10 The Share of Services in Economic Growth

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The positive association be-tween economic growth and the share of services in the industrial distribution of the labor force has been noted and documented by a number of Investigators, including Fisher (1935), Clark (1941), Kuznets (1957), Chancey (1979), and Fuchs (1980). Clark traced the observation of this relationship back to Sir William Petty and proposed that the shift of the working population from agriculture to manufactures and from manufactures to services in the course of economic growth be called Petty's Law. Kuznets, Fuchs, and others have suggested that the relative expansion of service employment could be due either to high income elasticities of demand for final-product services or to slower growth in productivity in the service industries.

In the literature cited, the statistical association between service employment and income growth, and the productivity explanation for the relationship, are both cast mainly in terms of the relative expansion of employment and output in the service industries-that is, industries that produce intermediate or final products other than commodities. (Commodities are defined as storable physical objects.) Kuznets, for example, pointed to a number of structural changes that would shift employment to service industries. These included the effect of economies of plant scale in concentrating production in a limited number of localities and thus increasing the need for distributive services, the increase in financial services with growing personal wealth, the expansion of government services (police, sanitation, education) necessitated by the shift away from family and rural production to production by units employing wage earners concentrated in urban areas, and the increase in military expenditures (Kuznets 1966, p. 150.)

The elasticity explanation, on the other hand, is based on the concept of final-product services-that is, goods other than commodities, purchased for ultimate use rather than as inputs to further production. There is a great deal of overlap between the output of service industries and final-product services, but the former includes purely intermediate activities (such as wholesale trade) as well as activities that count as intermediate when performed for a business purchaser and as final when performed for a household (for example, repair of an electrical outlet).

This chapter examines the elasticity explanation in both interspatial and intertemporal terms, and offers some insights on the productivity explanation as well. In isolating the pure income effect, account is taken of a systematic tendency for the price of services to be affected by changes in income. The interspatial data are drawn largely from the international comparisons of prices and real outputs produced by the United Nations International Comparison Project (ICP). The ICP data refer to 151 final expenditure categories of gross domestic product (GDP) for 34 countries for the year 1975 (Kravis, Heston, and Summers 1982).

The Nature of Final-Product Services

Final-product services constitute a heterogeneous collection of goods. They are alike in that the production of each is necessarily simultaneous with its consumption, and consequently none of them can be stocked. In few other respects, however, do all final-product services share common characteristics. [1]

Although services tend to be labor-intensive, some, such as air travel and electricity, are produced using extensive capital. Indeed, the industries producing commodities are clearly more concerned with the transformation of physical objects into other physical objects than are the industries usually classified in the service sector.' The differences emerge in the data from U.S. input-output tables for 1963 and 1972 presented in table 1.

Table I

Relative importance of service and commodity inputs in the output of U.S. service and commodity industries, as shown by percentage of total output.

	1963		1972	
	Service industries	Commodity industries	Service industries	Commodity industries
Intermediate inputs				
Services	23.5	12.8	19.2	16.0
Commodities	12.5	48.7	8.6	43.7
Value added	64.0	38.5	72.2	40.3
	100.0	100.0	100.0	100.0

Sources: Derived from data in *Survey of Current Business,* November 1969 (pp. 30--35) and April 1979 (pp. 62-67). In the latter source, commodities numbers 1-64, 80, 81, 83, and 85
have been treated as commodities and the rest as services.

Comparisons of Service Shares in Current and Constant Prices

Interspatial

The role of final-product services in final expenditures on GDP is shown in table 2 for groups for countries classified by real income level.' In lines 4-6 the per-capita expenditures on GDP and on the commodity and service components of final expenditures on GDP are presented. These data, based on exchange-rate conversions, suggest that poor-country per-capita spending on services is smaller relative to rich-country spending than is poor-country spending on commodities.' (Compare lines 5 and 6.) The lowest-income countries, for example, spent only 2.0 percent as much as the United States on services, but 5.0 percent as much on commodities. The impression is given that final-product services are indeed

Commodity inputs accounted for only around 10 percent of the output of service industries, while they accounted for around 45 percent of the output of commodity industries. Also, value added is much larger relative to output in the service industries than in the commodity sector.

Final-product services also may vary in the degree of unambiguity with which they can be differentiated from commodity production. Major final-product services such as health, education, and government have closely associated commodity flows, which may be regarded either as inputs (the doctor's stethoscope) or as supplementary or concomitant analysis below, goods

expenditures (drugs,textbooks). - in the empirical

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o ailed ICP categories that reach the hands of consumers in commodity form, such as drugs and textbooks, are treated as commodities even though they might in terms of their broader purpose be subsumed under a heading that is primarily a service, such as health care or education. Consistently, government purchases of goods and services are treated as commodities here, though they could logically be included as part of the total services provided by government.' After all, commodities purchased by governments are for the most part not passed on to the population qua commodities. In what follows, however, government services consist ı' of only the compensation of government employees. It appears that including government purchases as a service would not alter the conclu- reached in this paper. J,

Nothing that has been said here provides any basis for expecting a high or a low income elasticity of demand for most final-product services.

highly income-elastic (under the implicit assumption that price is unchanging). The same inference can be drawn from line 7, where the shares of services in final expenditures on GDP are given. The lowest-income countries (group 1) spent only about 22 percent of their GDP on services, the middle-income countries (groups 11, and 111, and IV) from 25 to 30 percent, and the highest-income countries (groups V and VI) from 35 to 45 percent. (The only country in group VI is the United States.)

In real terms-that is, in terms of the actual physical flows of commodities and services-matters are very different. This can be seen when purchasing-power parities (PPPs) rather than exchange rates are used to

Table 2

Nominal and real per-capita absorption of GDP in the form of services and commodities. and price indexes, by real per-capita GDP group. 1975.

