CHAPTER SIX

ON ESTIMATING THE RATE OF RETURN TO CAPITAL IN COLOMBIA

INTRODUCTION

The historical rate of return to capital in any country is a matter of interest both because it provides a basis for assessing the contribution of capital investment to the growth process and also because it is a key guide for estimating the opportunity cost of capital—a figure which in turn has a major role to play in the evaluation of projects by the public sector. The historical rate of return can be obtained for any year by taking the ratio of (a) that part of the national income which accrues to capital during the year to (b) the value of the national capital stock at the beginning of the year, with both (a) and (b) expressed in terms of prices of the same year. The problem is that we do not have direct information on either factor.

The national income accounts of Colombia explicitly segregate wage and salary payments, but it would be incorrect to attribute the remainder of the national income as income accruing to capital. The problem here concerns the income accruing to independent proprietors and partners in unincorporated enterprises. Some part of this income typically represents a compensation for the labor of the individual in question and possibly (especially in the cases of farms and small businesses) of his family members. Such income typically shows up as part of the profits of the enterprise, because the individuals concerned do not receive direct wage and salary payments. The problem, then, is how much of what is called *ingreso de las*

unidades familiares procedente de la propiedad y de empresas no constituidas en sociedades de capital should be added to the *Remuneración de los asalariados* before we regard the remainder of the national income as accruing to capital. This problem would exist even if there were no errors of estimation in the national accounts. It is naturally made more serious to the extent such errors exist.

With respect to (b), the problem is still more difficult. To my knowledge, there are no estimates of the entire capital stock of Colombia—or even of major segments of it such as fixed reproducible capital—for any year. And the data needed to obtain estimates that would deserve the term 'reliable' are simply unavailable.

Does this not render impossible the effort to estimate the rate of return to capital in the Colombian economy? I believe not. We obviously are not going to be able to have exact or nearly-exact estimates of either (a) or (b), but we can probably find plausible ranges for each of them, through judicious sifting of the available information. Using these ranges, in turn, we can obtain a plausible span of values for the ratio of (a) to (b), which is the rate of return that we seek.

THE NET EARNINGS OF CAPITAL

During the years 1951–60, wage and salary payments as reported in the national income accounts averaged around 40 percent of national income, with a rising tendency beginning about 1958. By 1962–67 this percentage appears once again to have stabilized, this time around 44 percent. Our first task is to estimate the imputed income generated by the labor effort of proprietors, independent workers, and unpaid family members. Fortunately, Robert L. Slighton has made such an estimate, in his study *Relative Wages, Skill Shortages, and Changes in Income Distribution in Colombia* (Table 2), for all sectors other than agriculture. Slighton uses three alternative assumptions to generate imputed labor income; for the purposes of this study, and for reasons that will become evident later, we shall adopt the lowest of his estimates, based on the assumption that in each sector the average labor income generated by the typical proprietor, independent worker, and unpaid family member is

equal to 80 percent of the average earnings of white- and blue-collar workers in that sector. On this assumption the imputed income accruing to proprietors, independent workers, and unpaid family members outside of agriculture was equal to 29·2 percent of non-agricultural wages and salaries in 1964. In Table 6.1, column 2, this percentage is applied to non-agricultural wages and salaries in each of the years 1960-67 to generate estimates of imputed non-agricultural labor income for these years.

In agriculture, the number of proprietors, independent workers, and unpaid family members exceeds the number of wage and salary earners by more than 30 percent; that is to say, these groups constitute over 55 percent of the total labor force. Their labor earnings have been estimated for 1964 using the following assumptions: the labor of the average proprietor (most of whom operate very small farms) is valued at 120 percent of the average earnings of wage and salary workers in agriculture, and the labor of the average independent worker is valued at 80 percent of this same figure.[1] For unpaid family members (many of whom are women and children who work only part of the normal agricultural work year), we imputed an average value-of-labor equal to 50 percent of the average earnings of wage and salary workers in agriculture. These assumptions combined to generate, for the three groups together in 1964, an imputed labor income equal to 110 percent of the wages and salaries paid in agriculture.

In Table 6.1, column 4, this percentage is applied to total agricultural wages and salaries to generate figures on imputed labor income within agriculture. In column 5, total labor income (including imputed income) is presented. This figure is subtracted from national income in order to produce the estimates of total income accruing to capital that are given in column 7. Finally, in column 8, the estimates of income accruing to capital are expressed as fractions of the national income.

Because our procedures for estimating the capital stock generate estimates that are expressed in pesos of 1958 purchasing power, we apply to national income in 1958 the fractions derived in column 8 of Table 6.1. This is done in Column 2 of Table 6.2. At the same time, we generate in

TABLE 6.1

Estimates of Income Accruing to Capital

(In Millions of Current Pesos, Except Column 8)

Year	(1) Total wages and salaries paid outside agriculture	(2) Imputed labor income outside agriculture = (1) × ·292	(3) Total wages and salaries paid within agriculture	(4) Imputed labor income within agriculture = (3) × 1·1	(5) Total labor income = (1) + (2) + (3) + (4)	(6) National income	(7) Total income accruing to capital = (6) − (5)	(8) Fraction of national income accruing to capital (7) ÷ (6)
1960	6,533	1,908	2,669	2,936	14,046	22,104	8,058	·365
1961	7,846	2,291	3,029	3,332	16,498	25,476	8,978	·352
1962	9,459	2,762	3,357	3,693	19,271	28,819	9,548	·331
1963	12,236	3,573	4,360	4,796	24,965	36,402	11,437	·314
1964	14,345	4,189	4,979	5,477	28,990	45,356	16,366	·361
1965	16,365	4,779	5,936	6,530	33,610	51,000	17,390	·341
1966	20,194	5,897	6,560	7,216	39,867	60,360	20,493	·340
1967	23,253	6,790	7,429	8,172	45,644	68,802	23,158	·337

column 3 an alternative set of estimates of income accruing to capital, expressed in pesos of constant purchasing power. We call the first set of estimates R_a, and the second set R_b.

