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NOTES ON A MACRO-ECONOMIC MODEL USED TO PROJECT THE POSSIBLE  
PERFORMANCE OF THE JAMAICAN ECONOMY 1968-1973

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This paper explains in detail the implicit methodology and calculations behind the projections contained in the Bank Mission report on Jamaica in 1968. It is presented as an example of how such projections might be made in situations where there is at least a moderate amount of available data.

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1. This paper is a description of a quantitative economic model, its evolution, and its integration into a country economic analysis in the World Bank.<sup>1/</sup> To those who routinely make such analyses what is presented here contains nothing particularly novel. The purpose of the paper is not to suggest new methods of making country economic analyses, but rather to make explicit the steps by which this type of activity is carried out (at least by the more quantitative among the country economists), particularly in situations where the data base is reasonably good. In such situations the analysis can be a fruitful combination of quantitative and qualitative economics. Thus we try to describe in detail an existing methodology rather than to suggest a new one.

2. Most economic projections involve some kind of model, often very simple and, in the case of the Bank, often implicit. These models, a blend of qualitative and quantitative elements, usually begin with past, measurable, structure. The parameters of this structure are then modified by desirable and feasible policy for the future, and combined with estimates of probable availabilities of development resources, such as savings and foreign exchange, to obtain possible outcomes for the various indicators of economic and social activity. This process is most often carried out in the framework of national income and public sector accounts.

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<sup>1/</sup> I am indebted to E.K. Hawkins and P.D. Henderson for their helpful comments and criticisms, and more particularly to Murray Ross who inspired this paper and provided many helpful comments during its preparation. I maintain, however, all responsibility for errors.

The model that forms an integral part of the report of the 1968 Bank mission to Jamaica,<sup>1/</sup> although possibly somewhat less sophisticated than would be warranted by the data,<sup>2/</sup> follows these same general lines. It is this model which is discussed in the following pages. It should be taken as an example of a methodology, rather than a blueprint or prescribed form for all country economic analysis.

3. At the outset it is important to stress that while the creation of such a model is an integral part of country economic analysis, it must not precede a number of important preliminary phases of the analysis. Simply to create a model of a country and then expect it to be "used" in the analysis of that country, or by a mission studying the country, is to be quite naive. Models are of no use unless they are an integral part of the thinking of those involved in the analysis and then only if they are created during the analysis and serve to illuminate and check the consistency of the conclusions and findings of the mission.

4. There are two important points here. (1) Almost always the most recent data are available only to a mission and are not published until sometime later. Thus a model made a priori from available sources will tend to be dealing with stale information and will inevitably be faced with a gap of at least two to three years between the end of the model and the present. A mission on the other hand can not only get more information, but often can get local best estimates of the probable behavior of certain

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1/ WH-187, September 1968 (available only to Bank staff).

2/ Jamaica has a well elaborated set of national accounts, and an input-output table.

aggregates in the near future. (2) A more important point is that a model, to be of any use, must have a focus. Usually this will be on the central problems of economic development, pointing to bottlenecks to growth and to their likely magnitudes. From this point the descriptive system can proceed, showing the consequences of particular constraints and the likely gains to be made from alleviating them. It is hard however to identify the specific problems beforehand. Usually the model builder must proceed as a member of the mission, gathering data and information for some time before it becomes apparent to him and to the mission exactly what the focus of the mission and thus of the model should be. Only at this point can the model be made, and as such it serves to quantify the general hypotheses and conclusions of the mission and to identify the relative magnitudes of the problems involved.

5. Thus the essential element in projection models is to identify the key constraint to development. After this has been done, an equation is set up describing this problem, and from this point the rest of the model is set forth. Once one defines the relevant constraint variable, most other key variables are dependent, via the structure of model, upon it. For example, in an economy with a balance of payments constraint, the central relationship is the supply of and demand for foreign exchange. Since exports are usually treated as exogenous, the central equation serves to provide the limits for the import equations, and thus for the foreign exchange available for investment and growth. In this fashion an entire model can be outlined. Similarly, in a savings constrained economy, a table setting out the sources and uses of savings (sometimes called "financing of investment") becomes the central part of the model. What

is important is that projection models typically proceed from a previously identified crucial constraint to a description of possible performance.

6. In formal sense, one would create a complete simultaneous model, with constraint equations for all development resources, and then would supply all the pertinent external conditions and then proceed to calculate the maximum rate of growth consistent with all these conditions. However, the purpose of projection models (at least in the Bank) is illustration and explanation of the non-quantitative conclusions of a mission rather than simple mathematical solution. Therefore, it is very important to detail the model by proceeding from what is felt to be the key constraint to development.