	Income group					
	1	11	111	IV	V	**VI**
Real GDP per capita (U.S. = 100)						
1. Number of countries	8	6	6	4	9	1
2. Range	0-14.9	15-29.9	30-44.9	45-59.9	60-89.9	>90
3. Mean	9.01	23.1	37.3	52.4	76.0	100.0
Per-capita expenditures converted at exchange rate						
4. GDP (U.S. - 100)	3.7	12.1	24.2	38.7	82.3	100.0
5. Commodities (U.S. - 100)	5.0	15.2	31.1	50.6	92.7	100.0
6. Services (U.S. = 100)	2.0	8.1	15.5	23.4	69.1	100.0
7. Share of services	22.2	28.4	27.4	25.6	36.8	43.9
Per-capita quantity indices (based on PPP conversion of expenditures)						
8. Commodities (U.S. = 100)	8.8	23.4	37.5	53.8	77.4	100.0
9. Services (U.S. = 100)	9.4	22.7	37.0	49.2	73.0	100.0
10. Share of services	33.8	31.7	31.8	30.3	31.2	32.3
Price indices						
11. GDP (U.S. = 100)	40.6	51.7	64.7	73.5	107.5	100.0
12. Commodities (U.S. - 100)	57.2	65.9	83.1	94.0	119.0	100.0
13. Services (U.S. = 100)	20.7	34.1	41.2	46.3	94.6	100.0

Source: Kravis, Heston, and Summers 1982.
The entries in lines 3-13 are unweighted averages of the values for the countries within each income group.
Line 2: (GD - P in domestic currency/Population)/PPP x 100
GDP in U.S./U.S. population
Line 4: (GDP in domestic currency/Population)/ Exchange rate x 100
GDP in U.S./U.S. population
Lines I I - 13: (PPP/Exchange rate) x 100

convert expenditures to a common currency, U.S. dollars. Before we examine the impact of PPP conversions on services and commodities, we should note the effect of the use of **PPPs on overall GDP. When PPPs** are used to convert national-currency GDPs, the dispersion of per-capita incomes across the countries is much smaller than the dispersion for exchange-rate-converted GDPs. The average index of real GDP per capita for the eight lowest-income countries is 2.4 times the nominal index. (Group 1: line 3 divided by line 4.) Differences for the succeeding income classes are smaller and smaller, but the ratio of the real to the nominal per-capita GDP of the countries in income class IV (real percapita GDPs 45-60 percent of the United States') is still nearly 1.4. This relationship can also be described in terms of price levels in different countries.' Price levels tend to be low in the poor countries; the price level of GDP for the group I countries is about 40 percent of that for the United States (line 11).

This tendency for real quantities to be larger than nominal ones extends to both the commodity and service components of final expenditures on GDP for the four lowest income classes in the table (compare lines 8 and 5, and lines 9 and 6.') Correspondingly, for each of the four lowest groups, prices are lower than U.S. prices for both sets of categories (lines 12 and 13).

It is noteworthy that the margin by which the real-quantity indices exceed the nominal indices is greater for services than for commodities. Furthermore, this margin of difference is greater the lower the income group. (For example, the ratio of line 9 to line 6 exceeds the ratio of line 8 to line 5 to a greater degree for group I countries than for group 11 countries.) The underlying cause is that services are much cheaper in the relative price structure of a typical poor country than in that of a rich country. Some illustrative ratios of the price indexes for the different income classes (table 3) show this. A quadrupling of real per-capita

Table 3

Ratio of real per-capita incomes and price indices for commodities and services, selected country groups.

	Ratio of real per-capita incomes	Ratio of price indices for Commodities	Services
Group I I I to group 1	4.1	1.45	1.99
Group V to group 111	2.0	1.43	2.30

income (group III relative to group 1) is associated with a doubling of service prices, while commodity prices increase by less than half. Doubling income again (group V relative to group 111) leads to a more than doubling of service prices, but again to only an increase of less than one-half in commodity prices.

The upshot is that, in real terms, the low-income countries tend to consume services in at least the same proportions as the high-income countries -indeed, in the case of the lowest-income countries, in a higher proportion (table 2, line 10). In real terms, the differences between the quantity indices for commodities and services (lines 8 and 9) tend to be smaller for each income class than the exchange-rate-converted expenditure indexes (columns 5 and 6). The gross impression of a high income elasticity for services conveyed by the use of the exchange rate as a conversion factor disappears when the PPP is used, but again this ignores the rise in service prices as income rises. Obviously, the income elasticity of services cannot be evaluated without simultaneously taking account of price and income effects.

In table 4, similar comparisons between exchange-rate-converted expenditures relative to the United States and PPP-converted quantity indexes are presented for consumption rather than for GDP. (The ICP definition of *consumption is* used here; it includes public expenditures for health care, education, and recreational services. The services in consumption include all the services in GDP less all those of government; the commodities in consumption include all the commodities in GDP except government purchases and capital formation.) Almost everything said about the behavior of commodities and services in GDP applies here with little modification. There is, however, one notable change: The share of services in real spending (that is, in international dollars) does rise. The increase in real terms, from 33 percent for group I to 40 percent for groups IV-VI (line 8) is, however, much lower than the rise from 24 to 53 percent found when exchange-rate conversions are used (line 4). The consumption data seem more hospitable to the hypothesis of high income elasticity for services than the more inclusive GDP data, particularly since relative service prices appear to rise with income.

Intertemporal

Changes in the relative importance of services over time are summarized for three countries- France, the United Kingdom, and the United States

Table 4
Nominal and real per-capita consumption in the form of services and commodities, and price indexes, by real per-capita GDP group, 1975.

	Income group					
	1	11	111	IV	V	VI
Per-capita consumption converted at exchange rate	192	612	1,130	1,830	3,825	5,183
1. Consumption (U.S. = 100)	3.7	11.8	21.8	35.3	73.8	100.0
2. Commodities (U.S. = 100)	5.8	16.8	30.0	49.1	87.1	100.0
3. Services (U.S. - 100)	1.8	7.3	14.4	23.0	61.9	100.0
4. Share of services	23.9	31.7	33.9	33.3	44.3	52.7
Per-capita quantity indices (based on PPP conversion of expenditures)						
5. Consumption (U.S. - 100)	9.4	23.5	36.2	50.7	71.3	100.0
6. Commodities (U.S. = 100)	10.5	25.0	37.2	51.2	72.3	100.0
7. Services (U.S. - 100)	7.7	21.3	34.6	49.9	69.7	100.0
8. Share of services	33.3	36.8	38.9	40.1	39.7	100.0
Price indices						
9. Consumption (U.S. 100)	39.9	50.1	59.5	69.1	102.9	100.0
10. Commodities (U.S. 100)	56.6	68.6	81.2	95.8	119.5	100.0
11. Services (U.S. = 100)	23.6	33.2	40.1	45.4	88.7	100.0

Source: Kravis, Heston, and Summers 1982.

See notes to table 2.

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Changes in Service Shares Over Time, France, United Kingdom, and United States.