TABLE 6.2

Estimates of Income Accruing to Capital

(in Billions of 1958 Pesos)

Year	(1) National income	(2) R_a = (1) × col. (8) Table 6.1	(3) R_b = (1) × ·4
		Income accruing to capital	
1960	18·246	6·725	7·298
1961	19·131	6·734	7·652
1962	20·173	6·677	8·086
1963	20·757	6·610	8·303
1964	22·884	8·261	9·154
1965	23·491	8·010	9·396
1966	24·825	8·441	9·930
1967	25·749	8·677	10·300

The alternative set is presented because, in my own opinion and that of a number of other economists I have consulted, it is indeed unusual for labor's share in national income to be as high as 65 percent in a country at Colombia's level of development.

Many countries with income per head equal to or greater than Colombia's have labor shares ranging between 50 and 60 percent. And it is quite possible that the procedures used by Slighton and by me to estimate imputed labor income have overstated the true value of such income. We have accordingly based R_b on the assumption that 60 percent of the national income accrues to labor, and 40 percent to capital.

ESTIMATING THE STOCK OF FIXED CAPITAL ASSETS

Colombia's national income accounts distinguish four categories of gross investment in fixed assets: (a) buildings; (b) other construction and works (including roads, railways, aqueducts, sewers, telephone and telegraph investments, land

clearing, irrigation works, fences, and so forth; (c) transport equipment; and (d) machinery and other equipment. For our purposes, we have aggregated (a) and (b) into one category, buildings and other construction, and (c) and (d) into another, machinery and equipment. For each of these categories a series of estimates of capital stock was generated, using the following procedure. First, an estimate was made of the capital stock at the beginning of 1952, this estimate being in part based on an assumed depreciation rate for the category. Capital stock at the beginning of 1953 was then obtained by first reducing the 1952 capital stock by the assumed depreciation rate, and then adding gross investment in that category during 1952, less one-half year's depreciation on such gross investment. The same procedure was followed for subsequent years.

When, for given assumed depreciation rates on the two major categories of investment, the procedure described above had been completed, the results were checked for plausibility in two different ways. The first check consisted of computing the total depreciation implied for each year by our procedure, and comparing it with the figures for depreciation given in the national accounts. The second check consisted of taking the ratio of estimated capital stock to GNP and to national income, in order to assess its reasonableness.

The details of the procedure will become apparent from the calculations presented below. These calculations will be based on assumed depreciation rates of 2·5 percent per year for buildings and other construction and 8 percent per year for machinery and equipment. To estimate the capital stock at the beginning of 1952, the following relationship was employed:

$$GI = (\delta + \gamma)K. \quad (1)$$

Here GI refers to gross investment, γ to the annual rate of growth of the capital stock, δ to the annual rate of depreciation, and K to the capital stock at the beginning of the year. For example, if the initial capital stock were 100, and if it were to grow by 5 percent in the following year while being subject to 10 percent annual depreciation, gross investment would have to be 15—10 to make up for the loss of capital through depreciation, and 5 to provide for the 5 percent growth of the capital stock that we have assumed. Our procedure goes through the

same sort of calculation in reverse: if we are prepared to assume a depreciation rate of 10 percent and a growth rate of the capital stock equal to 5 percent, and if we observe that gross investment is equal to 15, we infer that the initial capital stock was 100.

In the years from 1950 to 1953, both gross domestic product and national income in Colombia were growing at almost exactly 5 percent per year. We shall assume here that the normal rate of growth of capital in the form of buildings and other construction was also 5 percent at that time. However, because of the likelihood that war-induced shortages of machinery and equipment were not yet completely overcome, we shall assume that the stocks of these assets had a normal growth rate of some 6 percent per year during this period.

In the first exercise to be presented, it will be assumed that buildings and other construction have a depreciation rate of 2·5 percent per year, and that machinery and equipment have a depreciation rate of 8 percent per year. These depreciation rates, as will be seen, yield estimates of total depreciation that are quite close to those given in the national accounts.

In order to generate initial capital stock in 1952, 'normal' 1952 investment was estimated by taking the average gross investment for the three years 1951-53 in each of the two categories. The calculation of initial 1952 stock is shown in Table 6.3.

Tables 6.4 and 6.5 show how estimates of capital stock and

TABLE 6.3

Value of Stock in Colombia, 1952

(Columns 1 and 4, Billions of 1958 Pesos; Columns 2 and 3, Annual Rates)

	(1) Average gross investment, 1951-53	(2) Assumed depreciation rate (δ)	(3) Assumed growth rate of capital stock (γ)	(4) Estimated initial (1952) capital stock = (1)÷[(2)+(3)]
Buildings and other construction	1·368	·025	·05	18·24
Machinery and equipment	1·876	·08	·06	13·40

of annual depreciation are generated on the basis of the assumptions summarized in Table 6.3. In Table 6.6, the annual amounts of depreciation implied by Tables 6.4 and 6.5 are compared with the depreciation figures given in the national accounts. As can be seen, the correspondence is very close. For no single year does the implied figure differ by as much as 10 percent from that presented in the national accounts, and the average amounts of depreciation in Columns 1 and 2 are only 1·3 percent apart.

