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## THE PAKISTAN ECONOMY: EXAMPLES FROM INPUT-OUTPUT ANALYSIS

### I. INTRODUCTION

The Pakistan economy, to a large extent, can be characterized as a transitional agricultural economy. A major part of the economy depends on farming, the processing of agricultural commodities and wages paid by agriculture to the household. Agriculture is producing a marketable surplus that is supporting urbanization and the transition to a more market oriented economy.

For the most part, commercial agriculture is on the increase and both public and private capital are continuing to flow into farming and agricultural business. Poultry production in Pakistan is an example of expanding commercial agriculture. At this point, Pakistan has an exportable surplus of cotton, rice and wheat; the major staple crops. This makes the agricultural processing industry, which purchases, processes and exports the staple crops, a large share holder of the export market. As the rural populace migrates to higher income urban areas the widely separated and concentrated population centers are attracting more products that move greater distances for marketing and distribution. This transition to a more market oriented economy can often be tracked and facilitated with information from input-output analysis.

Input-output analysis is based on a tableau of transactions by industry sector, of the economy. The transactions are arranged in a matrix so that the sales among sectors can be read across rows of the matrix. Purchases among sectors are read down columns of the matrix. The first columns in the matrix consist of industry sectors and a household sector that are producing, processing and transferring goods and services. The last columns in the matrix are usually government services, investments and exports. These are called final demands because they are the final users of the goods produced. The first rows of the matrix are the industry sectors that are involved in some stage of producing or processing goods and services. The last rows of the matrix are taxes, savings and imports and are called final payments. Because final payments leave the transactions economy they are often called "leakages".

The original transactions tableau of the economy is usually converted to at least three other tables. Transactions along each row of the

transactions table are divided by total sales by sector to show the proportion of sales made by, say, the Agricultural Processing Sector to each of the other sectors. This is called the "Sales Coefficients Matrix". The second table is constructed by dividing the transactions down each column by the total purchases by sector to show the proportion of total purchases of an individual industry sector that are made from itself as well as each of the other sectors. This is often called the "Technical Coefficients" matrix. For the third table a set of simultaneous equations are solved to show the "business multipliers". The business multiplier shows the number of times that a Rupee's worth of added sales to final demands turns over in the economy. It shows the added economic activity, measured in gross sales or purchases, that occurs as all the industrial sectors interact to produce the added Rupee of sales to final demands.

For this brief the transactions developed by the Pakistan Institute of Development Economics for the 1975/76 Pakistan economy were used. The 108 individual sectors were condensed into 15 sectors. Other modifications were made that are discussed more fully in the base report, "A Guide to Interindustry Analysis of the Pakistan Economy", Directorate of Agricultural Policy, Government of Pakistan and the Economic Analysis Network Project U.S. Agency for International Development, Islamabad, June, 1987. The condensed 15 sector transactions tableau is shown below.

PAKISTAN INPUT-OUTPUT, 1975 [1] [2]  
TRANSACTIONS MATRIX  
(000,000 RUPEES)

