Changing Core-Periphery Economic Interdependence
in the Late Twentieth Century:
The Emergence of the Urban Core in Western Oregon

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Introduction

For many decades, rural areas in many parts of the United States have lagged economically behind urban centers. This has been true particularly in the Pacific Northwest. The relative vitality of urban centers has led some to suggest that rural areas and rural policy ought to pursue a strategy of strengthening rural-urban economic linkages (Porter 2004, Stauber 2001). Not very much is known, however, about the economic relationship between urban centers and their rural hinterlands.

Better understanding of these linkages would aid policymakers in addressing this and related problems, such as declining economic opportunity in rural regions and losses in quality of life in urban areas experiencing high rates of population growth (Harrison and Sieb 1990). Rural and urban legislators, for example, might better understand how the economic fortunes of rural and urban areas are interrelated and how certain policy proposals directed at the rural economy affect the urban economy. An example of such a policy in the Northwest is the planned phaseout of federal forest payments to county governments. This policy's economic impacts in rural regions will surely spill over into nearby urban regions.

In 1992, Holland, Weber, and Waters used 1982 data to study employment and trade interdependence between the Portland metro core and its periphery trade area (Holland et al. 1992a). Their objective was to determine the significance of each subregion's economic output in meeting the other's demand, the interdependence of labor markets, the most important sectors in core-periphery trade, and the relative importance of households and businesses in generating demand in each subregion for products and services from the other. The objective of the current study is to reexamine the core-and-periphery economic linkage with recent data and investigate how the economic interdependence of the Portland metro core and its periphery trade area has changed from 1982 to 2006.

Central place theory (Christaller 1966) suggests an ordering of cities over space within a region. Such an ordering begins with more rural hamlets, villages and towns that are limited to lower order economic activities. At the upper end of the ordering are regional cities and primary cities where all of the hierarchy of city functions are carried out. Primary cities are the main source of selected higher order services such as medical services and financial services that are not available in lower order cities and towns in the functional region. Using medical services as an example, there are some medical services and procedures that available only in facilities located in primary cities. When people living in smaller (lower order) towns and villages need these services they must travel to primary cities to obtain the service. The basic idea is that small towns are not just scaled down primary cities. This perspective suggests that rural places should be viewed in relationship to primary cities to better understand many of the forces for economic change in these places.

The Portland, Oregon trade area

The Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce has mapped principal trading regions of the United States into economic areas (EAs) (U.S. Department of Commerce 1975). The EAs are aggregations of counties that are functional economic regions consistent with central-place perspectives. According to central-place theory (Christaller 1966), regions are organized economically in a geographical hierarchy of central places. A place at a given level on the hierarchy provides not only goods and services that are specific to its level, but also goods and services to those places beneath it on the hierarchy. Goods and services supplied only by major central places are referred to as central-place goods and services. The rural periphery will not be self-sufficient in the supply of these goods and services and must, to some degree, depend on the central place for their supply. The EAs can be thought of as trade areas consisting of major central places and their surrounding periphery.

The Portland, Oregon trade area examined here has as its economic center a metropolitan core, which we define as the four counties in the 1982 Standard Metropolitan Statistical Area: Multnomah, Washington, and Clackamas counties in Oregon and Clark County in Washington. The periphery of this core consists of Benton, Clatsop, Columbia, Coos, Crook, Curry, Deschutes, Douglas, Hood River, Jackson, Jefferson, Josephine, Klamath, Lake, Lane, Lincoln, Linn, Marion, Polk, Sherman, Tillamook, Wasco, and Yamhill counties in Oregon and Cowlitz, Klickitat, Skamania, and Wahkiakum counties in Washington.[1]

The Portland trade area is bounded on the north by the Seattle trade area, which extends into southwestern Washington (figure 1). The western boundary is defined by the Pacific Ocean, while the eastern boundary extends to the Boise trade area, which dominates eastern Oregon. The Portland trade area extends south down the 1-5 corridor to the California border. It includes Eugene and portions of southern Oregon, which have increasingly been drawn into the Portland trade area as a result of ease of north-south travel on Interstate 5.

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[1] We define the Portland trade area to include both Western Oregon EAs (Portland and Eugene) linked economically by Interstate 5.