TABLE 6.4

Estimation of Capital Stock of Buildings and other Construction

(In Billions of 1958 Pesos)

Year	(1) Entering stock = (1)+(2) −(5) of previous year	(2) Gross investment during year[a]	(3) Depreciation on stock = ·025 × (1)	(4) Depreciation on gross investment = ·0125 × (2)	(5) Total depreciation = (3)+(4)
1952	18·24[b]	1·34	·46	·02	·48
1953	19·10	1·53	·48	·02	·50
1954	20·13	1·95	·50	·02	·52
1955	21·56	2·07	·54	·03	·57
1956	23·06	2·10	·58	·03	·61
1957	24·55	2·07	·61	·03	·64
1958	25·98	1·95	·65	·02	·67
1959	27·26	2·21	·68	·03	·71
1960	28·76	2·13	·72	·02	·74
1961	30·15	2·34	·75	·03	·78
1962	31·71	2·47	·79	·03	·82
1963	33·36	2·25	·83	·03	·86
1964	34·75	2·38	·87	·03	·90
1965	36·23	2·39	·91	·03	·94
1966	37·68	2·62	·94	·03	·97
1967	39·33	3·13	·98	·04	1·02

[a] From *National Accounts of Colombia*; sum of gross investment in 'buildings' and 'other construction and works'.

[b] From Table 6.3, row 1, column 4.

In Table 6.7 the ratios of fixed capital to GNP and to national income are presented, with the estimates of fixed capital being based on the assumptions listed in Table 6.3.

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TABLE 6.5

Estimation of Capital Stock of Machinery and Equipment Including Transportation Equipment

(In Billions of 1958 Pesos)

Year	(1) Entering stock = cols. 1+2−5 for previous year	(2) Gross investment during year^a	(3) Depreciation on stock = ·08 × col. 1	(4) Depreciation on gross investment = ·04 × col. 2	(5) Total depreciation = cols. 3+4
1952	13·40^b	1·64	1·07	·07	1·14
1953	13·90	2·48	1·11	·10	1·21
1954	15·17	2·72	1·21	·11	1·32
1955	16·57	2·86	1·33	·11	1·44
1956	17·99	2·58	1·44	·10	1·54
1957	19·03	2·44	1·52	·10	1·62
1958	19·85	1·39	1·59	·06	1·65
1959	19·59	1·37	1·57	·06	1·63
1960	19·33	2·10	1·55	·08	1·63
1961	19·80	2·24	1·58	·09	1·67
1962	20·37	2·13	1·63	·09	1·72
1963	20·78	1·98	1·66	·09	1·74
1964	21·02	2·38	1·68	·10	1·78
1965	21·62	2·11	1·73	·10	1·83
1966	21·90	2·24	1·75	·11	1·86
1967	22·28	2·05	1·78	·10	1·88

a From *National Accounts of Colombia*; sum of gross investment in transport equipment and machinery and other equipment.

b From Table 3, row 2, column 4.

These estimates appear to be on the low side, when judged against data for other countries. Moreover, the implication of Table 6.5, that the stock of machinery and equipment in Colombia grew by only 66 per cent during the period 1952–67, while gross domestic product was gaining by 98 percent in real terms, and national income by 89 percent, also appears to be on the low side (although there is obviously no theoretical ground for precluding such a possibility).

The doubts expressed in the previous paragraph are not serious enough to warrant the outright rejection of the estimates generated in Tables 6.4 and 6.5, but they clearly warrant exploring the consequences of some alternative assumptions. This is particularly so in the light of the fact that many obser-

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TABLE 6.6

Depreciation Check^a

(In Billions of 1958 Pesos)

Year	(1) Depreciation implied by^b Tables 6.4 and 6.5	(2) Depreciation from national accounts	(3) Difference
1952	1·62	1·52	+ ·10
1953	1·71	1·62	+ ·09
1954	1·84	1·81	+ ·03
1955	2·01	2·05	− ·04
1956	2·15	2·25	− ·10
1957	2·26	2·43	− ·17
1958	2·32	2·44	− ·12
1959	2·34	2·45	− ·11
1960	2·37	2·48	− ·11
1961	2·45	2·58	− ·13
1962	2·54	2·67	− ·13
1963	2·60	2·71	− ·11
1964	2·68	2·70	− ·02
1965	2·77	2·71	+ ·06
1966	2·83	2·72	+ ·11
1967	2·90	2·74	+ ·16
Total	37·39	37·88	− 0·49

a Based on assumptions presented in Table 6.3.

b Sum of total depreciation figures from Tables 6.4 and 6.5.

vers of the Colombian economic scene are of the view that the amounts of depreciation (capital consumption allowances) are overstated by the national income accounts. We have accordingly arbitrarily reduced by 20 percent the amounts of depreciation given in these accounts, and have sought a plausible set of assumptions regarding depreciation rates (in our two categories of assets) which are compatible with the national accounts depreciation figures thus adjusted. These assumptions are that buildings and other construction depreciate at 2 percent per year, while machinery and equipment depreciate at 5 percent per year. These assumptions, plus the estimates of initial stocks that they imply, are summarized in Table 6.8.