7. In the case of Jamaica, an analysis based solely on information available publicly outside the country appeared to indicate that Jamaica's growth was being hindered by a possible lack of foreign exchange. Once the mission carried out its field work it was apparent that this was not the case and that both foreign exchange and savings were reasonably abundant. Jamaica was thus in the position of having a good supply of the obvious development resources and yet her growth, while good, was not outstanding. In particular it was noted that the investment ratio was quite high (25%) and yet the growth was only just above 5 percent per annum in real terms. Furthermore, there were noticeable shortages in infrastructure such as roads, water and power; and these, it was clear, were real constraints to growth.

8. Most of these shortages, upon inspection, could be traced either to the failure of the public sector to plan and carry out infrastructure investment or to the failure of that sector to make the necessary policy

decisions so that the private sector could proceed with certain investments. An inspection of the Independence Plan (1963-1968) showed substantial shortfalls in infrastructure investment and also in the inflow of foreign official financing. Such financing is typically best suited for infrastructure investment, and all evidence available from the sources of external finance indicated a far greater potential supply than that which was actually lent. These phenomena all suggested a substantial lack of the requisite skilled manpower in the public sector for the preparation and implementation of infrastructure projects. To be more specific, the public sector was, and still is, in great need of individuals who are skilled in decision-making and implementation. With independence only a recent phenomenon in Jamaica's long history, the public sector has not yet had adequate experience in decision-making, nor has it been able to obtain sufficient numbers of skilled administrators to carry out fully the necessary extent of its activities. Recent years represent a transition period during which most of the energies of the people have been devoted to the political aspects of nation building and thus economic infrastructure has lagged behind.

9. In the private sector there has also been a skill shortage, but its nature has been more of a need for technical skills, and its intensity has been much less than the skill shortage in the public sector. It should be noted that the employment structure in Jamaica is not typical of most underdeveloped countries. In most such countries the prestige and the good salaries are generally to be found in the public sector and shortages of skills, particularly the technical ones are more apparent in the private sector. In Jamaica the opposite seems to be the case; thus an island-wide shortage of skilled manpower is most noticeable in the public sector.

10. This manpower shortage is a serious problem to which there do not seem to be any clear solutions. Part of the shortage arises from the nature of the education system. A heritage of the colonial period, this system continues to produce consumers rather than producers; i.e., there is a strong bias towards liberal arts and only recently has there been an increased emphasis on technical and vocational education. All too often the graduates of the system have neither the frame of mind nor the technical skills necessary for modern Jamaica.<sup>1/</sup>

11. The general shortage of skilled manpower is intensified by competition from North America, which is hard to meet, particularly in view of what is felt to be a lack of opportunities in Jamaica. Jamaica boasts of a relatively low rate of growth of population, but the difference between the natural rate of growth (2.8%) and the actual rate (1.8%), a full one percent of the population per annum, hardly represents the steady drain of skills to North America.<sup>2/</sup>

12. In this general scarcity of necessary skills the public sector is clearly worse off. Its ability to compete is hampered by less flexibility than the private sector with respect to salaries and by a much greater lack of perceived opportunity for skilled administrators within the public sector.

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<sup>1/</sup> There are numerous obvious entrepreneurial opportunities in Jamaica, yet the education system, like many systems with a liberal arts emphasis, seems to have removed entrepreneurial instincts from those who have passed through it. The more successful entrepreneurs are those with less education, and even among these the primary activity is real estate, a characteristic of "businessmen" in much less developed countries.

<sup>2/</sup> i.e. The proportion of skilled emigrants is much more than one percent of the population of skilled people.

13. There is no simple answer to the skill shortage in Jamaica.<sup>1/</sup> Clearly there must be an increasing emphasis on technical and vocational education and furthermore both the private and public sector alike must become increasingly flexible in offering opportunities for skilled Jamaicans.

14. In the short run within the public sector there is clearly a lot to be gained through improvements in the way in which public business is carried out. A mission from the UNDP clearly outlined this in 1967 and the Bank Mission in 1968 concurred in this view. It was felt that it would be reasonable to expect the public sector to take steps in this direction (this has in fact begun) and that this would go a good way toward alleviating the bottlenecks in the public sector.

15. A lack of effective administrative and managerial manpower is a concept that is difficult to measure in a quantitative sense, particularly with little or no data on the labor force. It can perhaps be represented by its effect on the capital-output ratio; that is, if one assumes no effective savings constraint, in which case the transformation of capital increments to output increments is most likely related to the nature of the skilled labor available.<sup>2/</sup>

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<sup>1/</sup> Whatever it is, it is not to indulge in technical assistance. The government of Jamaica has large numbers of foreign technical assistance personnel working for it, particularly in agriculture. The results have been very unimpressive. This has partly been caused by the administrative shortage itself, and this can only be resolved by Jamaicans.