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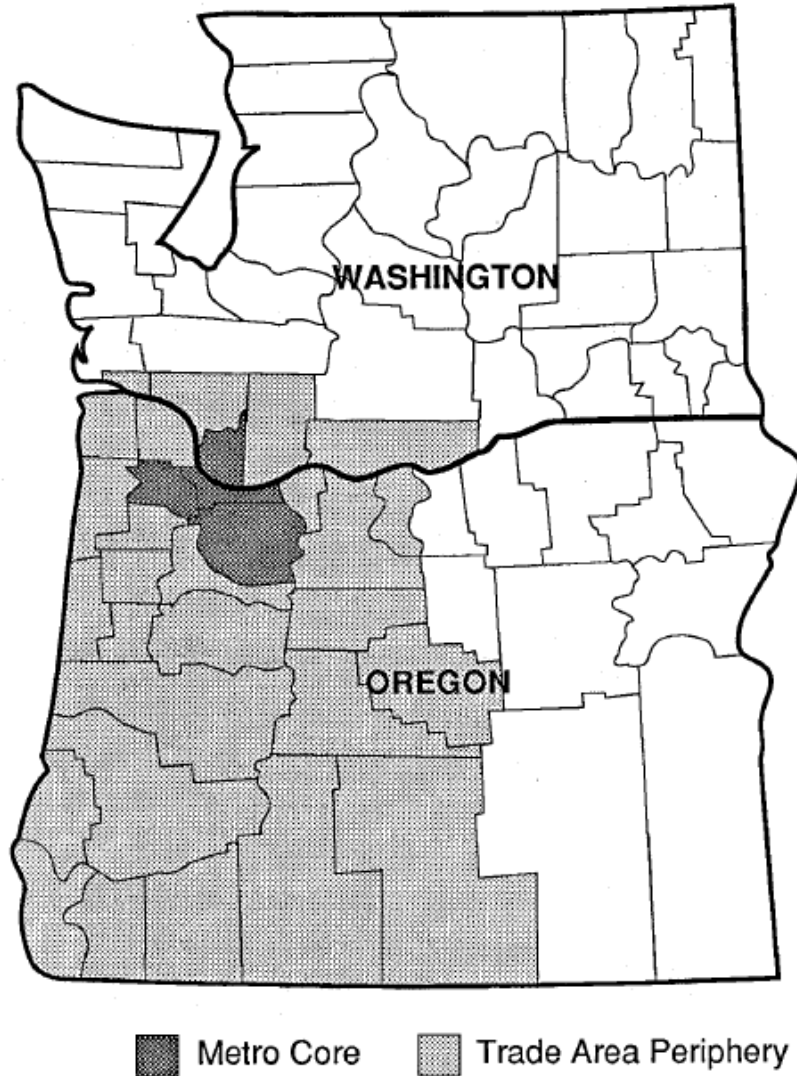
Figure 1. The Portland, Oregon Trade Area: Core and Periphery.

Labor and Earnings Flows Between the Urban Core and its Periphery

Commuting workers make up an important economic linkage between the urban core and its periphery. Although Portland's core and its periphery are not strongly linked through flows of labor and income, we see that the core and periphery have over time become more interdependent through labor commuting.

We calculated labor flows for 1980 and 2000 from census information (U.S. Census Bureau, 1980, 2008) and constructed earnings flows for 1982 and 2006 with data from the Bureau of

Economic Analysis (U.S. Bureau of Economic Analysis, 1988 and 2008). A detailed explanation of

our estimation procedures and assumptions may be found in Holland et al. 1992b).

The Holland et al. (1993) estimates of labor and earnings flows for 1982 are shown in table

1, with earnings reported in inflation-adjusted 2006 dollars. Each earnings flow appears below the

corresponding labor flow. Reading across the rows, we see, for example, how many of the 568, 916

workers who lived in the core in 1980 worked in the core, how many worked in the periphery, and

how many worked outside the Portland core-periphery region. We also see how much of the

approximately $18 billion in labor earnings that originated in the core in 1982 stayed in the core or

left for the periphery or outside the core-periphery region. Likewise, reading down the columns, we

can see where workers who commuted into the core and periphery lived.

Table 1: Labor and Earnings Flows between the Core and Periphery 1982, ($000 of 2006 dollars)

Place of Residence	Flows	Place of Work				
		Core	Periphery	Elsewhere	Total Labor by POR	Total Earnings by POR
Core	Labor	555,857	**8,434**	4,625	568,916	
	$ Earnings	17,921,323	**345,977**	171,109		18,438,409
Periphery	Labor	**15,917**	547,431	33,013	596,361	
	$ Earnings	**340,857**	14,915,804	668,417		15,925,078
Elsewhere	Labor	14,300	5,949			
	$ Earnings	403,884	213,782			
Total Labor by POW		586,074	561,814			
Total Earnings by POW $		18,666,064	15,475,562			

Source: Holland et al (1993). U.S Department of Commerce, Bureau of Census (1980); U.S.
Department of Commerce, Bureau Economic Analysis (1988)

Note: POR = place of residence; POW = place of work. Labor flows are for 1980 and earnings
flows are for 1982. Gross Earnings by POR are inclusive of Social Security Insurance by POW.
Labor Flows are Person. Earnings flows are in millions of dollars (1982) The Metro Region consists
of Multnomah, Washington, and Clackamas Counties, as well as Clark County, Washington. The
Periphery Region is an aggregation of 27 counties in Western Oregon and Southwestern
Washington.

Our estimates of labor and earnings flows between core and periphery for 2006 are shown in tables 2 and 3. The number of periphery-to-core commuters has roughly tripled from 1982 to 2006 from about 16,000 (2.7 percent of the total core employment) to about 45,000 workers (4.9 percent). The number of core-to-periphery commuters also has increased, though not nearly as quickly, from 8,500 (1.5 percent of the periphery employment) to 18,500 (2.3 percent) over this period.