Tables 6.9 and 6.10 derive estimates of capital stock and of depreciation for the two categories of fixed assets, on the basis of the assumptions summarized in Table 6.8. In Table 6.9, the depreciation check is presented, showing that depreciation rates

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TABLE 6.7
National Income Check[a]

(In Billions of 1958 Pesos)

	(1) Entering total stock of fixed capital (K_t)	(2) Gross domestic product (GDP)	(3) National income (Y)	Ratios	
Year				(4) K_t to GDP	(5) K_t to Y
1952	31·64	16·1	13·6	1·97	2·33
1953	33·00	17·1	14·8	1·93	2·23
1954	35·30	18·3	16·4	1·93	2·15
1955	38·13	19·0	16·2	2·01	2·35
1956	41·05	19·7	16·8	2·08	2·44
1957	43·58	20·2	16·7	2·16	2·61
1958	45·83	20·7	16·5	2·21	2·78
1959	46·85	22·2	17·5	2·11	2·68
1960	48·09	23·1	18·2	2·09	2·64
1961	49·95	24·3	19·1	2·06	2·61
1962	52·08	25·6	20·2	2·03	2·58
1963	54·14	26·5	20·8	2·04	2·60
1964	55·77	28·1	22·9	1·98	2·44
1965	57·85	29·1	23·5	1·99	2·46
1966	59·58	30·7	24·8	1·94	2·40
1967	61·61	31·9	25·7	1·93	2·40
				2·03	2·48

a Based on assumptions presented in Table 6.3.

TABLE 6.8
Estimated Value of Initial Capital Stock, 1952

(Columns 1 and 4, Billions of 1958 Pesos; Columns 2 and 3, Annual Rates)

	(1) Average gross investment 1951–53	(2) Assumed depreciation rate (δ)	(3) Assumed growth rate of capital stock (γ)	(4) Estimated initial (1952) capital stock = col. 1 ÷ [cols. 2 + 3]
Buildings and other construction	1·368	·02	·05	19·54
Machinery and equipment	1·876	·05	·06	17·05

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of 2 percent per year on buildings and other construction, and of 5 percent per year on machinery and equipment, imply annual amounts of depreciation which are very close to the adjusted national accounts figures.[2]

TABLE 6.9
Estimation of Capital Stock of Buildings and Other Construction

(In Billions of 1958 Pesos)

	(1) Entering stock = cols. 1 + 2 – 5 of previous year	(2) Gross investment during year[a]	(3) Depreciation in stock = ·02 × col. 1	(4) Depreciation in gross investment = ·01 × col. 2	(5) Total depreciation = cols. 3 + 4
Year					
1952	19·54[b]	1·34	·39	·01	·40
1953	20·48	1·53	·41	·02	·43
1954	21·58	1·95	·43	·02	·45
1955	23·08	2·07	·46	·02	·48
1956	24·67	2·10	·49	·02	·51
1957	26·26	2·07	·53	·02	·55
1958	27·78	1·95	·56	·02	·58
1959	29·17	2·21	·58	·02	·60
1960	30·78	2·13	·62	·02	·64
1961	32·27	2·34	·65	·02	·67
1962	33·94	2·47	·68	·02	·70
1963	35·71	2·25	·71	·02	·73
1964	37·23	2·38	·74	·02	·76
1965	39·85	2·39	·80	·02	·82
1966	41·42	2·62	·83	·03	·86
1967	43·18	3·13	·86	·03	·89

a From *National Accounts of Colombia*; sum of gross investment in buildings and other construction and works.
b From Table 6.8, row 1, column 4.

Table 6.12 presents the national income check. On the particular points on which the results of the earlier exercise gave us pause, those of the present one are considerably superior. The ratios of fixed capital stock to GDP and to national income are more in accord with other countries' experience, and the growth of the stock of machinery and equipment (79 percent between 1952 and 1957) does not strike one as implausibly low, particularly in the light of the import restrictions that were applied with varying intensity throughout the period.

TABLE 6.10

Estimation of Capital Stock of Machinery and Equipment including Transportation Equipment.

(In Billions of 1958 Pesos)

Year	(1) Entering stock = cols. 1+2−5 of previous year	(2) Gross investment during year[a]	(3) Depreciation on stock = ·05 × col. 1	(4) Depreciation on gross investment = ·025 × col. 2	(5) Total depreciation = cols. 3+4
1952	17·05[b]	1·64	·85	·04	·89
1953	17·80	2·48	·89	·06	·95
1954	19·33	2·72	·97	·07	1·04
1955	21·01	2·86	1·05	·07	1·12
1956	22·75	2·58	1·14	·06	1·20
1957	24·13	2·44	1·21	·06	1·27
1958	25·30	1·39	1·27	·03	1·30
1959	25·39	1·37	1·27	·03	1·30
1960	25·46	2·10	1·27	·05	1·32
1961	26·24	2·24	1·31	·05	1·36
1962	27·12	2·13	1·36	·05	1·41
1963	27·84	1·98	1·39	·05	1·44
1964	28·38	2·38	1·42	·06	1·48
1965	29·28	2·11	1·46	·05	1·51
1966	29·88	2·24	1·49	·05	1·54
1967	30·54	2·05	1·53	·05	1·58

[a] From *National Accounts of Colombia*; sum of gross investment in transport equipment and machinery and other equipment.

[b] From Table 6.8, row 2, column 4.