	Index of real per-capita GDP	Shares of: Private household services in private consumption		Shares of: Services in GDP[a]	
		Current prices	Constant prices	Current prices	Constant prices
France					
1959–60	49.1	28.9	36.3	31.3	38.0
1977–78	100.0	37.5	37.7	37.9	36.5
United Kingdom[b]					
1957–58	65.0	22.8	35.2	39.5	51.6
1967–68	81.1	29.4	33.6	43.8	50.5
1977–78	100.0	31.6	33.2	47.6	49.7
United States					
1947–48	52.3	37.4	39.6	53.2	42.4
1957–58	62.6	38.4	41.5	44.9	49.6
1967–68	82.0	42.2	43.6	46.8	50.8
1977–78	100.0	45.6	45.5	49.7	49.0

Sources: France: Institute National de la Statistique et des Etudes Economiques, *La Consommation des Menages*, October 1979; OECD, *National Accounts of OECD Countries, 1950–1979*, vol. 1 (Paris, 1981). United Kingdom: *National Income and Expenditure*, 1962, 1972, 1979; Central Statistical Office. United States: *Survey of Current Business*, January 1980, pp. 36, 35.

a. Includes all final expenditures of government. GNP is used for the U. S. instead of GDP.

b. The shares in current and constant prices were linked in the years 1961 and 1968 to cope with revisions in the series and the changes in the base year for constant prices. Since in each of these years the constant-price service shares were higher at the new prices than at the old, the use of the unlinked shares would produce rising service shares rather than the generally declining ones shown in the table. However, if the comparisons are made less equivocal by confining them to the most recent series, starting in 1968, the same attenuation of the upward movement of shares in current prices appears when a shift is made to constant-price shares, including a reversal of the trend in both concepts of service shares.

	U.K. shares of: Private household services in private consumption		Shares of: Services in GDP	
	Current prices	Constant prices	Current prices	Constant prices
1968–68	29.5	33.8	42.9	40.8
1977–78	31.5	33.2	47.6	49.7

-in table 5. In each of the countries the share of expenditures on services rises quite sharply over time as its income rises when shares are calculated in the current prices of each period. This is true whether the service share is defined as privately purchased services in household consumption or as the share of all services, including government, in GDP. When service shares are measured in constant prices, however, the secular rise in shares disappears completely in the cases of France and the United Kingdom and is sharply reduced in the case of the United States.' In the United States there was a moderate shift toward services, which was confined in the case of GDP to the 1950s.

The obvious inference is that, as the incomes of the countries rose, service prices must have been rising relative to commodity prices.' The ratios of terminal to initial implicit deflators for the three countries confirm this (table 6).

The Income Elasticity of Final-Product Services

The common view that services are characterized by relatively high income elasticities is based on the idea that commodities fill one set of human wants (the basic necessities) and services another (the desire for luxuries) (Fisher 1935, p. 31). The fact is, however, that changing times bring different forms through which age-old wants are satisfied, and it is easy to go astray by identifying luxuries with services.

The income elasticity of demand is only one of three sets of factors that influence the changes over time in the division of consumers' expenditures between services and commodities. Some generalizations can probably be legitimately made about income elasticities for broad categories of wants -for example, that the demand for recreation tends to be highly elastic

Table 6

Ratios of terminal to initial implicit deflators: France, United Kingdom, and United States.

	Services	Commodities	GDP
France, 1977-78/1959 60	3.77	2.64	2.99
United Kingdom, 1977 78/1957- 58	5.45	3.67	4.35
United States, 1977-78/1950 51	3.24	2.29	2.65

with respect to income-but such generalizations do not lead to a clear conclusion about shifts in the relative importance of services and commodities in consumer expenditures. Even a broad category of wants can be satisfied in a variety of ways, some involving a service and others involving a commodity. Higher incomes, for example, may lead to the substitution of a commodity for a commodity (meat for bread), or of a service for a service (an expensive restaurant meal for a cheap one), or of a service for a commodity (restaurant food for home-cooked food), or of a commodity for a service (ready-to-serve food for household help).

Another set of factors that determine whether the expansion path goes toward services or toward commodities are technological. Consider, for example, the possible ways for an individual to satisfy an income-elastic desire for entertainment in the form of a musical experience. The most direct physical sensation associated with the musical experience involves movements of molecules in the air and their impact on the ear (though clearly a variety of other sensations-e.g., visual-play a role too). The alternative ways by which an individual can arrange to have the molecules move in order to receive his entertainment depends upon the moleculemoving technological possibilities available. In the nineteenth century, the options were limited to direct contact between the performer and the listeners. In the twentieth century, various disembodied sources of music are available (phonograph records and live and recorded performances transmitted by radio and television), but access to these sources requires the purchase of commodities (records and record players, radios, television sets) instead of the purchase of a service in the form of a concert ticket. At some points in the evolution of music technology a stimulus was given to expenditures on services (radio broadcasting and later TV broadcasting) and at other points to expenditures on commodities (records and record players, radios, TV sets, and recording equipment).

The remaining factors with which the income elasticities and the technological factors interact, sometimes in a causative way, are relative prices. The existing structure of relative prices at a given moment may influence the relative size of income elasticities for different means of satisfying a broad want. For example, whether a high income elasticity of demand for recreation leads with an increase of income to a relative expansion of spending on services or on commodities is likely to depend on which ways of providing the desired form of recreation are the cheapest.

The influence that price may exercise on the income elasticities of close substitutes may vary with the level of income.

Relative prices will in turn be influenced by technological changes. If (as seems plausible) the cost-reducing aspects of technological change affect commodities more often than services, commodity prices will tend to fall relative to services prices. This behavior of relative prices is made more likely by the facts that services tend to be produced in a more laborintensive way than commodities and that wage rates rise relative to the rent of capital with development.

The powerful influence of the relative prices of commodities and services may help to explain the predominance of commodity over service avenues of satisfying the demand for musical performances. Though the enjoyment of theatrical and musical performances is usually thought of as involving a service transaction, in the United States consumers spend much more on the commodities necessary to get access to such entertainment (in 1975, $14.6 billion on radios, TV sets, records, and musical instruments) than on direct payments for the services these involve ($2.5 billion on motion-picture admissions and $0.8 billion on theater, opera, and other performances). More broadly, over 70 percent of the U.S. consumption expenditures on "recreation" were for commodities."

Recreation is not the only example of this phenomenon. Switches from the purchase of commercial laundry services to home washing machines and dryers and from the services of washers of dishes to dishwashers further illustrate the consequences of cost minimization even in the absence of changes in the state of technology.

The rise in service prices relative to commodity prices and their influence in tilting the balance in favor of shifts from the satisfaction of wants through services to their satisfaction through commodities may help explain the limited expansion of the share of services in final expenditures despite the fact that services often seem to contribute to income-elastic wants.