Table 2: Labor and Earnings Flows between the Core and Periphery, 2006 ($000)

| Place of Residence | Flows | Place of Work | | | | |
		Core	Periphery	Elsewhere	Total Labor by POR	Total Earnings by POR
Core	Labor	866,761	**18,575**	7,839	893,175	
	$ Earnings	50,287,477	**888,001**	575,514		51,750,992
Periphery	Labor	**44,932**	793,472	9,166	847,570	
	$ Earnings	**2,368,396**	34,463,113	464,318		37,295,827
Elsewhere	Labor	6,151	5,949			
	$ Earnings	281,640	224,448			
Total Labor by POW		917,844	817,996			
Total Earnings by POW $		52,937,512	35,575,563			

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Accounts (2006); U.S. Census Bureau, Journey to Work and Place of Work (2000)

Table 3: Percent of Core and Periphery Jobs and Earnings Going to Residents of Each Region, 1982 and 2006

| Place of Residence | Flows | Place of Work | | | |
| | | 1982 | | 2006 | |
		Core	Periphery	Core	Periphery
Core	Jobs	94.8%	**1.5%**	94.4%	**2.3%**
	US$	96.0%	**2.2%**	95.0%	**2.5%**
Periphery	Jobs	**2.7%**	97.4%	**4.9%**	97.0%
	US$	**1.8%**	96.4%	**4.5%**	96.9%
Elsewhere	Jobs	2.4%	1.1%	0.7%	0.7%
	US$	2.2%	1.4%	0.5%	0.6%
Total Jobs by POW		100.0%	100.0%	100.0%	100.0%
Total Earnings by POW		100.0%	100.0%	100.0%	100.0%

Interregional Trade in Goods and Services

Trade in goods and services is a much more significant linkage between core and periphery

than commuting. We used regional commodity reports from IMPLAN[2] to estimate trade in goods and services between the core and its periphery trade area, and between the combined core-periphery area and the rest of the United States, based on a procedure developed by Holland and Pirnique (2000). A detailed account of the estimation procedures may be found in Holland et al. (2008)

In 1982, the economies of the core and the periphery were roughly equal in terms of total sales (table 4). The Portland core economy was quite open, exporting 37 percent of its gross commodity supply. It imported slightly more than it exported, indicating a negative trade balance from goods and service traded. There was significant trade to the surrounding region: 20 percent of Portland's exports went to its trade-area periphery.

Table 4: Portland Core-Periphery Goods and Services Trade (1982, $millions)

From		To			
		Core	**Periphery**	**ROW**	**TOTAL SALES**
Core	Total	19,619	**2,400**	9,408	31,427
	Goods	4,017	**709**	5,630	10,356
	Services	15,602	**1,691**	3,778	21,071
Periphery	Total	**1,039**	20,029	11,487	32,555
	Goods	**749**	5,848	10,197	16,794
	Services	**290**	14,181	1,290	15,761
ROW	Total	11,313	13,447		
	Goods	7,650	8,958		
	Services	3,663	4,489		
TOTAL PURCHASES	Total	31,971	35,876		
	Goods	12,416	15,515		
	Services	19,555	20,361		

Source: Holland et al, 1993. Using IMPLAN data.

The periphery region was similarly open, exporting 38 percent of gross commodity supply

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[2] IMPLAN is a software and database system developed and maintained by the Minnesota IMPLAN Group, Inc. This system allows the user to create a Social Accounting Matrix and input-output model for any county or multi-county region (and some sub-county regions) in the United States. See Lindall and Olsen (n.d.) for a more complete discussion of the system.

and importing 44 percent of its regional demand. Only 8 percent of the periphery's exports went to the core. The net trade balance between Portland and the trade-area periphery in 1982 was positive and large in favor of Portland. The value of Portland's exports of goods and services to the periphery ($2.4 billion) was more than twice the value of its imports from the periphery ($1.039 billion). More than $1 billion flowed from the periphery to Portland on the trade account, most of it in the service sector (table 4).

Between 1982 and 2006, both core and periphery grew in value of the sales each made to the other, but the core's growth was much faster. Value of total sales from the core to periphery in 2006 was half again as large as value of total sales from the periphery to the core. The Portland core's overall (goods and services) trade surplus with the periphery was more than $5 billion in 2006, an almost fivefold increase since 1982. Again, most of the trade surplus was generated in the service sectors, with service exports from core to periphery of $5.533 billion and imports to the core of services from the periphery of $855 million (table 5).

Table 5: Portland Core - Trade Area Periphery Goods and Services Trade (2006, millions of dollars)

From		To			
		Core	**Periphery**	**ROW**	**TOTAL SALES**
Core	Total	115,271	**7,402**	65,044	187,716
	Goods	19,610	**1,869**	40,667	62,146
	Services	95,661	**5,533**	24,377	125,570
Periphery	Total	**1,816**	81,874	36,331	120,022
	Goods	**961**	14,372	25,379	40,712
	Services	**855**	67,503	10,952	79,310
ROW	Total	61,712	46,900		
	Goods	36,191	31,116		
	Services	25,521	15,784		
TOTAL PURCHASES	Total	178,799	136,176		
	Goods	56,762	47,357		
	Services	122,037	88,820		

Source: 2006 IMPLAN data.