ROW/COLUMN	FARM PROD.	AG. PROC.	FARM INPUTS	COMMUN- ICATION	TRANS- ENERGY	PORT	COM. MFG	MACH. MFG	SER- VICE	CON- TRADE	GOV'T SERV.	HOUSE HOLDS	EXPORT	INV./ DIS.	TOTAL PUR- CHASES	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
FARM PROD. 1	16625	20173	0.035	0.022	0	495	140	5	0	0	535	180	27407	278	2100	67944
AG. PROC. 2	0	10042	0.123	128	0	0	363	44	19	5	13	1020	33387	7302	1393	53718
FARM INPUT 3	1069	0	0	0	0	0	0.300	0	0	0	0	0	81	18	209	1378
COMMUNICA. 4	0	119	7	50	2	0	95	25	233	40	0	145	740	15	-93	1417
ENERGY 5	754	780	167	17	396	1510	771	47	299	46	0	186	867	192	128	6158
TRANSPORT. 6	2345	1882	200	46	184	0	1033	313	292	368	0	705	7427	0	5690	20486
COMMOD.MFG 7	199	576	100	9	244	1166	4375	397	84	0	4551	57	5151	829	-1613	16065
MACH. MFG 8	0	238	102	61	1	73	126	493	24	0	244	69	1531	121	604	3687
SERVICE 9	373	1112	58	51	59	1537	487	137	341	524	726	3770	5150	0	521	14866
TRADE 10	5595	2946	85	66	407	0	1165	53	0	0	0	0	7701	0	779	18799
CONSTRUCT. 11	0.150	0.501	0.031	13	0.050	0.031	0.229	0.080	78	0	434	9018	5297	0	5610	20401
GOV'T SER. 12	530	47	3	19	29	1012	144	3	204	52	416	2561	11897	9496	1204	27618
HOUSEHOLD 13	11246	3512	107	215	1314	2738	2286	499	2100	1652	4897	4143	0	16440	79767	130917
IMPORTS 14	726	4948	270	45	2628	7003	1938	1099	91	0	1979	167	15909	167	0	36976
TAX-SUB. 15	0	2819	7	0.154	-106	359	535	127	0	0	0	0	0	0	0	3742
SELF-SAV. 16	28481	4524	272	696	1001	4653	2598	445	11150	16112	6606	5538	11467	0	0	93541
TOTAL SALES	67944	53718	1373	1417	6158	20486	16065	3687	14866	18799	20401	27618	134012	34858	96300	517708

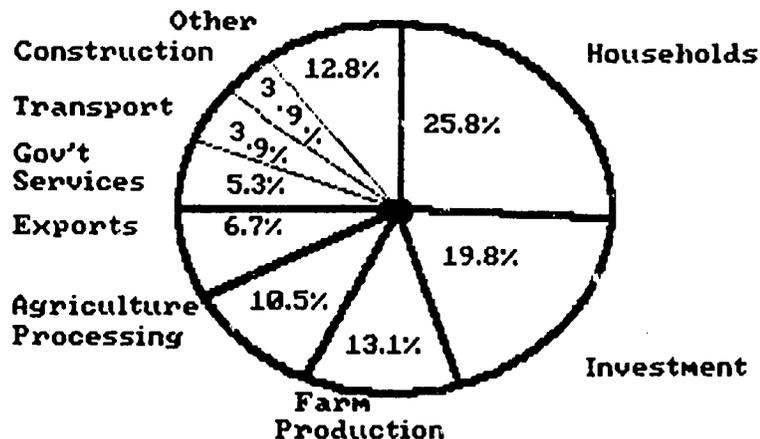
[1] Based on the 1975/76 model developed by the Pakistan Institute for Development Economics.

[2] Transactions that round to zero are shown in decimal place to prevent the illusion of empty cells.

## II. TRANSACTIONS AMONG INDUSTRIAL SECTORS

Transactions among industry sectors are depicted by a "transactions matrix" that lists the industry sector purchases down columns and industry sector sales across rows. Table 14, Transactions Among Sectors: Pakistan 1975, shows, for example, that the total farming purchases (the sum of the farming sector column) amounted to Rps. 67,944,280,000. By accounting definition the total sales from farming (the sum of the farming sector row) is the same as the total purchases which include savings. It is interesting to note that the farming sector purchases from and sells to most other sectors. It doesn't purchase from Agriculture Processing, Communications, and Machine Manufacture. It also does not sell to Energy, and Services. This contrasts to the more developed and dependent Agriculture Processing sector that purchases from every other sector except Farm Inputs and sells to every other sector except Energy and Transport. Another contrast is the less developed trade sector that doesn't collect a margin from the Transportation, Services, Construction or Government Services. In this model, Trade transactions are represented as a margin, the difference in value of goods purchased and goods sold, and the transactions or "margins" appear to be a relative small share of the total economy--about 3.6%--compared to as much as 20% or 30% in developed economies. The relative shares that major industrial sectors occupy as a percentage of total transactions are shown on the following illustration.