It seems clear, then, that there are no strong a priori grounds for expecting collections of final products classified as services to have higher income elasticities than those we classify as commodities, and that tables 2, 4, and 5 indicate that prices and income were both changing interspatially and intertemporally, so the separate effect of income change on service quantity has not been measured. The actual elasticities may be estimated in several ways.

Table 7
Price and income elasticities for services and commodities, based on cross-section data for 34 countries, 1975

	Elasticity estimates[a]	
	Price	Income
ICP consumption[b]		
Services	−0.1940	1.1274
	(0.1364)	(0.0412)
Commodities	−0.3064	0.9271
	(0.1406)	(0.0292)
ICP GDP		
Services	0.1491	1.0015
	(0.1488)	(0.0493)
Commodities	0.2717	0.9900
	(0.1853)	(0.0243)

a. Elasticities were estimated using regression equations of the form $\ln q = \alpha + \beta \ln(p/P) + \beta \ln(y/y_{t-1}) + u$ where q and p are the quantity and price of the sectors and y represents income. In ICP consumption, P refers to the price level for consumption and y to real per capita consumption. In ICP GDP, P and income refer to GDP. Numbers in parentheses are standard errors.
b. Includes public expenditures on education and medical care.

Cross-National Estimate of Income Elasticity

One approach, the results of which are set out in table 7, relies on cross-section data for the 34 ICP countries. The parameters of log-linear demand regressions were estimated for both commodities and services on the basis of two different income concepts.[11] When the service-commodity dichotomy in "ICP consumption" (the concept in which government expenditures on education and medical care are included) is analyzed, the income elasticity for services is distinctly above unity, and significantly so; correspondingly, that for commodities is below unity, and significantly so. However, when all final-product services (including those of government) are taken into account, the difference between the service and commodity elasticities virtually disappears. Since the purpose of this chapter is to describe the changes in the structure of the economy, the latter is the more relevant basis.

It may be of further interest to examine the pattern of the income elasticities that emerges from the estimation of individual demand equations for each service and commodity category. The results for ICP consumption categories are given in table 8. Although the service set

Table 8 Percentage distributions of income elasticities for commodity and service categories.

Percent distribution of categories

Income elasticity	Commodities	Services'
< 0.5	18.2	7.7
0.5--0.99	14.3	3.8
1.0-1.49	37.7	53.8
> 1.5	29.9	34.6
	100.0	100.0

Note: The income variable is total consumption inclusive of the public expenditures alluded to in text. The numbers of categories for which income-elasticity estimates were computed were 77 for commodities and 26 for services. Data from Kravis, Heston, and Summers 1982.
a. Includes both private and public expenditures on health, education, and recreation, but excludes general government.

clearly has a higher proportion of elasticities over unity, the margin by which it exceeds the commodity set in the very high elasticity category (L 5 and over) is modest and the difference between the median elasticities for service categories (1.36) for commodity categories (1.23) is not very great. When the significance of the difference between the two distributions is assessed (albeit with limited power) by a Z' contingency table test, the null hypothesis that the distributions are the same is accepted at the 0. 10 level. There is no very strong basis here for predicting an income elasticity on the basis of the classification of a final-product category as a commodity or a service.

Intertemporal Elasticies

Another approach to the estimation of income elasticities is through time-series data. Price and income elasticities based on annual data for periods of 10 to nearly 30 years for France, the United Kingdom, and the United States are shown in table 9. As might be expected from the dampened expansion of service shares over time when data were expressed in constant prices in table 5, the evidence on the difference between services and commodities is mixed in these regressions. While the French data indicate higher income elasticities for services than for commodities, the U.K. and U.S. data definitely do not. The quite possible endogeneity of prices and the almost certain oversimplification of the "model" limit the weight that can be placed on these results. (This is particularly true in view of some positive and significant price elasticities.)

Table 9

Price and income elasticities for services and commodities, France, United Kingdom, and United States.

Elasticity estimates'

	Price	Income
France, 1959-78		
Private consumption		
1. Services'	-0.6029	1.0383
	(0.1831)	(0.0472)
2. Commodities'	-0.5146	0.7465
	(0.1168)	(0.0155)
GDP		
3. Services'	-0.7869	1.2300
	(0.3436)	(0.1151)
4. Commodities'	-0.7836	0.8745
	(0.3964)	(0.0681)
U.K., 1%8-78		
Private consumption		
5. Services	+0.0142	0.5704
	(0.0079)	(OA975)
6. Commodities	--0.1463	1.0913
	(0.2933)	(0.0965)
GDP		
7. Services	+0.4696	0.6838
	(0.1533)	(0.1155)
8. Commodities	+0.5416	1.3040
	(0.1913)	(0.1206)
U.S., 1950-77		
Private Consumption		
9. Services'	-0.3862	0.6665
	(0.1540)	(0.0701)
10. Commodities'	-0.4555	1.2254
	(0.1809)	(0.0558)
GDP		
11. Services'	+0.4598	0.8703
	(0.3521)	(0.1033)
12. Commodities'	-0.0982	0.9887
	(0.4757)	(0.1204)

a. Elasticities were estimated using regression equations of the form Inq)!ln(plP) +

P ln(y/yu.s) + u where q and p are the quantity and price of the sector and y represents income. In lines 1, 2, 5, 6, 9, and 10, P refers to the price level for consumption and ' V to real per-capita consumption. In lines 3, 4, 7, 8, 11, and 12, P refers to the price of all GDP and y to real per-capita GDP. Numbers in parentheses are standard errors.

b. The Durbin-Watson test rejected non-autocorrelated disturbances at the 0.05 level of significance. Reported elasticities are based upon Cochrane-Orcutt transformed data.

Service Shares and Petty's Law

From the reconciliation of the cross-section analysis of shares in table 2 and demand regressions in table 7 emerges a story of economic development involving Petty's Law about shifts in manufacturing industry and service industry employment over time. For GDP, table 2 shows sharply rising service expenditure shares associated with rising nominal incomes but constant shares when both services and incomes are expressed in real terms. The price and income elasticity coefficients of table 7 suggest the reason for the difference: Neither the quantity of services nor that of commodities is very responsive to changes in relative prices, but both expand in equal proportions as income rises. Thus, service shares remain constant in real terms from group I to group VI. They are altered neither by changes in prices nor by changes in incomes. Though relative servicecommodity prices change and income rises as development proceeds, the real shares remain the same. The nominal shares (which are the same as the exchange-rate-converted shares) reflect the change in relative prices, and on that account would rise with rising income. Rising service prices, as will be argued in the next section, reflect a lower rate of productivity improvement than is experienced in commodities. The inference, then, is that equal rates of expansion in the absorption of the two forms of final product require a more rapid expansion of employment in services.