When core-periphery trade is viewed in relative terms, however, we see that the trade linkages have declined over time. In 1982 the core was exporting roughly 8 percent of its services output to the periphery, while in 2006 the figure was only 4 percent (table 6). Over the same interval, the proportion of goods and services exported from the core to the rest of the world increased from 30 percent to 34 percent.

Table 6: Goods and Services Trade 1982 and 2006 (Percent of sales from each region to each region)

From		1982				2006			
		To				To			
		Core	Periphery	ROW	Total	Core	Periphery	ROW	Total
Core	Total	62%	8%	30%	100%	61%	4%	35%	100%
	Goods	39%	7%	54%	100%	32%	3%	65%	100%
	Services	74%	8%	18%	100%	76%	4%	19%	100%
Periphery	Total	3%	62%	35%	100%	2%	68%	30%	100%
	Goods	4%	35%	61%	100%	2%	35%	62%	100%
	Services	2%	90%	8%	100%	1%	85%	14%	100%

Source: Tables 4 and 5

In 1982 the periphery was exporting 2 percent of its services to the core; by 2006, the figure was only 1 percent (table 6). As economic activity has diversified and become more geographically dispersed in the last quarter of a century, some specialized goods and services (such as specialized medical and business services) that were once available only in large cities have become available in the periphery. The result has been a relative weakening in the trade linkages between the Portland core and its periphery as the periphery has become more self-sufficient. Goods and services produced and consumed in the periphery increased from 62 percent of output in 1982 to 68 percent of output in 2006 (table 6).

A comparison of tables 4 and 5 shows that the Portland core experienced a much faster rate of economic growth than the periphery. The periphery rate of total output growth was only about one-half that of the core. This growth in the core was led by its expansion of goods exports to the

rest of the world. In fact, the Portland core's export of goods grew faster than its export of services, during a time when service sectors were nationally were increasing faster than goods-producing sectors.

Goods exports from the core to the rest of the world were growing at four times the rate of such exports from the periphery.   By 2006, the Portland core had transformed itself into an export-driven economy with a positive trade balance (surplus of exports over imports), something that was not true in 1982. The periphery, on the other hand, with its mix of resource-based goods, was less successful in expanding its exports and remained a regional economy with a negative trade balance (tables 4 and 5).

The Multi-Regional Input-Output (MRIO) Model

Model closure

In creating the core-periphery MRIO model, we treated household income and household expenditures in the two-region area as "endogenous," meaning that the spending of this income has the effect of increasing regional demand and output. We identified nine distinct household income classes for each region from IMPLAN data. The resulting MRIO model identifies linkages across regions according to industry, factor of production, and household income class. Thus the model is able to show how an exogenous shock to the periphery economy affects industry output and payments to households across the size distribution of income in the periphery region, and also how that same shock affects industry output and households in the various income classes in the core.

The model is closed under the assumption that regional consumption for each household income class is a function of the personal income received by that household group. Personal income is the sum of employee compensation, proprietors' income, government transfers, and

property income. The regional contribution to regional personal income is measured as the sum of employee compensation and proprietors' income from the IMPLAN input-output accounts.

All "other property income" generated in the region is assumed to be paid to capital owners outside the combined region. Payments of interest, dividends, and rent to households and government transfers in each region were treated as exogenous and were derived from the IMPLAN Social Accounting Matrix (SAM) constructed for each region.

In the MRIO model, each industry is assumed to pay a fixed proportion of earnings to commuting workers from each region. The proportion is assumed to be constant for all industries in the region. (The standard IO assumption of fixed proportion distribution functions is used.) As is conventional in SAM-type models, employee compensation and proprietors' income are assumed to be distributed in fixed but different proportions across the size distribution of households in each region. The marginal propensity to consume is assumed to be equal to the average propensity to consume for each household income class, which is estimated by normalizing each regional household consumption vector with respect to the claim by that household income class on personal income in the region. Personal income is composed of an endogenous portion derived from earnings within the combined region, and an exogenous portion made up of government transfers and returns to capital outside the region. As is true for the standard input-output analysis, this model is static and does not trace the time path of changes generated by external economic shocks.

Output multipliers

Households-endogenous output multipliers are derived from the Leontief inverse matrix of the multiregional transactions table. The own-region output multipliers are the column sums of inter-industry coefficients in the diagonal blocks of this matrix. These multipliers capture both inter-industry linkages within the region and feedback effects from changes in activity in the other region induced by a shock in the first region. The cross-regional multipliers are the column sums of inter-

industry coefficients in the off-diagonal blocks of the inverse matrix. They show the output change across regions for a one-unit change in the exogenous demand of the opposite region.