SHARE OF TOTAL TRANSACTIONS:  
PAKISTAN INDUSTRIAL SECTORS



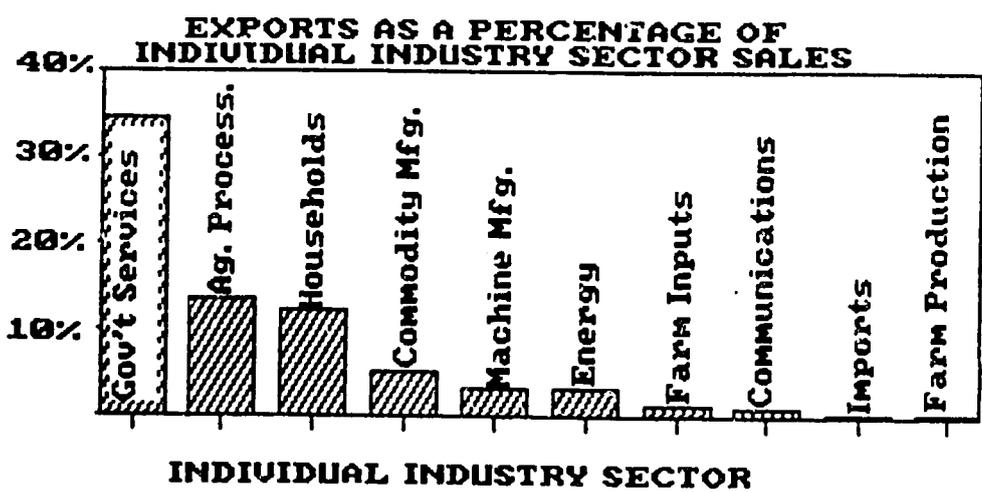
As shown in the previous illustration, about half of the total transactions are Household wage income, Farm Production or Agricultural Commodity Processing. The 19.8% Investment share also contains the discrepancy in the model that was assigned to Investment to make the model balance. The model was unbalanced after the household consumption column was reduced to allow for saving, which was not in the original P.I.D.E. model. All of the other sectors together only make up about one third of the transactions. In brief the transactions matrix shows an economy that is largely agriculture based

with most economic activity in that area and somewhat under developed manufacturing and trade sectors.

2. Sales Coefficients Matrix for Industrial Sectors

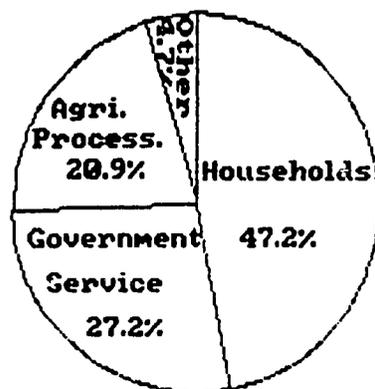
The sales coefficient matrix, shown in the base report, in Table 16, Sales Distribution Coefficients: Pakistan 1975, shows the proportion that sales to individual sectors are of total sales for an industrial sector as Commodity Manufacturing. For example commodity manufacturers sold 28% of their total sales to the Construction sector. The Commodity Manufacturing sector manufactures and sells materials as chemicals, paints, plastics, cement, glass, iron etc. which are a major part of the inputs used by the construction industry. Commodity Manufacturing also sells a large portion of their total sales to households--32%.

The sales coefficient matrix can also be used to show the dependence of individual sectors on a single sector as Exports. In this case the Government Services sector makes over one third of its total sales to exports, this includes fertilizers produced by the government sector, wheat and rice acquired under procurement programs, as well as, grants and loans acquired by the Government of Pakistan. Agricultural processors also sell a large share of their total sales to exports--about 13% or 14%. Agriculture Processing is made up of businesses as grain millers, rice huskers, rice millers, gur producers, sugar refineries, cotton yarn and textile manufacturers, leather, footwear, apparel etc. Even sales from households includes sales to exports. In this case household labor is usually working in another country and sending saved wages back to Pakistan or has established businesses in other countries with profits being returned to Pakistan. The following graph shows export sales as a share of major industrial sector sales.