A similar analysis applies if attention is confined to the consumption component of GDP. The main difference is that the real service share rises from group I to group IV (though not as much as the nominal service share). This behavior is reflected in the higher income elasticity of consumption services relative to that for consumption commodities shown in table 7 (lines I and 2). However, similar inferences can be made about the reasons for the difference between real and nominal shares and about Petty's Law.

Why Services Are Low in Price in Low-Income Countries

The most striking characteristic of services that has emerged from this review is the behavior of their prices relative to those of commodities as real per-capita income rises. As table 2 shows, in 1975 at the lowest income level (group I countries) this association involved service prices that were one-fifth of the U.S. level and average real per-capita GDPs that were

less than 10 percent of the U.S. level. Commodity prices are also positively correlated with real incomes, but the gradient is much smaller, and prices in the lowest-income countries were slightly over 60 percent of the U.S. level.

These differences were explained in earlier work in terms of the productivity-differential model (Kravis, Heston, and Summers 1978). As a first approximation it may assumed for purposes of explaining the model that the prices of traded goods (mainly commodities) are the same in different countries. With similar prices for traded goods in all countries, wages in the industries producing traded goods will differ from country to country according to differences in productivity-a standard conclusion of Ricardian trade theory. In each country the wage level established in the traded-goods industries will determine wages in the industries producing nontraded goods (mainly services). Because international productivity differences are smaller for such industries, the low wages established in poor countries in the low-productivity traded-goods industries will apply also to the not-so-low-productivity service-and-other-nontraded-goods industries. The consequences will be low prices in low-income countries for services and other nontraded goods. (An algebraic treatment of this productivity-differential model is presented in the appendix.)

Here, a more extensive effort is made to seek empirical verification of the model than was undertaken before. This involves probing into the question of the capital and labor intensities of services and commodities.

In the first place, the data of the ICP, as has just been mentioned, show that although commodity prices are far from uniform in countries at different income levels, they are much more similar than service prices (see table 2). Logically, the next proposition of the model that should be investigated is the behavior of wages in service- and commodity-producing industries, but we move directly to the penultimate propositions of the model dealing with relative productivity in services and commodities. (The final proposition is that prices reflect these productivity differences.) For this purpose we find it necessary to shift from the concept of commodities and services as final products to a consideration of the industries that produce both final and intermediate services, Direct evidence on the relative behavior of productivity may be found in Kuznets-type sectoral productivity ratios (sectoral shares in output divided by sectoral shares in employment)." Kuznets's own work relating first to 1950 and later to 1960 and the independent work of Chenery and Syrquin (1975) sum

marizing the period 1950-1970 show clearly that the productivity of the service sector relative to the commodity sector tends to be inversely related to the income level of the country. This finding is confirmed when sectoral productivity indices, circa 1975," are regressed against real percapita GDP for the 20 ICP phase III countries for which data for such indices were available. In the following regression, productivity in the service industries (SP) relative to productivity in the commodity industries (CP) of each country is taken as the dependent variable and the ICP estimate of 1975 real per capita GDP (r) is the independent variable (standard errors are shown in parenthesis):

$$\ln(SP/CP) = 7.3988 - 0.31001nr$$
$$(0.4349)\ (0.0550)$$

where k2 = 0.618, S.E.E. = 0.198, and n = 20. The coefficient of r is negative and highly significant. The higher the country's per-capita income, the lower its service-sector productivity relative to its commoditysector productivity.

An alternate assessment of the relative productivity in the service- and commodity-producing industries, using a completely different body of data and also offering insights into the relative factor intensities of the two sets of industries, can be obtained by using input-output data for countries at various income levels. Fortunately, the formidable task of assembling input-output studies for different countries and reconciling differences in the industrial classification can be avoided by relying upon a World Bank study by Stern and Lewis (1980) which gives capital and labor requirements for 30 sectors for eight income levels of countries based on a sample of input-output tables. "' It was relatively easy to adapt this grouping to the six ICP income groups used in table 2. Three of the sectors represented services (transportation, communication, and a catch-all category that combined all other services, including those of barbers, restaurants, physicians, and educational institutions); the others involved commodity production. For each of the six income groups of countries, we computed weighted average direct capital and labor requirements. The weights were based on the relative importance of each sector in contributing to GDP within individual countries. The percentages indicating relative importance were averaged for the countries in each income group. " The resulting coefficients for services and for commodity

Table 10

Average direct capital and labor requirements by ICP income groups for commodities and services, in 1970 dollars.

Income	Capital' (SK/$ output)			Labor b		
group	Commodity	Service	GDP	Commodity	Service	GDP
	(1)	(2)	(3)	(4)	(5)	(6)
1	0.755	0.401	0.622	0.172	0.162	0.200
2	1.081	0.816	1.008	0.117	0.158	0.158
3	1.015	0.590	0.834	0. t 80	0.095	0.140
4	1.085	0.613	0.872	0.157	0.097	0.132
5	1.009	0.850	0.931	0.062	0.090	0.080
6	1.075	0.855	0.937	0.049	0.078	0.067

Derived from Stern and Lewis 1980. See text. a. Thousands of dollars per dollar of output. b. Man-years per $1,000 of output.

Table 11

Inputs of capital and labor per unit of output in group I countries relative to group VI.

	Group I/Group VI	
	Capital	Labor
Service	0.47	2.08
Commodity	0.70	3.51

producing industries, presented in table 10, are expressed as dollars of capital required per dollar of output and as man-years of labor per thousand dollars of output in 1970 prices.

What are the implications of these data for relative productivity in service and commodity industries for countries at different levels of income? The relationships can be seen by concentrating on the two extreme groups, I and V1. The ratio of the inputs of capital and labor per unit of output in group I to the inputs in "group V1- (the United States) is given in table 11. For example, from columns I and 2 of table 10, 0.401/0.855 = 0.47 and 0.755/1.075 = 0.70.

The quantity of each factor used by the lowest-income countries is relatively smaller for services than for commodities. " The lowest-income countries use only 2 times as much labor as the United States to produce $1,000 worth of services, as compared with 3.5 times as much for commodities. The relatively small amounts of capital used by the low-income

Table 12 Capital/labor ratios for commodities and services, country groups I-VI.