Another interesting feature of the results of Table 6.12 is the close correspondence between the average capital-output ratios there derived, and the marginal capital-output ratios derived from the national income accounts. Between the beginning of 1952 and the beginning of 1957, accumulated gross investment was 63·45 billion 1958 pesos. During the same period adjusted depreciation (that is, ·8 times the national accounts figures) was 28·12 billion 1958 pesos. Accumulated net investment, based on adjusted depreciation figures, was therefore 35·33 billion pesos. The change in GNP between 1952 and 1967 was 15·85 billion 1958 pesos. The implied marginal capital-output ratio of 2·23 is quite close to the 2·37 average figure emerging from Table 6.12. The correspondence is even closer when the

TABLE 6.11

Depreciation Check[a]

(In Billions of 1958 Pesos)

Year	(1) Depreciation implied by Tables 6.9 and 6.10[b]	(2) Depreciation from national accounts × 0·8	(3) Difference
1952	1·29	1·22	+·07
1953	1·38	1·30	+·08
1954	1·49	1·45	+·04
1955	1·60	1·64	−·04
1956	1·71	1·80	−·09
1957	1·82	1·94	−·12
1958	1·88	1·95	−·07
1959	1·90	1·96	−·06
1960	1·96	1·98	−·02
1961	2·03	2·06	−·03
1962	2·11	2·14	−·03
1963	2·17	2·17	−·00
1964	2·24	2·16	+·08
1965	2·33	2·17	+·16
1966	2·40	2·18	+·22
1967	2·47	2·19	+·28
Total	30·78	30·31	+0·47

[a] Based on assumptions presented in Table 6.8.

[b] Sum of total depreciation figures from Tables 6.9 and 6.10.

ratio of fixed capital to adjusted national income (Y') is taken. The change in Y' between 1952 and 1967 was 12·43 billion 1958 pesos; the marginal capital-output ratio obtained by taking $\Delta K_f / \Delta Y'$ over this period is 2·84, almost exactly the same as the 2·83 figure that we obtain for the average capital-output ratio in Table 6.12. This correspondence is reassuring, although it must be recognized that there is no theoretical necessity or presumption that the marginal capital-output ratio should be equal or close to the average.

The exercise summarized in Tables 6.8 through 6.12 thus yields results which are more plausible than those emerging from the exercise developed in Tables 6.3 through 6.7. Given this fact, it is important that readers fully understand the implications of the depreciation adjustment which is the fundamental source of the differences between the two exercises. The

TABLE 6.12

National Income Check[a]

(In Billions of 1958 Pesos)

	(1)	(2)	(3)	(4)	
	Entering total stock of fixed capital (K_f)	Gross domestic product (GDP)	National income (Y) + 20% of depreciation (Y')	Ratios	
Year				K_f to GDP	K_f to Y'
1952	36·59	16·1	13·9	2·27	2·63
1953	38·28	17·1	15·1	2·24	2·54
1954	40·91	18·3	16·8	2·24	2·44
1955	44·09	19·0	16·6	2·32	2·66
1956	47·42	19·7	17·3	2·41	2·74
1957	50·39	20·2	17·2	2·49	2·93
1958	53·08	20·7	16·9	2·55	3·14
1959	54·56	22·2	18·0	2·46	3·03
1960	56·24	23·1	18·7	2·43	3·01
1961	58·51	24·3	19·6	2·41	2·99
1962	61·04	25·6	20·7	2·38	2·95
1963	63·55	26·5	21·3	2·40	2·98
1964	65·61	28·1	23·4	2·33	2·80
1965	69·13	29·1	24·0	2·38	2·88
1966	71·30	30·7	25·3	2·32	2·82
1967	73·72	31·9	26·3	2·31	2·80
Average				2·37	2·83

[a] Based on assumptions presented in Table 6.8.

national accounts series on gross national product remains unaffected by the downward adjustment of the depreciation figures. However, since depreciation is one of the main elements that is subtracted from GNP to obtain national income, the downward adjustment of depreciation implies a corresponding upward adjustment of the national income. This is what was done to generate the series on Y' in column 3 of Table 6.12.

A similar adjustment is required for our series on income accruing to capital. The adjustment of depreciation does not affect the series on wage and salary payments, nor does it impinge on the procedures we used to derive imputed labor income. Since the earnings accruing to labor remain unaffected by the downward adjustment of the depreciation figures, this latter adjustment has as its direct counterpart a corresponding

increase in the net income accruing to capital. This adjustment is presented in Table 6.13, columns 4 and 5.

TABLE 6.13

Revised Estimates of Net Income Accruing to Capital, Reflecting a 20 Percent Downward Adjustment of Official Depreciation Figures

(In Billions of 1958 Pesos)

	Initial estimates		(3)	Revised estimates	
	(1)	(2)		(4)	(5)
	R_a (Table 6.2, col. 2)	R_v (Table 6.2, col. 3)	Revision = 20% of national accounts depreciation	= Cols. 1 + 3 (R_a')	= Cols. 2 + 3 (R_v')
Year					
1960	6·73	7·30	·50	7·23	7·80
1961	6·73	7·65	·52	7·25	8·18
1962	6·68	8·09	·53	7·21	8·62
1963	6·61	8·30	·54	7·15	8·84
1964	8·26	9·15	·54	8·80	9·69
1965	8·01	9·40	·54	8·55	9·99
1966	8·44	9·93	·54	8·99	10·47
1967	8·68	10·30	·55	9·23	10·85

It should be noted for future reference that wherever figures from column 1 of Table 6.7 are used for fixed capital stock, the corresponding income figures should be those from Table 6.2. By the same token, wherever figures from column 1 of Table 6.12 are used for fixed capital stock, the corresponding figures on income accruing to capital should be those from Table 6.13.

INVENTORIES

From the beginning of 1952 to the beginning of 1967, net inventory accumulation in Colombia, according to the national accounts, totaled 6·87 billion 1958 pesos. During the same period the increment in gross domestic product was 15·85 billion 1958 pesos. The marginal inventory/GDP ratio was thus 0·43. If this is applied to the 1952 GDP (16·1 billion pesos) in order to estimate the inventory stock at the beginning of 1952, a figure of 6·92 billion pesos is obtained for that stock.[3]

Starting from 6·92 billion 1952 pesos as the base, annual inventory changes were accumulated to yield the inventory-stock series given in Table 6.14.