Own- and cross-regional output multipliers for the Portland core and the trade-area periphery are shown in table 7. The own-region effect in 2006 of a $1 increase in crop exports in the periphery, for example, is a $1.59 increase in total output in the periphery economy. Simultaneously, because the cross-regional multiplier for the core is 0.12, a $1 increase in crop exports from the periphery would result in a $0.12 increase in total output in the core. The sum of the own-region and the cross-region effects yields the total effect of the increase in exports on the entire trade-area economy. Thus, in our example, a $1 increase in periphery crop exports would generate a $1.71 increase in output in the trade area.

Table 7: Own-region and Cross-region multipliers for Portland Oregon Trade Area Core and Periphery, 1982 and 2006

Sector	1982						2006					
	Core			Periphery			Core			Periphery		
	Core	Periphery	Total	Periphery	Core	Total	Core	Periphery	Total	Periphery	Core	Total
Crops	1.82	0.13	1.95	1.63	0.18	1.81	1.57	0.04	1.61	1.59	0.12	1.71
Livestock	1.65	0.13	1.78	1.77	0.18	1.95	1.65	0.09	1.75	1.90	0.17	2.07
Forest Products & Logging	1.78	0.18	1.96	1.84	0.14	1.98	1.78	0.03	1.80	1.91	0.20	2.11
Commercial Fishing	1.53	0.06	1.59	1.37	0.13	1.50	1.81	0.04	1.85	1.89	0.18	2.07
Landscaping & Ag. Services	1.75	0.11	1.86	1.60	0.18	1.78	1.81	0.06	1.87	1.79	0.15	1.94
Mining	1.58	0.08	1.66	1.48	0.14	1.62	2.04	0.06	2.09	1.58	0.17	1.75
Construction	1.80	0.08	1.88	1.60	0.20	1.80	1.76	0.06	1.82	1.70	0.14	1.83
Other Manufacturing	1.60	0.08	1.68	1.50	0.19	1.69	1.78	0.09	1.87	1.86	0.22	2.08
Food Processing	1.69	0.19	1.88	1.79	0.25	2.04	1.71	0.04	1.75	1.56	0.15	1.71
Wood Products	2.12	0.25	2.37	2.18	0.21	2.39	1.88	0.06	1.94	1.87	0.19	2.06
Pulp & Paper Products	1.69	0.13	1.82	1.66	0.19	1.85	1.65	0.04	1.69	1.68	0.19	1.87
Electronics & Instruments	1.68	0.07	1.75	1.55	0.20	1.75	2.01	0.05	2.06	1.75	0.21	1.97
Transportation	1.94	0.07	2.01	1.58	0.18	1.76	1.76	0.05	1.81	1.74	0.14	1.88
Communications	1.46	0.05	1.51	1.41	0.12	1.53	1.78	0.04	1.82	1.73	0.14	1.88
Utilities	1.61	0.21	1.82	1.32	0.08	1.40	1.72	0.04	1.76	1.51	0.17	1.68
Wholesale Trade	1.72	0.08	1.80	1.59	0.19	1.78	1.69	0.05	1.74	1.67	0.14	1.81
Retail Trade	1.67	0.07	1.74	1.57	0.17	1.74	1.71	0.05	1.76	1.70	0.13	1.83
Financial	1.80	0.07	1.87	1.61	0.19	1.80	1.78	0.05	1.83	1.76	0.12	1.89
Insurance & Real Estate	1.42	0.03	1.45	1.23	0.06	1.29	1.67	0.04	1.71	1.62	0.11	1.73
Eating, Drinking & Lodging	1.79	0.11	1.90	1.63	0.22	1.85	1.73	0.07	1.79	1.75	0.16	1.92
Other Services	1.67	0.07	1.74	1.54	0.16	1.70	1.82	0.05	1.87	1.79	0.15	1.94
Business Services	1.72	0.07	1.79	1.60	0.18	1.78	1.84	0.06	1.90	1.83	0.16	1.99
Health Services	1.84	0.08	1.92	1.69	0.19	1.88	1.78	0.06	1.84	1.76	0.14	1.91
Govt. Industry & Enterprise	1.74	0.09	1.83	1.64	0.18	1.82	1.74	0.07	1.81	1.75	0.14	1.89
Household Industry & Other	1.05	0.01	1.06	1.05	0.01	1.06	1.37	0.02	1.38	1.42	0.07	1.48

The range of core-to-periphery cross-regional output multipliers for 2006 (excluding household industry) is between 0.03 (for forest products and logging) and 0.09 (for other manufacturing) (table 7). The magnitude of the cross-regional output multiplier is a rough indication of that sector's backward linkage (input purchases) with the other region's economy.

The cross-regional output effects, and thus the economic linkages, from the periphery to the Portland core generally are stronger than the linkages in the opposite direction (table 7). The largest cross-regional multipliers from periphery to core are in the other manufacturing and forest products/logging sectors. The range of cross-regional output multipliers (excluding household industry) is between 0.11 (for insurance and real estate) and 0.22 (for other manufacturing). As a general rule, unit changes in final demand for periphery goods and services generate output changes ranging from 0.15 to 0.2 in the Portland core economy. The periphery-to-core cross-regional output multipliers are uniformly two or more times larger than the corresponding core-to-periphery multipliers, indicating that backward linkages from periphery to core are generally stronger than the backward linkages from core to periphery. For most industries, the periphery is a more important market for the core than the core is for the periphery.