Income group	Capital/labor ratioa	
	Commodities	Services
1	4.39	2.48
11	9.24	5.16
111	5.64	6.21
IV	6.91	6.32
V	16.27	9.44
VI	21.94	10.96

Source: Table 10.

a. Thousands of dollars'worth of capital per man-year. For a thoughtful assessment of various measures of capital intensity, including the capital-labor ratio, see Stern 1977, pp. 10 ff.

countries probably reflect their much less extensive substitution of capital for labor.

Table 10 also presents significant insights into the factor intensities of service and commodity production at different levels of income. Capital requirements in the services are lower than those in commodities for all groups. The use of labor per unit of output declines with rising incomes, reflecting the higher labor productivity of higher-income countries. The association of capital requirements with per-capita income is less clearcut, owing to the offsetting effects of greater productivity and of substitution of capital for labor in the higher-income countries.

When the two inputs are put together to form capital-labor ratios, the results are those given in table 12. Services are generally more laborintensive than commodities (in the sense of low capital-labor ratios). It is difficult to know whether the lack of a more regular progression in the capital-labor ratios for commodities-the ratio for group 11 is out of line-reflects statistical noise or represents a genuine economic phenomenon.

Sometimes the ICP ratios of relative per-capita GDP are interpreted as a rough estimate of relative labor productivity. The problem with this interpretation is that it uses total population as a proxy for total labor input. It may be of interest, then, to compare the total factor-productivity levels implied by the data in table 10 with the labor-oriented estimates directly derived from the ICP. For example, the implied weighted average

productivity for GDP as a whole for group I countries is 38 percent of the U.S. value, whereas the ICP estimate is a little under 10 percent. [17] **This large difference (and the somewhat smaller differences for the other income groups) might be accounted for by difference in quantities of capital as well as labor inputs, but may also reflect data problems.**

Attention must be called to two caveats about the input-output data. One is that the original task of distilling the input-output matrices of different countries into a consistent set of industrial categories for eight different groups of countries required a broad-brush approach. In particular, the work of correcting exchange-rate-converted values for capital and output to a basis that took into account differences in the purchasing power of the currencies could only be done very roughly, as those who carried out the task clearly realized. Further possibilities for substantial errors arise in the considerable liberties we have taken in further pressing the data into a form suitable for the present analysis." The second caveat concerns the heterogeneity of both sets of goods. This means that averages relating to them may not be typical of all of their components. This lack of intragroup similarity marks the capital-labor ratios as well. For example, table 13 gives the diversity in capital-labor ratios that can be found for income groups I and VI. Transportation (a service industry) is more capital-intensive than textiles (a commodity industry). Textiles, wearing apparel (a commodity industry) is not always more capital-intensive than services, N.E.S. Nevertheless, as table 10 indicates, the amount of capital per person is, on average, higher in commodity than in service industries.

Table 13 Capital-labor ratios of services and commodities, country groups I and V1.

	Direct capital-labor ratio[a]	
		V1
Services		
Transportation	4.17	40.43
Services, N.E. S.[b]	0.98	7.75
Commodities		
Textiles, Wearing Apparel	2.00	4.75
Electrical Machinery	10.40	6.60

a. Excludes the labor and capital content of inputs purchased from other industries.
b. N.E.S. = not elsewhere specified.

Reasons for the Differences in Sectoral Productivity

The intersectoral productivity indexes can be decomposed as follows:

$$\frac{P_s}{P_c} \quad \frac{[(W_s + O_s)Q_s]/N_s}{[(W_c + O_c)Q_c]/N_c}$$

where s indicates services, c indicates commodities, P = output per worker in own-currency prices, W = labor compensation per unit of output, 0 = non-labor costs per unit of output, *Q = units* of output, and *N* = number of workers. The decline in relative productivity found in the service industries as we move from low- to high-income countries and in the course of time as individual countries move from lower to higher income levels could be due to any of the terms on the right. One possibility is that the variation may be due not to differences in physical output per worker *(Q,IN,* and *Q,IN,)* but to differences in the relative compensation of labor in the two sectors (W, and W,,). Alternatively, the intersectoral differences in labor productivity may be attributed to differences in nonlabor costs, mainly capital costs (0, and 0j; that is, in either the quantity of capital per person or the rate of return on capital or both. A third explanation is that the intersectoral differences do indeed reflect differences in physical output per worker (the Qs in relation to the *Ns).*

It seems rather doubtful that high relative wages in services can explain the high sectoral productivity of services in poor countries. There is, indeed, some evidence that education and skill differentials tend to be higher in poor countries (Phelps Brown 1977, chapter 3), and some services are intensive in their use of educated and skilled personnel (e.g., medical services). On the other side, there is a clear tendency for service wages to rise with rising per-capita incomes. This tendency is revealed when ICP data on compensation of particular types of service workers are related to per-capita income. For example, exchange-rate-converted compensation of first- and second-level teachers (WTIXR) is related to real per-capita GDP (r) across the countries as follows:

$$\ln WTIXR = \underset{(1.0589)}{-2.8489} + \underset{(0.1349)}{0.8528} \ln r \qquad (2$$

where $R^2 = 0.600$, S.E.E. = 0.629, and n = 27. Price levels of commodities and services *(PPP,IXR* and *PPPs/XR)* generally tend to be correlated

Table 14
Estimates of coefficients of Inr and standard errors for five occupational groupings.

	Estimated coefficient'	Standard error
Unskilled government employees	0.79	0.07
Skilled government employees	0.64	0.07
White-collar government employees	0.56	0.07
First- and second-level teachers	0.44	0.11
Professional government employees	0.36	0.09

a. i, of $\ln(WT/Ppp(iDP) = go + g, Inr$

with income levels, so it is more relevant to consider compensation relative to the purchasing-power parity for GDP as a whole (PPP,,,):

$$\ln(WT/PPPGDP) = 0.7730 + 0.4361\ Inr$$
$$(0.8755)\ (0.1115)$$

(3)

where R' ~ 0.355, S.E.E. = 0.520, and n = 27.

Similar relationships indicating rising absolute and relative compensation are found for each of the four ICP categories of government employees. There is some indication, however, that among these groups, those with the most education tend to have relatively higher compensation in poor countries compared with their relative compensation in rich countries. The coefficients of Inr in equations like 3 for five groups, arrayed in what may be guessed to be an ascending order of educational qualifications, are given in table 14. Salaries of all groups rise with rising incomes, but those of the more educated groups tend to rise less." Thus, these occupational data provide some support for the hypotheses of higher income differentials for educated people in low-income countries. However, relative incomes in the whole set of service occupations are positively correlated with incomes and hence are lower rather than higher in poor countries. We do not know the extent of the education and skill intensities of workers in the service industries relative to commodity industries, but it seems unlikely that the differences in the intensities in conjunction with the differences in the labor market shown in table 14 are sufficient to produce such marked differences in sector productivity.