TABLE 6.14

Stocks of Inventories

(In Billions of 1958 Pesos)

Year	Inventory stock at beginning of year
1960	9·15
1961	9·70
1962	10·38
1963	10·61
1964	11·09
1965	11·68
1966	12·40
1967	13·79

LAND

Land is by far the most difficult category for which to estimate capital value. The only available Colombian data are collections of property value assessments for tax purposes. These tend to be significantly out of date, a problem made even more acute by Colombia's rapid rate of inflation. There is also the problem of how accurately the assessments reflect market values, even at the moment when they are completed. Finally, there are problems connected with the fact that the statistics generated by the official assessments in Colombia do not distinguish be-[b] tween land and improvements.

Rather than contend directly with all these difficulties in the Colombian data, we shall follow an alternative estimation procedure. Goldsmith, Lipsey, and Mendelson[4] have recorded the values of land, structures (residential and nonresidential), producer durables, and inventories in the United States for the years 1945–58. From these data we compute the ratios of land to the sum of structures, producer durables, and inventories on the one hand and of land to GNP on the other, for each of the fourteen years. Then, since there is not a significant trend in either of these ratios, we take their fourteen-year averages and apply them to the corresponding Colombian concepts (that is,

to buildings and other construction plus machinery and equipment plus inventories, for which sum we have two alternative series, and to GDP) to obtain three sets of land value estimates for the years 1960–67. Of course, such estimates cannot be ideal. However, they do give a plausible range of land values, and, perhaps more important, the implied values are not subject to the same degree of capriciousness as would be those derived from the tax assessment data.

TABLE 6.15

Ratios of Land to the Sum of Structures, Producer Durables and Inventories, and Land to GNP, for the United States

(In Billions of Current Dollars)

Year	(1) Land	(2) Sum of structures, producer durables, and inventories[a]	(3) GNP[b]	(4) Land/ Sum	(5) Land/ GNP
1945	121·5	386·9	211·9	·314	·574
1946	142·0	472·1	208·5	·301	·681
1947	164·2	568·3	231·3	·289	·711
1948	178·9	623·1	257·6	·287	·695
1949	176·0	622·6	256·5	·281	·686
1950	201·7	713·8	284·8	·283	·707
1951	221·6	779·4	328·4	·284	·674
1952	226·7	817·6	345·5	·277	·657
1953	228·0	854·2	364·6	·267	·625
1954	238·3	887·9	364·8	·269	·653
1955	256·1	953·6	398·0	·273	·643
1956	274·1	1036·3	419·2	·264	·654
1957	295·7	1110·2	441·1	·266	·670
1958	310·8	1163·5	447·3	·267	·710
Averages				·283	·667

[a] *Studies in the National Balance Sheet of the United States*, Vol. II: *Basic Data*. National Bureau of Economic Research, Princeton University Press, 1963, pp. 42–69.

[b] *Economic Report of the President* (Washington, D.C.: U.S. Government Printing Office, 1970), p. 177.

As seen in Table 6.16, the largest land value estimates, for all eight years, are those derived from the other three components of capital stock, including the depreciation adjustments

(column 5); the lowest are those derived from GDP (column 6); Consequently, in the calculations of the rate of return to capital which follow, the results of column 5 will be used with the depreciation-adjusted capital stock data and the results of column 6 will be used with the nonadjusted data. (The land value estimates in column 4 will henceforth be ignored.)

TABLE 6.16

Estimates of the Value of Land in Colombia

(In Billions of 1958 Pesos)

Year	(1) Unadjusted^a *Sum of buildings, construction, machinery, equipment, and inventory*	(2) Depreciation adjustment^b	(3) GDP^c	(4) Col. 1 ×·283	(5) Col. 2 ×·283	(6) Col. 3 ×·667
1960	57·24	65·39	23·1	16·19	18·48	15·40
1961	59·65	68·21	24·3	16·89	19·30	16·20
1962	62·46	71·44	25·6	17·68	20·21	17·08
1963	64·75	74·62	26·5	18·31	21·10	17·69
1964	66·86	76·70	28·1	18·90	21·70	18·22
1965	69·53	80·81	29·1	19·69	22·85	19·40
1966	71·98	83·70	30·7	20·38	23·70	20·47
1967	75·40	87·51	31·9	21·35	24·79	21·28

^a From Tables 6.4, 6.5, and 6.14.
^b From Tables 6.9, 6.10, and 6.14—contains depreciation adjustments.
^c From Table 6.12.

ESTIMATES OF CAPITAL STOCK AND THE RATE OF RETURN: NO DEPRECIATION ADJUSTMENT

Table 6.17 presents estimates of the total capital stock for the years 1960 through 1967 on the basis of the assumptions presented in Table 6.3 (accepting at face value the depreciation figures of the national accounts). In Table 6.18 these figures are compared with the two alternative series on income accruing to capital (R_a and R_b) which are consistent with these assumptions.