The cross-regional multipliers from the core to the periphery are almost all considerably smaller in 2006 than they were in 1982 (table 7). This reflects a general weakening of core imports from the periphery relative to the size of the core economy. In contrast, the cross-regional multipliers from the periphery to the core are, for many industries, larger in 2006 than they were in 1982. This reflects a relative strengthening of periphery imports from the core relative to the size of those industries in the periphery.

In contrast to the core, where many own-region multipliers declined from 1982 to 2006, many of the periphery own-region multipliers increased over this time period. This was especially true for the periphery's service industries, for which virtually all multipliers increased over the time

period (table 7). This likely indicates import substitution on the part of many periphery industries, as formerly imported goods and services have been replaced by those produced by firms in the periphery.

Conclusion

Over the past quarter-century, the Portland trade area has grown rapidly and experienced significant changes in industrial structure and in the relationship between its core economy and that of the periphery. In the period between our two studies, decreasing transportation costs and improved communication technology have enabled regional economies to expand export sales to more distant markets. Likewise increased imports from more distant places have become available and expanded. At the same time these forces have encouraged the decentralization of selected marketing and service firms into the periphery. Regional centers in the periphery have taken over medical procedures as well as retail and wholesale function that formerly were conducted in the core. The result has been a weakening of Central Place hierarchy as a description of economic organization over geographic space. The previous data as well as the following discussion are consistent with this observation. Our core-periphery multi-regional input-output analysis suggests four major conclusions about rural-urban economic interdependence in this region.

* The core has grown faster than the periphery**. **This growth has been fueled mainly by rapid growth in goods exports. Whereas in 1982 core sales were just slightly smaller than periphery sales, in 2006 the core sold half again as much value in goods and services as the periphery.

* Commuting flows have increased over the 1980-2000 period. Commuting linkages between core and periphery have grown stronger as the core region has grown, both in numbers of commuters and also relative to the size of the respective labor forces. In 2000, 2.3 percent of people working in the periphery lived in the core (compared to 1.5 percent in 1980), while 4.9 percent of people working in the core lived in the periphery (compared to 2.7 percent in 1980). As expected,

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many more people commute from the periphery into the core (45,000 in 2000 versus 16,000 in 1980) than the other way (19,000 in 2000 versus 8000 in 1980).

At the same time, both the Portland and periphery regions represent relatively self-contained labor markets. In 1980, only 1.5 percent of the resident Portland labor force worked in the periphery, while roughly 2.7 percent of periphery residents worked in Portland. By 2000, 2.1 percent of the Portland resident workforce worked in the periphery and 5.3 of the periphery resident workforce in the periphery worked in the Portland core.

* Core-periphery trade flows have weakened as the core has expanded trade to other regions, and as the periphery has become more self-contained. Since 1982, core-periphery trade linkages have generally grown weaker, at least with respect to the relative size of output sales in the regional economies. For example, in 1982 the core sold an estimated 8 percent of its service output to the periphery; by 2006 the figure was 4 percent. Likewise, in 1982 the periphery sold 4 percent of its goods output to the core; in 2006 the figure was 2 percent. Interregional trade between the two regions has grown smaller relative to the economic size of the regions: each region sells a smaller share of its output to the other. The core sells a larger share of its output to the rest of the world than it does to the periphery, while the periphery sells an increasing share of its total output within its own boundaries.

* Spillover impacts of exports have generally weakened in both core and periphery, although at a much greater rate in the core. In a core-periphery input-output model, the spillover coefficient shows what portion of total indirect and induced effect occurs in the opposite region. For example, the spillover coefficient for the livestock sector in the metro region in 1982 is 0.17 (table 7). This means that 17 cents of every dollar of indirect and induced effect associated with core livestock exports "spills over" into the periphery region. The spillover coefficient measures the strength of cross-regional impact associated with expansion or contraction of an own-region sector.

The spillover coefficient for a given sector is calculated as the cross-regional multiplier for that sector (0.13 for 1982 core livestock sector; table 8) divided by the total periphery livestock multiplier from table 8 minus one (1.78-1 = 0.78). So the spillover coefficient is 0.17 (0.13/0.78).