<sup>2/</sup> Chenery and Strout in their "Foreign Assistance and Economic Development" try to deal with the same problem, which they called "skill constraint". In their analysis they chose to specify the maximum rate of growth of investment with a constant incremental capital-output ratio. In the present work we chose to use a constant investment rate and a declining ICOR. The two approaches are equivalent.

16. The analysis begins with a consideration of the incremental capital-output ratio.<sup>1/</sup> Over the past five years this ratio in real terms has been about 4.0, and in 1967,<sup>2/</sup> as a result of certain bottlenecks, and some exogenous influences, it reached 4.5. After some deliberation by the mission about desired and feasible growth paths, and about potential productivity in the public sector, it was decided that as a moderate target it would be reasonable to postulate a fall in the capital to output ratio from 4.5 to 3.5 over the six years 1968-1973.<sup>3/</sup> This reflects the existence of early bottlenecks, with an assumed continuous improvement particularly in the effectiveness of the public sector; furthermore, as some of the near future investment will be in mining with a long gestation period, the later years are expected to show the results of this early investment and thus the capital-output ratio should be lower.

17. The next step is to estimate the investment ratio. Over the past this ratio has been steadily rising, from just under 20 percent of GDP at market prices to almost 25 percent. Some of this rise has been due to an increasing admixture of mining, but with the very generous investment laws recently enacted, especially in hotels, it was felt by the mission that the ratio would not fall very much even though investment in the mining sector was expected to decline. Thus the investment ratio was

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<sup>1/</sup> The incremental capital-output ratio ( $k$ ), is defined and measured here as referring to the year of the income increment, not the capital increment. In formal terms,  $k_t = I_{t-1} / (Y_t - Y_{t-1})$ .

<sup>2/</sup> See Table 7.

<sup>3/</sup> This is approximately equivalent to a rate of decline, asymptotic to 3.0, in the ICOR of 17 percent per annum.

specified to remain constant at the recent figure of 24.5 percent of GDP for the years 1969-1973. (For 1968 there was enough partial information to be able to estimate independently the gross value of investment and it turned out to be 24.7 percent of GDP.) Since the average incremental capital-output ratio over the projection period is about 4.0, the growth of the economy should be about six percent.

$$\text{i.e., } g = (I/Y)/k = 24.5/4.0 = 6.1 \quad (1)$$

18. From these assumptions we can now build up year-by-year a first approximation of the probable path of GDP and investment. It should be emphasized here that this initial calculation, following equation (1) is to obtain the growth path or trend, not the actual year-to-year figures. Over the projection period the actual path may well fluctuate around the one indicated by (1). In some years higher exogenous demand for exports or a shift in timing of investment may produce an actual level of GNP higher than that of the growth path, while in other years bottlenecks or export shortfalls may produce the opposite effect.<sup>1/</sup>

19. The reasons for calculating this median path are: (1) that some of the aggregates of the economy such as consumption and non-capital imports are likely to be more closely related to the average path than to the annual fluctuations; (2) that the long-run growth of the economy is more related to this path than to the year-to-year, largely exogenous, shifts in exports and investment; (3) that the key to growth, as asserted

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<sup>1/</sup> This of course assumes that there is no supply problem with exports, which is the case for most of Jamaica's commodities, and that any unexpectedly large increase in investment is associated with foreign enterprises and thus is unaffected by the constraints referred to above as investment is brought in from abroad.

above, is skilled manpower rather than savings or foreign exchange, so that long-run growth is not likely to be noticeably affected by short-term fluctuations in the amounts of those two resources, and (4) a minor point, that the mathematical computations become considerably more complicated if long-run growth is calculated simultaneously with the other national income aggregates.

20. In calculating this path we take investment in period  $t$  and apply the value of  $k$  in period  $(t+1)$  to obtain the change in income between  $(t)$  and  $(t+1)$ . Thus investment in 1968 was estimated to be £96.6 million<sup>1/</sup> and we postulated  $k$  for 1969 at 4.3. This means that the change in income would be  $£96.6/4.3 = £22.5$  million. Since the estimate for 1968 GDP was £390.7 million we get an estimate for 1969 of £413.2 million. To this we apply the investment rate to get investment in 1969; £413.2 million  $\times$  .245 = £101.2 million. This process then continues until we have the entire series.<sup>2/</sup>

<sup>1/</sup> It later turned out that this was a substantial underestimate, but most of the difference was due to earlier phasing of already planned private sector investment. Over the five-year period the aggregate amount of growth and investment probably will not deviate noticeably from that set forth in the model. Furthermore, the extra investment in 1968 will simply raise  $(k)$  rather than the growth rate.