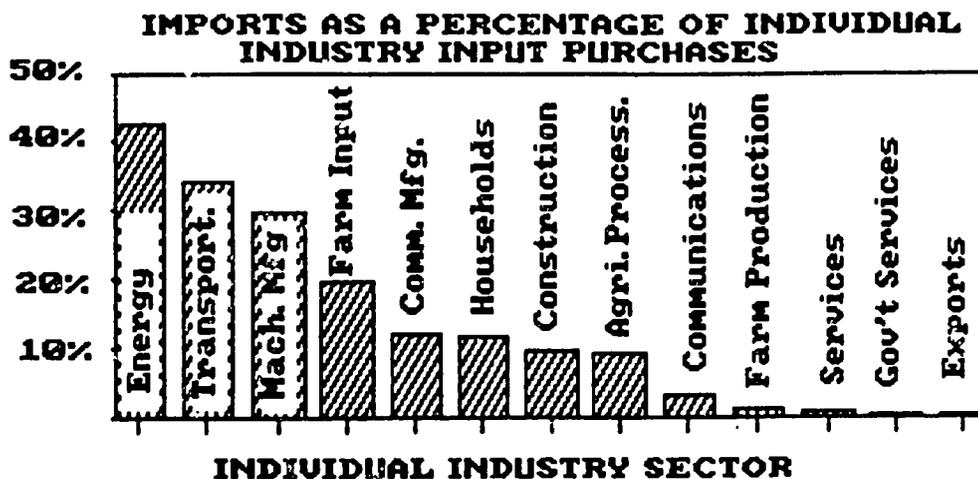
The technical coefficients matrix can be used to construct a similar illustration showing the dependence of one sector on another for sales. For example the Export sector depends heavily on households for sales. Of the total export sales 47.2% were made by households, 27.2% by Government Services and 20.9% by Agriculture Processing as depicted by the following illustration.

**SHARE OF TOTAL EXPORTS SOLD  
BY INDUSTRY SECTOR**



**3. Technical Coefficients: Pakistan 1975**

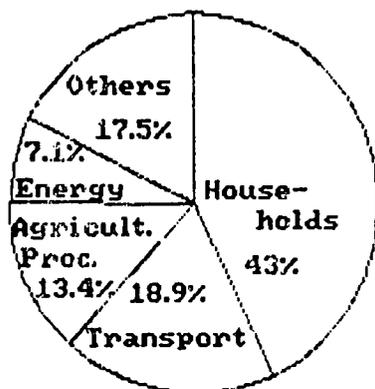
The "Technical Coefficients" matrix shown in the base report in Table 15 is often called the "Direct Input Coefficient Matrix" because it shows the proportion of purchases that each sector spends on the other. It is a very useful matrix for showing the dependency of one industry on another. For example Agriculture Processing makes 38% of its purchases from the Farm Production sector where it acquires most of the raw products for manufacturing as paddy rice, wheat, cotton, wool, hides, etc. The following chart shows a similar comparison of imports as a percentage of total industry sector purchases.



The graph above shows the heavy direct dependence of the Energy sector on imports along with the Transport and Machine Manufacturing sectors. Imports in the Energy sector are mostly the purchases of petroleum products, Transportation is the purchase of fuel, trucks and automobiles and the Machine Manufacturing sector is the purchase of component parts and specific technology for manufacturing. In short, imports, with a scarcity of foreign exchange, can become a major "bottleneck" to the Energy, Transport, and Machine Manufacturing sectors.

Looking at imports another way, that is imports purchased by sectors as a proportion of total imports shows that most imports are purchased directly by households with most of the rest being purchased by Transportation, Agriculture Processing and Energy.