Table 8 Spillover Coefficients for Portland Oregon Metro Core and Trade Area Periphery, 1982 and 2006

Sector	Core 1982	Periphery 1982	Core 2006	Periphery 2006
Crops	0.14	0.22	0.07	0.17
Livestock	0.17	0.19	0.12	0.16
Forest Products & Logging	0.19	0.14	0.04	0.18
Commercial Fishing	0.10	0.26	0.05	0.17
Landscaping & Ag. Services	0.13	0.23	0.07	0.16
Mining	0.12	0.23	0.06	0.23
Construction	0.09	0.25	0.07	0.17
Other Manufacturing	0.12	0.28	0.10	0.20
Food Processing	0.22	0.24	0.05	0.21
Wood Products	0.18	0.15	0.06	0.18
Pulp & Paper Products	0.16	0.22	0.06	0.22
Electronics & Instruments	0.09	0.27	0.05	0.22
Transportation	0.07	0.24	0.06	0.16
Communications	0.10	0.23	0.05	0.16
Utilities	0.26	0.20	0.05	0.25
Wholesale Trade	0.10	0.24	0.07	0.17
Retail Trade	0.09	0.23	0.07	0.16
Financial	0.08	0.24	0.06	0.13
Insurance & Real Estate	0.07	0.21	0.06	0.15
Eating, Drinking & Lodging	0.12	0.26	0.09	0.17
Other Services	0.09	0.23	0.06	0.16
Business Services	0.09	0.23	0.07	0.16
Health Services	0.09	0.22	0.07	0.15
Govt. Industry & Enterprise	0.11	0.22	0.09	0.16
Household Industry & Other	0.17	0.17	0.05	0.15
Average Spillover Coefficient	**0.13**	**0.22**	**0.07**	**0.18**

The average (unweighted) spillover coefficient in 1982 was much larger for the periphery than for the core: 22 percent of the total regional (core plus periphery) indirect and induced effects of exports from the periphery spilled over to the core, whereas only 13 percent of the effects of exports from the core spilled over into the periphery. The metro sectors with the largest spillover

coefficients in 1982 were food processing and utilities (table 8) because these sectors purchased important production inputs from the periphery economy. The spillover coefficients for these two industries indicate that more than 20 percent of the indirect and induced economic impact of every dollar of exports from the core actually was felt in the periphery. However, the spillover coefficients of the rapidly expanding metro service and electronic industries in the core were less than 10 percent, indicating that very little of the economic impact from expansion in these sectors spilled over into the periphery. The small numerical value of these coefficients shows that, with the exception of its resource-processing sectors, the Portland metro region did not serve as a growth pole to the rural periphery. In other words, very little impact of Portland's economic growth was felt in the periphery in 1982.

Looking at it from the other end, in 1982 most periphery sectors exhibited spillover coefficients greater than 20 percent (table 8), indicating that the effects of the periphery's economic activity on the Portland was larger than the effects of Portland's economic activity on the periphery. For many periphery sectors, most of this effect is in the form of induced rural household spending for Portland-produced services.

Between 1982 and 2006, the average spillover effect of exports declined in both core and periphery. The average core-to-periphery spillover effect declined by over 45 percent, from 0.13 to 0.07. The average periphery-to-core spillover declined by less than 20 percent, from 0.22 to 0.18.[3] For several natural-resource sectors and utilities, the periphery-to-core spillover effects increased between 1982 and 2006: for logging the spillover coefficient increased from 0.14 to 0.18; for wood products, from 0.15 to 0.18, and for utilities, from 0.20 to 0.25. For all other periphery sectors, the

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[3] The fact of greater declines in spillovers in the core than in the periphery seems inconsistent with the evidence of roughly proportional declines in shares of cross-regional exports in core-periphery trade. The explanation lies in the different rates of economic growth in the two regions. The core grew faster than the periphery. While periphery imports from the core declined only slightly (from 6.7 percent to 5.4 percent) as a percent of total purchases in the periphery, the decline in core imports from the periphery as a share of total purchases in the core was larger (from 3.1 percent to 1.0 percent).

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spillovers declined or stayed the same. Core-to-periphery spillover effects declined in all sectors, and in the case of natural-resource industries and utilities, the decline was significant. For logging, for example, the spillover coefficient declined from 0.19 in 1982 to 0.04 in 2006. Wood products declined from 0.18 to 0.06, and pulp and paper declined from 0.16 to 0.06. Utilities declined from 0.26 to 0.05.

Both core and periphery have a significant interest in each other's economic health: 18 percent of the indirect and induced impact of a shock to the periphery economy leaks across to the core economy, and 7 percent of indirect and induced impact of a shock to the core economy spills over to the periphery.

Implications

In general, Portland has not been an important market for the periphery. While certain goods and services in the periphery have sold an important part of their output to Portland markets (such as utilities; livestock eating, drinking and lodging; and pulp and paper), most natural-resource and manufacturing industries in both regions—which are historically the dominant sectors—served markets that were mostly outside the functional economic region.

Possibilities for increased trade from periphery to core

Given the current structure of trade between core and periphery, very little growth of the metro Portland economy will trickle across to the periphery. The economic linkage of the metro market for periphery products is generally weak. Whether these linkages can be strengthened with public intervention is an open question. Part of the problem is getting an accurate assessment of possible trading opportunities between core and periphery regions. Regional trade estimates such as those developed for this study have not been used in rural development planning, and perhaps could be helpful in attempting to increase periphery-to-core sales. The problem is complicated because, even with a relatively detailed sectoring scheme such as that used in this study, what appears to be

the same commodity in the input-output accounts may in reality not be suited for periphery-to-core trade. For example, the periphery may have an excess supply of food grains and the core may have excess demand, but trade really is not possible because the core wants rice and the periphery sells wheat. The agricultural sectors in the periphery exhibited important linkages to the metro core, but most sales are made in raw-product form to business rather than household markets.