<sup>2/</sup> Using the notation above, the increase in GDP in the span of a year can be described as:

$$1. Y_t = Y_{t-1} + \frac{I_{t-1}}{k_t} \quad \text{and} \quad 2. Y_t = Y_{t-1} + \frac{I_{t-1}}{k_t}$$

$$= Y_{t-2} + \frac{I_{t-1}}{k_t} + \frac{I_{t-2}}{k_{t-1}}$$

$$= Y_0 + \sum_{i=1}^t \frac{I_{i-1}}{k_i}$$

now  $I_t = \sigma_t Y_t$  where  $\sigma_t$  is the investment ratio in time period  $t$ . This, when put into (2) gives:

$$3. Y_t = Y_0 \prod_{i=1}^t \left(1 + \frac{\sigma_{i-1}}{k_i}\right)$$

In the special case where  $\sigma_t = \sigma_{t-1}$ , etc. and  $k_t = k_{t-1}$ , etc. we get

$$4. Y_t = Y_0 (1 + \frac{\sigma}{k})^t \quad \text{where } g = \frac{\sigma}{k} \text{ and this is the same version of a projection model.}$$

Table 1: POTENTIAL GROWTH PATH, 1968-1973

	1968	1969	1970	1971	1972	1973
GDP (£ million)	390.7	413.2	437.9	465.5	496.3	531.0
I/Y	.247	.245	.245	.245	.245	.245
I (£ million)	96.6	100.2	107.3	114.0	121.4	129.0
ICOR	4.5	4.3	4.1	3.9	3.7	3.5

The implicit growth rate of GDP is 6.15 percent per annum, a rate which is feasible in the light of past experience. Over the period 1962-1967 the economy grew by 5.3 percent per annum, and this included the year 1967 when real growth was only one percent. In earlier periods growth rates of seven percent and over have not been uncommon.

21. The investment series can be broken down into several functional components using other information derived by the mission, specifically, the estimates of the likely course of realized (as distinct from forecast) public sector investment, and the estimates of mining investment as given to the mission by the aluminum companies.

Table 2: DISTRIBUTION OF INVESTMENT, 1968-1973

(£J million)

	1968	1969	1970	1971	1972	1973
Investment	96.6	100.2	107.3	114.0	121.4	129.0
Public	29.2	29.0	29.5	30.0	30.8	32.0
Mining	20.0	20.0	20.0	15.0	10.0	5.0
Other Private	47.4	51.2	57.8	69.0	80.6	92.0

22. The above is however only the long-run growth path. For planning purposes we need to know actual annual levels of the GNP aggregates.

23. In looking at expenditures we shall focus on the national income identity for GNP from the expenditure side:

$$\text{GNP} = \text{C} + \text{I} + \text{E} - \text{M} \quad (2)$$

where C is consumption, I is investment, E and M are exports and imports defined here as including goods and services, but not transfers. Investment has been calculated above. Consumption consists of public and private consumption and will be calculated separately. Once we have all the items on the right hand side of equation (2) the actual year-to-year levels of GNP (as distinct from the long-run growth path levels calculated in equation (1)) can be calculated.

24. The first element of expenditures to be considered is personal consumption expenditure. Our main assumption was that this item would maintain a steady relationship to the long-term growth path of the economy. Thus since we are using a particular growth rate for the economy over the five-year period, we assume the growth of consumption to be related to this growth rate, and not to be responsive to year-by-year fluctuations in GDP as these tend to be generated by external factors which do not feed back immediately into personal disposable income. Over the past the elasticity of personal consumption with respect to GDP has been about 0.96 (this implies that the marginal savings rate is higher than the average).<sup>1/</sup> Thus if we postulate long-term growth at 6.15 percent, then the growth of personal consumption expenditure can be set at 5.9 percent per annum. This series, with 1968 as a base, is shown in Table 10.

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<sup>1/</sup> Derived from figures in Table 7.