TABLE 6.17

Estimates of Capital Stock at Beginning of Year, No Depreciation Adjustment

(In Billions of 1958 Pesos)

Year	(1) Fixed capital (Table 6.7, col. 1)	(2) Inventories (Table 6.14)	(3) Land (Table 6.16, col. 6)	(4) Total capital stock (K) (cols. 1 + 2 + 3)
1960	48·09	9·15	15·40	72·64
1961	49·95	9·70	16·20	75·85
1962	52·08	10·38	17·08	79·54
1963	54·14	10·61	17·69	82·44
1964	55·77	11·09	18·22	85·08
1965	57·85	11·68	19·40	88·93
1966	59·58	12·40	20·47	92·45
1967	61·61	13·79	21·28	96·68

TABLE 6.18

Estimates of Rate of Return, No Depreciation Adjustment

(Columns 1–3: Billions of 1958 Pesos; Columns 4–5: Annual Rates)

Year	(1) Total capital stock (K) (Table 6.17)	Income accruing to capital (2) R_a (Table 6.2, col. 2)	(3) R_b (Table 6.2, col. 3)	Rates of return (4) R_a/K	(5) R_b/K
1960	72·64	6·73	7·30	·093	·101
1961	75·85	6·73	7·66	·089	·101
1962	79·54	6·68	8·09	·084	·102
1963	82·44	6·61	8·30	·080	·101
1964	85·08	8·26	9·15	·097	·107
1965	88·93	8·01	9·40	·090	·106
1966	92·45	8·44	9·93	·091	·107
1967	96·68	8·67	10·30	·090	·106
Averages				·089	·104

ESTIMATES OF CAPITAL STOCK AND THE RATE OF RETURN: 20 PERCENT DEPRECIATION ADJUSTMENT

In Tables 6.19 and 6.20, the counterparts of Tables 6.17 and 6.18 are presented. Here the calculations are based on the assumptions.

assumption that depreciation is over-stated by 20 percent in the national accounts, and on the series for capital stock, for income from capital, and for land values that were derived on the basis of this assumption.

TABLE 6.19

Estimates of Capital Stock and the Rate of Return, 20 Percent Depreciation Adjustment

(In Billions of 1958 Pesos)

Year	(1) Fixed capital (Table 6.12, col. 1)	(2) Inventories (Table 6.14)	(3) Land (Table 6.16, col. 5)	(4) Total capital stock (K') (cols. 1+2+3)
1960	56·24	9·15	18·48	83·87
1961	58·51	9·70	19·30	87·51
1962	61·04	10·38	20·21	91·63
1963	63·55	10·61	21·10	95·26
1964	65·61	11·09	21·70	98·40
1965	69·13	11·68	22·85	103·66
1966	71·30	12·40	23·70	107·40
1967	73·72	13·79	24·79	112·30

TABLE 6.20

Estimates of Rate of Return, 20 Percent Depreciation Adjustment

(Columns 1-3: Billions of 1958 Pesos; Columns 4-5: Annual Rates)

Year	(1) Total capital stock (K') (Table 6.19)	Income accruing to capital (2) R'_a	(3) R'_b	Rates of return (4) R'_a/K'	(5) R'_b/K'
1960	83·87	7·23	7·80	·086	·093
1961	87·51	7·25	8·18	·083	·093
1962	91·63	7·21	8·62	·079	·094
1963	95·26	7·15	8·84	·075	·093
1964	98·40	8·80	9·69	·089	·098
1965	103·66	8·55	9·99	·083	·096
1966	107·40	8·99	10·47	·084	·097
1967	112·30	9·23	10·85	·082	·097
Averages				·083	·095

THE OPPORTUNITY COST OF CAPITAL TO THE PUBLIC SECTOR

On both sets of assumptions, the estimates of the rate of return to capital range between 8 and 10·5 percent. The differences between the results emerging with no depreciation adjustment and those that are implied by a 20 percent depreciation adjustment are surprisingly small. This stems from the fact that the depreciation adjustment increases both the numerator and the denominator of the rate-of-return ratio.

We now turn to the question of what is the opportunity cost of capital to the public sector. The figures on income accruing to capital in 1967 include only ·24 billion 1958 pesos of income received by government from public enterprises and properties. Yet during the period 1952 through 1966, the public sector accounted for 14·5 percent of total gross investment. In Table 6.21, row 2, we assign to the public sector 14·5 percent of the

TABLE 6.21

Capital, Income from Capital, and Rate of Return by Major Sectors, 1967

(Cols. 1, 2, 4, 5: Billions of 1958 Pesos; Cols. 3, 6: Annual Rates)

	No depreciation adjustment			20% depreciation adjustment		
	(1) Beginning of year capital stock	(2) Income accruing to capital	(3) Rate of return	(4) Beginning of year capital stock	(5) Income accruing to capital	(6) Rate of return
Total	96·68[a]	9·49[b]	·098	112·30[c]	10·04[d]	·089
Public sector	14·02[e]	·24[f]	·017	16·30[e]	·24[f]	·015
Private sector	82·66	9·23	·112	96·00	9·80	·102
Housing	27·71	1·94[g]	·070	27·71	1·94[g]	·070
Private sector less housing	54·95	7·29	·133	68·29	7·86	·115

[a] Table 6.17, column 4; Table 6.18, column 1.
[b] Average of R_a and R_b; Tables 6.2 and 6.18, columns 2 and 3.
[c] Tables 6.19, column 4; Table 6.20, column 1.
[d] Average of R'_a and R'_b.
[e] 14·5 percent of total capital stock.
[f] Income of government enterprises in 1967 (652 million current pesos) deflated by GNP deflator (2·674) for 1967. Both figures from national accounts.
[g] Net house rents in billions of 1958 pesos from national accounts.

capital stock of the nation. It can there be seen that the rate of cash return on public sector capital is less than 2 percent. This is only in part due to low levels of public utility tariffs; it also stems from the fact that a lot of public investment is in areas (roads, public buildings, and the like) where no cash return is received even though the benefit to the economy may be substantial.