It is even less plausible to think that higher labor productivity in services relative to commodities in poor countries is attributable to larger amounts of capital. Table 10 and I I clearly show less physical capital per dollar of output in services than in commodities in very-low-income

countries. Conceivably, the smaller amount of capital could be more richly rewarded than capital employed in commodity production, but it is not at all apparent why this should be the case, and it is highly implausible that the differential in the rate of return could be large enough to inflate the product of the service sector in low-income countries sufficiently to produce the substantial differences in sectoral productivity that are observed.

We are left with the hypothesis that the poor country-rich country physical productivity ratios in the service industries, though well below unity, are higher than in commodity industries. There are two circumstances that point to this as the probable explanation. **One is the ICP** finding of low final-product prices in the services, an outcome that would be less likely if there were high factor rewards. (In assessing this result, however, it must be recognized that the sectoral-productivity indices pertain to an industrial classification while the price comparisons relate to categories of final product.) The second circumstance is the apparent tendency for the dispersion of country-to-country ratios of outputs per person to be greater across industries than the dispersions in the corresponding country-to-country wages per person (Kravis 1956). This tendency, though observed across manufacturing industries, suggests that the low service prices are more apt to be attributable to productivity differences than to wage differences.

Finally, in the area of the relative behavior of service and commodity prices over time, too, it may be surmised that the underlying explanation for the rise in service prices relative to commodity prices is to be found in productivity trends. One may speculate that technological advance in its innovative aspects may affect both commodity and service industries (especially transportation, communication, and health care among the latter), but that in its cost-reducing aspect it has borne most heavily on the commodity-producing industries. If so, the higher wages this made possible in such industries may have pushed service wages and thus service prices up in relation to commodity prices.

Conclusion

The analysis suggests that the driving force behind the expansion of service employment associated with higher per-capita incomes in both cross-national and intertemporal data is the evolution of technology

rather than the change in wants associated with rising income. This inference rests on the absence of any clear evidence that the income elasticity of demand is consistently (or even on the average) higher for final-product services than for final-product commodities, and the tendency for service prices to rise relative
national and intertemporal data). We ascribe this tendency to differential productivity ratios. Across countries, productivity is, of course, lower in poor countries relative to rich countries in both services and commodity-producing sectors, but it is lower by a larger margin in commodities. (The possibility that these differences may reflect mainly superior renumeration of the factors of production in service industries is rejected.)

It seems plausible that, in the creation of new ways of satisfying wants, technological changes are as important in service sectors (such as health care) as in commodity sectors, but that when it comes to cost reduction for existing products or services technological change is more frequent and more powerful in its effects in the commodity sector.

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Appendix

Glossary

Lower case refers to a poor country, upper case to a rich country.

q T, QT	Output of traded goods
q11' QIT	Output of nontraded goods
gdp, GDP	Gross ornestic pro uct
pop, POP	Population
S NT, sNT	Share of nontraded goods in gross national product
1T , *L* T	Labor input in producing traded goods
INT , *L* NT	Labor input in producing nontraded goods
P T, PT	Price of traded goods
P NT, pNT	Price of nontraded goods

k^{T}, K^{T}	Productivity per worker in traded-goods industry
k^{NT}, K^{NT}	Productivity per worker in nontraded-goods industry
w, W	Wages in both industries (equal because of labor mobility within each country)
XR	Exchange rate
μ	Markup in both industries in both countries (assumed equal for simplicity.)
p, P	Poor country's prices or wages expressed in rich country's currency by conversion at the exchange rate
C^{NT}	Poor country's labor productivity in nontraded-goods industry divided by the corresponding rich-country labor productivity
C^{T}	Poor country's labor productivity in traded-goods industry divided by the corresponding rich-country labor productivity
C	Ratio of C^{T} to C^{NT}
I^{XR}	Income comparison between the poor and rich countries obtained through exchange-rate conversion
I^{PPP}	Income comparison between the poor and rich countries obtained through purchasing-power-parity conversion

Algebraic Treatment

The production functions (where output depends on quantity and productivity of labor) are, for the poor country,

$$q^{T} = f_1(l^{T}, k^{T})$$

and

$$q^{NT} = f_2(l^{NT}, k^{NT}).$$

and, for the rich country,

$$Q^{T} = F_1(L^{T}, K^{T})$$

and

$$Q^{NT} = F_2(L^{NT}, K^{NT}).$$

The wage-price equations are, for the poor country,

$$p^{T} = \frac{l^{T} w}{q^{T}}(1 + \mu)$$

and

NT T,,,

P q NT +

and, for the rich country,

pT=L T W

QT 0 + *P)*

and

pNT = *L* NTw

QNT 0 + P).

The assumptions are (a) that pl pT (that is, the prices of traded goods are the same everywhere), and therefore p 11pT = XR, (b) that

CT < 1,

OT <

and

CI<CNT SOC<I

(that is, labor productivity is greater in rich countries than in poor but the differential is smaller in the nontraded-goods sector), and that

ITW

P *TITO + P) = W*TO + P*)*

k *k*

and

NT 1 INT W W

P = k NTINTO + P) = kNTO + 1*0*

for the poor country and

P, = L T W 0 + P) =- W 0 + P)

KT-L T

and

pNT = *L* NTw W

K NT *L* NTO + *P) = K* NTO +'U) for the rich country.

The exchange-rate conversions are

T - P T pNT P NT p

XR' XR XR

Therefore,

T = ~1' (1 + P), PNT = W - I + P (A 1)

P k T X R OT XR

PT I + /I r W W lk T IV

(0 _XR)/ [K T (I + W

p-NT _ (w I IV/ kNT /cNT (A3)

pNT N / [-IT + u] =

T u) [K W

(k XR

Under assumption a,

W = C.
W

It follows then from equation A3 that

p-NT (w W)/CNT CT

pNT (w W)/CT CNT

and

PNT

PNT = C.

Under assumption b

PNT j;NT < 1.