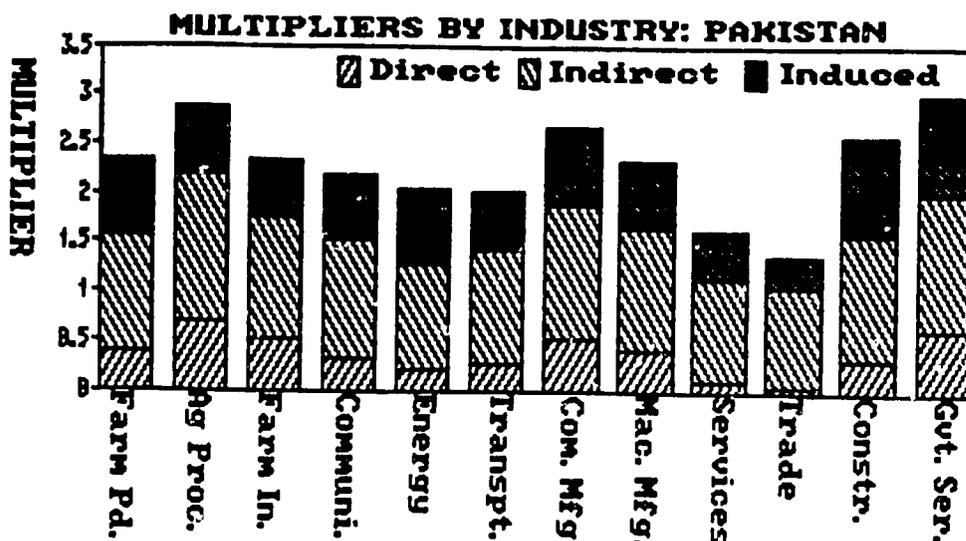
**SHARE OF TOTAL IMPORTS PURCHASED  
BY INDUSTRY SECTOR**



In this case it appears that a major portion of imports are consumer goods purchased by households which to some extent can be related to the underdevelopment of the manufacturing and trade sectors in Pakistan. The low margins in the trade sector apparently do not encourage storage, transportation or additional processing of domestically produced products.

**4. Multipliers: Pakistan 1975**

The multipliers shown in the base report in Table 16, Total Requirements or Leontief Inverse Matrix with Households Endogenous: Pakistan 1975, are the result of input requirements for additional production used to satisfy final demands. Multipliers are made up of three major requirements: direct, indirect and induced. The direct requirements are the proportion of a rupee spent for production that is paid to the industrial sectors in the transaction matrix. The indirect requirements are the additional spending that occurs as the receiving industrial sectors spend the portion of the rupee they were paid for the original production. The induced requirements are the result of the additional spending induced by households as wages or payments for production of the product are spent by households. The sum of the direct, indirect and induced requirements is conventionally called the business multiplier. The following illustration shows the estimated business multipliers by industry, as well as, the portion of the business multiplier that is a direct, indirect or induced requirement.



Two of the larger business multipliers are for Government Services and the Construction industry. Both sectors show a relatively high proportion of the multiplier as being made up of the induced requirement caused by the spending of households. The proportion of the construction business multiplier that results from direct requirements is relatively low because a large share of the rupee spent for construction is either used for direct consumption by the household or held in savings. A large part of the construction industry is self employed. The household sector of the original P.I.D.E. model was adjusted for wage income but not self employment income. This omission is high in Agriculture, Services, Construction and Trade. As a result the direct inputs and multipliers in these sectors are probably understated.

Both the Agriculture Processing and Commodity Manufacturing business multipliers stand out as somewhat larger than most of the others. Both industries purchase from most of the other sectors. Agriculture Processing has an unusually high direct requirement. A high proportion of households employed in Agriculture Processing are wage earners rather than self employed entrepreneurs that are not included in the multiplier calculations. Trade and Services are at the opposite end of the spectrum with rather low business multipliers. Neither trade nor services purchase from a broad spectrum of other industries. In addition the direct requirements are rather low because a large part of the input requirement is absorbed by the self employed in the industry for consumption or savings and are not shown directly in the model as discussed in the previous paragraph.

#### 5. Impact Analysis With Expanded Final Demand

One form of input-output impact analysis is the estimation of increased transactions or sales that result from a change in final demand either in total or by sector. This is done by multiplying the final demands by sector times the "inverse matrix" to estimate a new set of transactions. In this case final demands by selected sector were increased by a constant Rps. 2,685,925 on an individual basis to

show the impact from that one sector. A summary of the changes is shown in the following table.

