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Linkages in the Construction Sector

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Why look at construction linkages?

- Vital sector in any economy
  - Provides public infrastructure as well as private physical structures for productive activities (industry, service, commerce, utilities, etc)

- Construction investment can be an important public policy tool
  - Used by central and local government alike to accelerate development, create employment during periods of recession or slow economic growth

Backward and Forward Linkages in a Nutshell

- Backward linkages: relationship of interindustry purchases to total purchases
- Forward linkages: relationship of interindustry sales to total output

Linkage Measures

Eight most commonly used linkage measures:

1. Direct backward linkage
2. Direct forward linkage
3. Total backward linkage
4. Total forward linkage
5. Power of dispersion
6. Sensitivity of dispersion
7. Coefficient of variation for backward linkages
8. Coefficient of variation for forward linkages

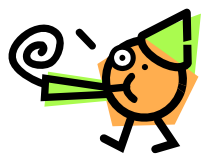
Factors of Variation

Why do backward linkages differ among countries and over time?
There are variations in

- Product mix
- Relative prices of construction inputs
- Construction technologies

Although there is not a sufficient amount of data to standardize these factors of variation, there are other ways to assess the strength and nature of construction backward linkages…

Examine backward and forward linkage measures for aggregate construction sector in a number of countries and over time!



Direct Backward Linkage

- **Shows the proportion of total inputs of a sector accounted for by its intermediate inputs**

- The higher the backward linkage of a sector, the more important that sector in promoting economic growth

- A value of .68 for Japan in 1960 indicates that in this year, intermediate inputs into the construction industry were 68% of Japan's total construction output

- The Rank column indicates that construction is always in the top half of sectors generating large backward linkages

Construction Direct Backward Linkages in Developed and Developing Countries

Author	Country	Year	Direct backward linkages*			
			Construction linkage		All sectors linkage value	
			Value	Rank**	Minimum	Maximum
Minami	Japan	1960	0.68	2/6	0.22	0.72
Minami		1965	0.62	2/6	0.21	0.70
Minami		1970	0.62	2/6	0.22	0.69
Minami		1975	0.56	3/6	0.23	0.70
Minami		1980	0.57	3/6	0.23	0.71
Bon, Zlaoui	USA	1947	0.59	2/7	0.28	0.62
Bon, Zlaoui		1958	0.58	2/7	0.29	0.61
Bon, Zlaoui		1963	0.57	3/7	0.29	0.60
Bon, Zlaoui		1967	0.56	3/7	0.28	0.60
Bon, Zlaoui		1972	0.54	3/7	0.28	0.62
Bon, Zlaoui		1977	0.58	3/7	0.32	0.64
Panchamukhi	India	1973	0.515	40/66	0.045	0.856
Panchamukhi	Indonesia	1969	0.618	17/42	0.050	0.891
Panchamukhi	Malaysia	1965	0.647	13/30	0.004	0.970
Panchamukhi	Philippines	1965	0.537	15/51	0.00	0.730
Panchamukhi	Korea	1966	0.612	13/43	0.011	0.878
Panchamukhi	Sri Lanka	1965	0.429	18/42	0.021	0.950
Delmar	Ireland	1956	0.39	4/6	0.20	0.72
Zlaoui		1964	0.43	3/11	0.19	0.72
Zlaoui		1968	0.44	4/11	0.16	0.77
Delmar		1969	0.41	3/6	0.17	0.74
Zlaoui		1974	0.40	4/11	0.18	0.75
Zlaoui		1978	0.51	4/11	0.17	0.75
Delmar		1982	0.50	2/6	0.05	0.70

**Direct backward linkage is defined as the ratio of intermediate inputs for sector j over the total inputs for that sector*

***Sectors ranked in descending order*

Total Backward Linkage

- **Measures the total direct and indirect effects associated with a change in final demand for a given sector**

- A high value indicates large direct and indirect effects of increase in final demand for output of a sector

- Total measure for countries with more than one year of data show same tendencies as direct backward linkage measure

- Comparative rankings column shows that the total backward linkage is very high for construction compared with other sectors