For the poor country,

gdp = q Tp T + q NTPNT

JXR gdp/pop / /GDP
XR POP'

,pop gdp/pop /GDP
PPP / POP'

iXR PPP(Paasche)

IPPP P XR

C I,

(A2)

$$\text{PPP}^{\text{Laspeyres}} = \frac{q^{\text{T}}p^{\text{T}} + q^{\text{NT}}p^{\text{NT}}}{q^{\text{T}}P^{\text{T}} + q^{\text{NT}}P^{\text{NT}}} = \frac{q^{\text{T}}P^{\text{T}}\text{XR} - q^{\text{NT}}p^{\text{NT}}\text{XR}}{q^{\text{T}}P^{\text{T}} + q^{\text{NT}}P^{\text{NT}}}$$

$$= \frac{q^{\text{T}}P^{\text{T}}}{q^{\text{T}}\overline{P}^{\text{T}}} \frac{q^{\text{NT}}P^{\text{NT}}C}{+ q^{\text{NT}}\overline{P}^{\text{NT}}}\text{XR},$$

$$\frac{I^{\text{XR}}}{I^{\text{PPP}}} = \frac{q^{\text{T}}P^{\text{T}} + q^{\text{NT}}P^{\text{NT}}C}{q^{\text{T}}P^{\text{T}} + q^{\text{NT}}\overline{P}^{\text{NT}}} = 1 + S^{\text{NT}}(C - 1) < 1;$$

for the rich country,

$$\text{GDP} = Q^{\text{T}}P^{\text{T}} + Q^{\text{NT}}P^{\text{NT}}$$

and

$$\frac{I^{\text{XR}}}{I^{\text{PPP}}} = \frac{\text{PPP}^{\text{Laspeyres}}}{\overline{\text{XR}}}.$$

Similar algebra leads to $I^{\text{XR}}/I^{\text{PPP}} < 1$. Furthermore, relaxing assumption a to allow the price level of tradables to be lower in the poor country than in the rich, $p^{\text{T}} < P^{\text{T}}$, leads to I^{PPP} exceeding I^{XR} by even more.

Notes

1. See chapter 5 of Kravis, Heston, and Summers 1982 for a discussion of the characteristics of services. See also Hill 1977.

2. To make this comparison it is necessary to shift from final-product definitions to an industrial classification.

3. For the ICP classification see Kravis, Heston, and Summers 1982, chapter 2 appendix.

4. The classification is by real per-capita GDP—i.e., own currency GDP converted to a common currency via purchasing-power parities rather than through exchange rates. See Kravis, Heston, and Summers 1982, table 1.2.

5. Exchange rate converted shares are the same as shares calculated from expenditures in own currency.

6. The price level is the PPP divided by the exchange rate, both taken relative to the U.S. dollar. The ratio of the real to the nominal per-capita GDP, referred to as the exchange-rate deviation index, is the reciprocal of the price level.

7. These figures are based on the treatment of government purchases of goods and services as commodities. Neither these figures nor the others in table 2 are altered very much if these purchases are classified with services.

8. There are at least two sources of possible error in these constant-price comparisons: there may be errors in the deflators for both goods and services, and there are probably incomparabilities in deflation procedure between the countries. It would be a major task to investigate these possible errors, and this task has not been attempted. In any case, there does not appear to be any obvious direction in these possible errors.

9. Clark (1979, pp. 147 -155) reports similar results for Australia, Belgium, France, Japan, and the United States. However, Clark makes the point for Japan that from 1926 to 1960 service productivity apparently rose as rapidly as commodities, as only after 1960 did service prices rise substantially relative to commodities.

10. 1975 data from *Surve - y of Current Business,* July 1977, p. 29. Expenditures on admissions to spectator sports were $1.6 billion. If the $3.7 billion spent in producing and broadcasting TV entertainment were included, the service expenditure would still be only 33 percent of the enlarged recreation total. The TV expenditure estimate was kindly provided by John E. Cremeans of the U.S. Department of Commerce. For the methods underlying this estimate see Cremeans 1979.

11. The log-linear functional form for the demand functions must be regarded as only an approximation to the true functional form. Postulating that the income elasticity of each good is the same at all levels of income cannot be right unless the elasticities are equal to unity. This is because the weighted average of the elasticities, with the shares of total expenditure devoted to each good as the weights, must be equal to unity. The income elasticities reported in table 7 meet this condition (using the average share for all 34 countries as weights), suggesting that perhaps the approximation is acceptable. However, such income elasticities estimated from the time-series data underlying table 5 (reported in table 9) do not average out to unity.

12. The original source is Kuznets 1957 ' see p. 41 for the data and p. 53 for Kuznets's discussion of the meaning of sectoral productivity measures. See also the revision reaching the same conclusions on the basis of later data: Kuznets 197 1, pp. 208 248. The latter part of that section (pp. 236ff.) considers the possible explanations for the observed intersectoral differences.

13. The labor force employed in agriculture, mining, manufacturing, and construction was regarded as engaged in commodity production, while that employed in electricity, gas and water, transportation and communication, trade, finance, and real estate, and community and social services was regarded as engaged in service production. The percentage shares were calculated on the basis of the labor force, excluding those whose industrial affiliation was unknown. Labor-force data were from International Labor Organization 1979. For production, a similar division was used. The categories treated as services were electricity, gas and water, transportation and communication, trade and finance, public administration and defense, and others (including ownership of dwellings, private services, and any statistical discrepancy from the use of alternative methods of estimating GDP). Data were from International Bank for Reconstruction and Development 1980.

14. Stern and Lewis 1980. This set of coefficients did not include labor coefficients for agriculture for low-income countries. These coefficients were approximated on the basis of the relations within the 1973-74 input-output table for India. The labor-requirement coefficients for India were kindly supplied by R. G. Nambiar.

15. The weights were based on data for 29 of the 34 countries in phase III of the ICP. The relative importance of broad sectors (agriculture, manufacturing, etc.) was based on data in United Nations 1979, and the breakdown within manufacturing, which contained the large preponderance of the Stern-Lewis sectors. was based on data in United Nations 1975.

16. This is true of any weighted combination of the inputs.

17. (0.15 x 0.622/0.937) + (0.85 x 0.200/0.067) = 2.64, where the weights 0. 15 and 0.85 are from Kravis, Heston, and Summers 1982 and the ratios are the ratios respectively of capital and labor requirements for a dollar's worth of GDP of group I to group V1 taken from table 10. The weighted average use of labor and capital per dollar of output in the group I countries is 2.64 times that of group V1. The reciprocal of 2.64, 0.38, may be taken as the productivity ratio.

18. The difficulty of treating the agricultural sector in group I countries, noted above, may be an important factor. Another possibility is that the more extensive unemployment and underemployment in low-income countries pull down relative real per-capita incomes below the level implied by labor requirements per unit of output.

19. Elliot 1975, chapters 7 and 8 and particularly pp. 189-190. Elliot attributes some of these differences to the heritage of colonial salary structures, and reports that although they have been reduced in some countries they still tend to exceed those in higher-income countries.

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