In row 3 of Table 6.21, the capital and the income accruing from capital in the public sector are deducted from the corresponding national totals to yield private-sector figures. Total income from capital was taken to be the average of R_a and R_b in column 2 and of R_a' and R_b' in column 5 of row 1. The resulting estimates of private-sector rate of return are greater than 10 percent under both of our alternative assumptions regarding depreciation. This is conceptually the best estimate of the opportunity cost of capital to the public sector in Colombia.

Rows 4 and 5 of Table 6.21 attempt to break down the private sector capital stock and related income into those amounts corresponding to the provision of housing services and the remainder. The capital stock (that is, buildings and land) devoted to residential housing was estimated by capitalizing the figure given in the national accounts as net rent from housing (including the imputed rent from owner-occupied housing) at a rate of 7 percent. This is consistent with gross annual rents (including depreciation maintenance, and property taxes) of from 10 to 12 percent of the value of the property. When housing and house rents are taken out of the private sector figures, as is done in row 5, it is seen that the remaining private-sector capital stock has estimated yields of from 11.5 to 13 percent. If the government could guarantee that any funds that it fails to spend on public projects would be put to use in the non-housing area of the private sector, then 11.5 to 13 percent would be an appropriate estimate of the opportunity cost of public funds. However, it is difficult to guarantee this. If the government raises more funds by taxation or if it spends less on current or capital account, the end result in all likelihood will be a reduction in the amount of public borrowing. This in turn would permit the banking system to augment its credit to the private sector which has as its likely

outcome the stimulation of investment throughout the private sector, including the area of housing construction. I therefore feel that it is more appropriate to consider the over-all private-sector rate of return of 10 to 11 percent as the opportunity cost of public funds.

A word of caution in closing: the opportunity cost of capital that is relevant for public decision-making is a forward-looking magnitude: what would be the yield of these private-sector investments that would additionally be undertaken this year if more capital were to be made available to the private sector? Our figures do not provide a direct answer to this question. They rather estimate what has been the historical yield of investments undertaken in the past. It can be seen in Tables 6.18 and 6.20 that the estimated rates of return based on R_b and R_a show no perceptible trend, while those based on R_b and R_b' reveal a tendency to rise over time. This is indeed the direction in which we would expect the yield in capital to move as Colombia's economic development efforts bear increasing fruit.

Notes

[1] In this exercise, total wages and salaries are taken from the national accounts of Colombia, and the numbers of wage and salary workers, proprietors, independent workers and unpaid family workers are taken from Departamento Administrativo Nacional de Estadística *XIII Censo Nacional de Población, Resumen general*, Table 37, pp. 134–35.

[2] They could be made still closer by taking, for example, depreciation rates of ·019 and ·049 for the two categories, respectively; we did not carry out such an exercise because it would give an exaggerated impression of the degree of accuracy of the procedure and the results. It can be stated clearly, however, that either reducing the depreciation rate on buildings and other construction from 2 to 1·5 percent, or reducing that on machinery and equipment from 5 to 4 percent per annum would result in a substantially greater difference between the depreciation figures corresponding to columns 1 and 2 of Table 6.11. In short, depreciation rates of ·02 and ·05 for the two categories provide the set of plausible 'round numbers' for which the implied depreciation is closest to the adjusted official series given in column 2 of Table 6.11.

[3] There is a possibility that the use of the 0·43 ratio might overestimate the 1952 inventory stock, because of the unprecedented buildup of inventories (1·388 billion pesos of 1958) that occurred in 1966. But even if the year 1966 is neglected in the computations, the marginal inventory/GDP ratio turns out to be ·384, and applying this to 1952 GDP yields estimated beginning-1952 inventories of 6·18 billion 1958 pesos. The absolute difference between 6·18 and 6·92 billion pesos, when compared with the probable levels of total capital stock in Colombia, did not seem

great enough to warrant making two alternative sets of inventory estimates. The 6·92 billion peso figure was therefore chosen as the base for deriving the inventory stock series.

⁴ *Studies in the National Balance Sheet of the United States*, Vol. II, *Basic Data*. National Bureau of Economic Research, Princeton University Press, 1963, pp. 42–69.

ON MEASURING THE SOCIAL OPPORTUNITY COST OF LABOUR

In this paper I attempt to examine in some detail the commonly held notion that the opportunity cost of labor is represented by the product that is forgone from other activities as a consequence of being labor for a given activity. The first variant of this notion that will be treated is the idea that in some poor countries the pool of labor in the agricultural sector is so abundant, and its marginal product so low (effectively zero, according to this idea) that other sectors can expand their demand for labor without entailing any significant loss in production elsewhere. The second variant to be considered is the idea, less restrictive than the first, that the product forgone in other sectors (in this case not necessarily zero or insignificant) is the appropriate measure of the social opportunity cost of labor. I shall argue that the data seen to contradict the idea that great masses of labor can be withdrawn from the agrarian sector without a palpable loss in product. I shall also contend that the use of forgone product as a measure of opportunity cost is an oversimplification which can lead an analyst to wrong conclusions in a number of different ways. Far preferable is the concept that the supply price of marginal units of labor of given skill characteristics for given jobs in given labor-market areas is the relevant measure of social opportunity cost. But even this concept has some deficiencies, and I shall present analyses indicating that the true measure of social opportunity cost lies somewhere between the measurable supply price of labor and the market price actually paid in a given activity. In the course of this analysis, I shall discuss how to deal with