Construction Total Backward Linkages in Developed and Developing Countries

Author	Country	Year	Total backward linkages*			
			Construction linkage		All sectors linkage value	
			Value	Rank**	Minimum	Maximum
Acharya and Hazari	India	1963	2.23	1/20	1.19	2.23
	India	1963	2.05***	1/20	1.02	2.05
Acharya and Hazari	W. Pakistan	1962	2.02	5/20	1.36	2.63
	W. Pakistan	1962	1.44***	3/20	0.30	1.74
Acharya and Hazari	E. Pakistan	1962	1.53	11/20	1.00	1.99
	E. Pakistan	1962	1.34***	5/20	0.29	1.54
Riedel	Taiwan	1969	2.226	14/25	1.242	3.134
Riedel	Taiwan	1969	1.878***	4/25	0.091	2.003
Miller & Blair	USA	1947	2.220	2/7	1.524	2.319
Miller & Blair		1958	2.204	2/7	1.563	2.286
Miller & Blair		1963	2.156	3/7	1.523	2.272
Miller & Blair		1967	2.127	3/7	1.538	2.239
Miller & Blair		1972	2.085	3/7	1.108	2.295
Miller & Blair		1977	2.208	3/7	1.144	2.354
Zlaoui	Ireland	1964	1.658	4/11	1.284	2.325
Zlaoui		1968	1.742	5/11	1.307	2.449
Zlaoui		1974	1.694	5/11	1.318	2.364
Zlaoui		1978	1.811	3/11	1.156	2.238
Minami	Japan	1960	2.70	1/6	1.47	2.70
Minami		1965	2.34	2/6	1.46	2.54
Minami		1970	2.43	2/6	1.47	2.55
Minami		1975	2.35	2/6	1.49	2.64
Minami		1980	2.43	3/6	1.52	2.76
Yotopoulos and Nugent	Developed		2.090	9/18	1.617	2.425
Yotopoulos and Nugent	LDC		2.042	10/18	1.493	2.393

**Total backward linkages are the column sums of the $(I - A)^{-1}$ matrix, where I is the identity matrix and A is the input-coefficient order*

***Sectors ranked in descending order*

****These total backward linkage measures were obtained by using the $(I - A + m)^{-1}$ matrix where m, the import coefficient for each sector, is equal to the ratio of its imports over its gross domestic output*

LDC = Less-developed countries

Power of Dispersion

- **Shows the relative extent to which an increase in final demand for products of a sector are dispersed throughout the system of sectors**

- Laumas (1976) contends that of all measures one can use to describe backward linkages, the power of dispersion measure is the most appropriate for intercountry comparisons

- A value >1 indicates that the country has a greater than average backward linkage

- The value is greater than 1.0 for almost all countries, which indicates that the construction backward linkage is equal to or greater than the average backward linkage in almost all countries

Power of dispersion and coefficient of variation of construction linkages in developed and developing countries

Author	Country	Year	Power of dispersion for total backward linkages			
			Construction linkage		All sectors linkage value	
			Value	Rank	Minimum	Maximum
Nimoyina	Thailand	1975	1.148	7/31	0.730	1.340
Nimoyina		1980	1.169	6/31	0.703	1.362
Nimoyina		1982	1.185	4/31	0.702	1.390
Panchamukhi	India	1973	0.966	40/66	0.649	1.466
Panchamukhi	Indonesia	1969	1.156	15/42	0.593	2.023
Panchamukhi	Malaysia	1965	1.211	8/30	0.789	1.592
Panchamukhi	Philippines	1965	1.260	10/51	0.625	1.614
Panchamukhi	Korea	1966	1.148	12/43	0.638	1.491
Panchamukhi	Sri Lanka	1965	1.012	21/42	0.607	1.564
Boucher	Developed		1.011	NA	0.772	1.178
Boucher	LDC		1.028	NA	0.733	1.198

Coefficient of Variation for Backward Linkages

- **Measures the extent to which a given sector draws evenly from other sectors**

- A high value indicates that a sector draws unilaterally on other sectors, while a low value indicates that it draws evenly on other sectors
  - Major implications for the scope and impact of policy interventions!

- Table 4 shows that for most countries, the coefficient of variation for construction backward linkages are fairly low relative to the minimum and maximum values for all sectors in the country in question
  - Construction sector's economic impact is dispersed relatively evenly throughout all sectors in the economy

Author	Country	Year	Coefficient of variation for total backward linkages		
			Construction linkage	All sectors linkage value	
			Value	Minimum	Maximum
Nimoyina	Thailand	1975	NA	NA	NA
Nimoyina		1980	NA	NA	NA
Nimoyina		1982	NA	NA	NA
Panchamukhi	India	1973	5.283	4.29	7.389
Panchamukhi	Indonesia	1969	3.122	2.911	6.48
Panchamukhi	Malaysia	1965	3.534	3.513	5.418
Panchamukhi	Philippines	1965	3.648	3.334	7.14
Panchamukhi	Korea	1966	3.219	3.149	5.995
Panchamukhi	Sri Lanka	1965	3.91	3.185	6.476
Boucher	Developed		2.091	2.091	3.265
Boucher	LDC		2.096	2.064	3.149

Figure by MIT OpenCourseWare.

Above graphic adapted from Table 4 in Polenske and Sivitanides (1989)