIS employment reconciliation and completed our first set of Study Area edits.

Next, we met with the Executive Director and the Chairperson of the EDP to identify businesses and government agencies that were major parts of the economic base, were fast growing, or had a high potential to spin-off other businesses. The 12 businesses and government agencies that we decided to ground-truth represented 40 percent of the employees in the County. The Executive Director then announced the project in his monthly newspaper column and sent a letter of introduction/endorsement to the businesses and agencies. Throughout the study, we met regularly with the EDP Board and their diversity advisory committee.

Following transmittal of the introductory letter, we scheduled 1-hour meetings with experienced people in each organization. These people were typically the general manager, controller, or the human resources manager. They are busy folks and usually required multiple calls and rescheduling. In preparation for the interviews, we printed the relevant IMPLAN Industry Balance Sheet and highlighted questionable sectors. We also reviewed the organizations' Web pages.

The interviews usually consisted of a brief overview of the project and model, a commitment

to protect proprietary data, a fairly detailed discussion of the elements of the organization's production function, and a concluding general brainstorming session on how to improve the stability and diversity of the Benton County economy. The interviewee often would make calls during the interview or refer the interviewer to people within the organization for follow-up calls.

The information gathered from the interviews was not as precise as we might have hoped. However, reaching a high level of precision often would have exceeded the interviewee's available time or willingness to disclose information. When we discussed the organization's production function, the interviewee often would respond, "We don't do or use that at all," or "We use a lot less," or "We use a lot more," or "We hardly ever purchase that within the County," or "We never purchase those within the County."

The time required to do the ground-truthing is not onerous given the accuracy and credibility the process attains. We spent approximately 2 person-weeks doing interviews and making the edits that we discovered from the interviews. We made 137 changes to the Study Area variables, 35 changes to the Absorption Coefficients (AC) by creating Library Functions for 7 sectors, and 34 changes to the Regional Purchase Coefficients (RPC) by creating a text file in Excel and then importing it as the last edit when constructing a model. Now, it takes less than 3 hours to modify the Study Area within the model, retrieve the AC library functions, import the RPC text file, and reconstruct the model after each step.

Ground-truthing is an investment in the precision of the model and in building community trust that is essential to the continuing usefulness of the model. It is also an investment in understanding the businesses and agencies, which can be critical when evaluating the feasibility of suggestions for expanding the export base or finding import substitutes.

We tried to encourage precision. However, approximately 75 percent of the responses remained vague or at best in terms of general percentages. To work towards some consistency in the edits, we settled on multiplying absorption coefficients and regional purchase coefficients within the model by the following factors: 0.15 to represent "none" (we did not zero these out because we felt other existing or entering businesses may be closer to the national production function than the businesses we interviewed); 0.5 to represent "a lot less"; and 2.0 to represent "a lot more."

Patterns did emerge across industries, including the move to commercial rather than custom software, more frequent purchasing of computer hardware rather than repairing computers, buying by mail order rather than purchasing them locally, and more air and truck shipment and less railroad shipment than is reflected in the "out-of-the-box" IMPLAN model. The last visit for the IMPLAN model ground-truthing overlapped with the Business Retention and Expansion (BR&E) portion of the study, which was just getting underway. We combined the BR&E questionnaire with the IMPLAN questions and the two were very complementary.

Two points about the IMPLAN data base used in this report should be noted. First, the analysis is based on 1997 data, the most recent data available when we began the analysis. Second, "Employment is listed as a single number of jobs for each industry. Data came from ES202 employment security data supplemented by county business patterns and REIS data (and it does) include full-time and part-time workers in employment estimates. Employment includes total wage and salary employees as well as self employed jobs in a region…and is measured in annual average jobs" (Minnesota IMPLAN Group, Inc. 1999; 125 & 231).

IMPLAN is a carefully developed and documented system for generating local Input-Output models. When extensively ground-truthed, as we have done, it is an effective tool for understanding local economic interdependencies and gauging the impact of economic events or groups of events.

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