One strategy to increase periphery sales to core businesses would be to explore the nature of agricultural sales from the periphery used as inputs to food processing in the core region. It is also possible that selected crops would lend themselves to increased marketing to households, especially if niche markets for organic and local produce can be exploited. Of course the strategy of increased processing of agricultural commodities in the periphery may be an effective way to penetrate metro household markets with processed agricultural products rather than raw products. The study data indicate a strong economic linkage between the eating, drinking and lodging sector in the periphery and the Portland metro region, a reflection of the tourism and recreation services that the periphery provides to the core. There is little doubt the demand for these services will continue to expand.

Porter has suggested a need for a "holistic policy framework" for rural economic development "that would address the specific circumstances of particular regions" (Porter 2004, p. 59). Such a framework should "incorporate linkages between the rural region and nearby urban areas" (op. cit., p. 60). In the literature on rural economic development, "there is a growing understanding that the central issues is competitiveness, and there is widespread agreement on the importance of cluster thinking" (op. cit. p 61). The most pressing research priorities related to rural economic policy are for better "knowledge about how rural areas relate to nearby urban economies on the level of specific clusters… Each rural area will differ in its cluster composition and in the opportunities created by the cluster strengths in nearby urban areas." (op. cit., p.63)

The importance of a healthy rural economy to the urban core

Where there are important trade linkages from periphery to core, such as Portland's processing of periphery-produced agricultural commodities, core industries have some interest in the economic health of the periphery. For example, food-packing plants in Portland need a steady supply of fruits and vegetables from the surrounding rural areas. If the raw-material supply is cut off, manufacturers must either curtail processing or find alternate sources from other areas. If raw materials remain unavailable or unaffordable, a plant might have to shut its doors. Even in this extreme example, however, the economic impact of raw-material shortages from the periphery would be likely to stop at the next level (the processor), rather than cascading through the economy.

To take a real-life example, timber-harvest restrictions in the western Oregon periphery have been linked to reduced sales of Portland core businesses. Waters et al. (1994) found that about 15 percent of the total regional economic impact of timber-supply shocks would be felt in Portland, with most of this impact coming from reduced household spending by the periphery for core-produced services, rather than from reduced output of wood products in Portland.

The central-place dominance of the core over the periphery suggests that Portland metro core has reason to be interested in a healthy periphery economy. This study shows that the rural demand for central-place services derives from both businesses and households. Declines in rural income will be felt as declining demand for Portland-based services. Given the central-place nature of these services, it is likely that there will be limited alternative demand for them outside the Portland functional economic region. A periphery in economic decline will place a drag on the service economy in the urban region.

Are rural and urban areas economically interdependent? In a global sense, the answer is certainly yes. Urban areas depend on rural areas for their supply of natural resources, certain manufactured goods, and recreational services, and as markets in which to sell urban-produced

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goods and services. Rural areas depend on urban areas for their supply of central-place services and manufactured goods, and as markets in which to sell their natural resource-based goods and services.

In the case of a major central place such as Portland, however, the interdependence of core and periphery in both labor markets and trade is more limited. For most industries in both regions, the bulk of trade takes place outside the functional economic region. Yet for businesses in such major urban sectors as wholesale and retail trade, financial services, and consumer services—in which the majority of core export sales are made to the rural periphery—the health of the rural economy is important. That said, a major downturn in the periphery economy would be felt in the urban center, but it would have to be quite substantial to produce a large effect. For example, an analysis of the effects of the policy to reduce federal timber harvest after the 1990 listing of the northern spotted owl—by most accounts a substantial shock to rural timber communities—revealed that the reduced timber harvest in the Western Oregon periphery caused an estimated loss of 4,400 jobs in Portland, out of a base of 534,000 jobs, or 0.08 percent of the total. (Waters et al., 1994)

Summary

As the larger Portland trade area has grown over the past quarter century, the core has grown faster than the periphery. Slightly smaller than the periphery in 1982, the core economy was 50 percent larger in 2006. The Portland core depends increasingly on the periphery as a source of labor, but it depends on it less than in previous decades as a market for its goods and services.

The periphery, in turn, increasingly depends on the Portland core as a source of personal income for its residents, and has continued to purchase needed inputs from the core while increasing its local production. The periphery depends less on Portland as a market for its output than it did in previous decades.

Yet the fortune of each region is affected by growth or decline in the other region. Growth in exports from the periphery have a significant cross-regional impact on the Portland core: about one-sixth of the indirect and induced economic impact of periphery exports accrues to the Portland core. The Portland core benefits more from a growth in periphery exports than the periphery benefits from a growth in core exports. Nonetheless, growth in Portland core exports does affect the periphery: less than one-eighth of the indirect and induced impact of core exports spills over to the periphery. Each region benefits from growth in the other region's economy and is harmed by declines in the other region. The futures of the core and the periphery in the Portland trade area are inextricably intertwined.

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