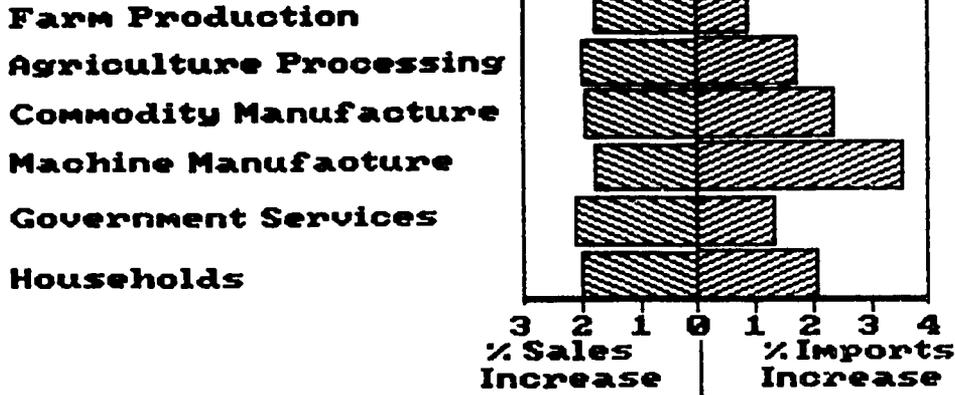
IMPACT OF INCREASING FINAL DEMAND BY RPS. 2,685,925 IN SELECTED INDUSTRIAL SECTORS  
(PERCENT CHANGE IN TOTAL TRANSACTIONS)

-----SELECTED SECTORS INCREASED BY RPS. 2,685,925-----

IMPACTED SECTOR:	1	2	3	4	5	6
	FARM PRODUCTION	AGRICULTURE PROCESSING	COMMODITY MANUFACTURE	MACHINE MANUFACTURE	GOVERNMENT SERVICES	HOUSEHOLDS
FARM PRODUCTION	5.8%	2.9%	0.7%	0.6%	0.9%	2.1%
AGRICULTURE PROCESSING	0.5%	6.6%	0.7%	0.6%	0.9%	2.0%
FARM INPUTS	4.5%	2.3%	0.6%	0.5%	0.8%	1.8%
COMMUNICATION	0.7%	1.3%	2.5%	2.5%	3.0%	2.3%
ENERGY	1.5%	2.0%	4.1%	2.0%	1.7%	1.8%
TRANSPORT	1.1%	1.3%	1.7%	1.9%	1.1%	1.6%
COMMODITY MANUFACTURE	0.8%	1.1%	23.9%	3.6%	2.8%	2.0%
MACHINE MANUFACTURE	0.6%	1.0%	1.5%	84.7%	1.4%	1.7%
SERVICES	0.8%	1.2%	1.6%	1.6%	3.9%	1.9%
TRADE	2.2%	2.3%	2.2%	1.0%	1.0%	2.1%
CONSTRUCTION	0.4%	0.5%	0.6%	0.5%	5.4%	1.3%
GOVERNMENT SERVICES	0.5%	0.4%	0.6%	0.4%	11.3%	1.3%
HOUSEHOLDS	0.6%	0.6%	0.7%	0.6%	0.8%	2.5%
IMPORTS	0.9%	1.7%	2.4%	3.6%	1.4%	2.1%
TAX-SUBSIDIES	0.6%	5.2%	4.1%	3.9%	1.2%	1.9%
SAVINGS	2.5%	2.0%	1.8%	1.3%	2.3%	2.0%
TOTAL	1.7%	2.0%	1.9%	1.7%	2.1%	2.0%

Each column in the table above shows the percent increase in each transaction caused by the increase in final demand. The impact on total sales or total transactions of 2.1% for the Government Services sector is largest of the six sectors being compared. This is probably due to the governmental involvement in a broad range of businesses, as well as, public services. Agriculture Processing, Commodity Manufacture and Households are all similar with increases of around 2% in total transactions or sales. However, as shown by the following illustration Households and Commodity Manufacture use more imports to support the roughly 2% increase in transactions.

**SALES AND IMPORTS IMPACT FROM INCREASING FINAL DEMAND BY RPS. 2,685,925 BY SECTOR**



The illustration above compares the impact of a Rps. 2,685,925 increase in final demand on total sales and imports by selected industry sector. The Rps. 2,685,925 quantity was used as a benchmark since it would represent a 5% increase in Agriculture Processing production, a sector which has wide swings in exports and other final demands. The smallest increase in imports is caused by increased exports ( a final demand) from Farm Production. At this point Farm Production requires the imports of phosphate and potash, as well as, increasing amounts of pesticides and machinery.