25. In the case of public sector consumption a more detailed analysis was undertaken. In the first place the mission had a lot of information, and in the second place we felt that the government budget needed tightening and thus we had to examine it closely in order to find out where the possibilities for improvement lay. It will be noted that in the case of Jamaica, as in the case of many countries, the current expenditures of the public sector are not identical with the item of public consumption in the national income accounts. The latter does not include transfers and interest payments and also excludes certain capital items that public authorities often place in the current account. Thus there is always a job of translation from one definition to the other. Rather than go into a myriad of details we took advantage of the fact that the two series are highly correlated and tend to have the same growth rate. Thus the approach was to determine how the government current expenditures might move over the five-year period and to apply the implied growth rate to the series for public consumption.

26. Table 8, and more particularly Table 6, show the manner in which the analysis was carried out. The entire set of accounts, classified by economic function, was deflated to constant prices using the sector value-added deflator for the wage and salary component and the GDP deflator for the residual. This having been done, the implied growth rates of each item were extracted. At this point a number of decisions were made as to the desirable future trends. In particular current expenditures for health and education were growing very slowly and it was felt that in the light of obvious needs they should grow faster. On the other hand current expenditures on general administration and on certain "economic sectors"

were felt to have been growing too rapidly, especially in view of the low effectiveness of such expenses, and thus the growth rates were reduced for the projection period. Outright subsidies, such as those carried by agriculture as part of the welfare budget, and transfers to local governments have shown themselves to be ineffective and their growth rates were sharply cut. The specific historical rates and those chosen for the future can be seen in Table 6. The projection of the specific items can be seen in Table 8.

27. One problem that arose was that part of current expenditure is interest on debt. This cannot be known exactly for the future until calculations are made as to what the debt will be and this follows from the magnitude of the current and capital deficits, the former of which cannot be determined without knowing the level of current expenditures. This is a simultaneous problem and is treated as such in the actual determination of the size of the debt, but for the purposes of the national accounts the assumption was made that this item would have the same growth rate as the aggregate of the other items. The error thus involved is probably much smaller than that created elsewhere in our calculations.

28. The overall growth of public sector consumption (national account definition) was thus projected at 4.3 percent per annum; this is the rate implied by the individual items of Table 8. The actual values derived for public consumption contained in Table 10.

29. The other two items to complete the GNP identity are imports and exports of goods and services, including factor services but excluding current transfers.

30. Exports of goods were estimated by looking at all the major commodities and their output trends. Basically there are three groups: mining (which is over 50 percent of the total), agricultural products, and others (mainly manufactures). The details of these projections are shown in Table 11.<sup>1/</sup> In general the estimates were arrived at by careful consideration of the actual good in question and mission discussions with the local people involved in the industry.

31. Exports of services were estimated, again exogenously, from a consideration of the elements involved, investment income, emigrants' remittances, and especially tourism. This last item was based on estimates of probable capacity (beds)<sup>2/</sup> over the next five years, and average tourist stays and expenditures.

32. Merchandise imports were subdivided into five types of goods, and each of these aggregates was projected according to historical relationships with GDP aggregates. Food was related to the growth of tourism and population, investment goods to the level of capital formation, raw materials to the probable growth of the industrial sector (which in turn was related to the growth of the economy as a whole), and the two types of consumer goods were related to the aggregate of private and public consumption. Table 12 shows the actual figures for the projections. On

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<sup>1/</sup> These projections were made in current prices but, as export prices are expected to remain constant, they are usable as constant price series. On the import side we assumed no price changes. Thus we did not deal with terms of trade effects. Normally, of course, these should be taken care of.

<sup>2/</sup> We were able to obtain detailed breakdowns of most of the anticipated investment in the tourist sector.

invisibles, the item of freight and insurance is a simple proportion of the c.i.f. value of goods landed. Factor income payments are related to the level of external debt (we had an explicit series detailed by each debt instrument)<sup>1/</sup> and to the level of manufacturing output (as most Jamaican manufacturing has a high degree of foreign participation) and to previous foreign capital inflow. Other items were projected exogenously, generally on the basis of past trends.

33. As the central part of this model is a skill constraint, and as we have assumed that the balance of payments will not be a binding constraint, the balance on current account for the balance of payments becomes a variable that is determined by the model, and to the extent that we know the long-term capital flows, the changes in reserves (in this particular case they are increases) become determined. Thus the balance of payments picture is not the main focus of the analysis.

34. Having the necessary information on imports, exports, factor income payments, and transfers, we then are able to assemble GNP and GDP from the expenditure side, and are thus able to get the resultant capital-output ratios, growth rates, and savings rates. These are shown in Table 10. Note that the incremental capital-output ratios are somewhat different from our initial estimates, especially in 1969 and 1970. This is because of the fluctuations in exports. These variations cause changes in the

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<sup>1/</sup> Here again the slight error in estimation arises due to not knowing at this point the exact amount of future debt commitments. Again the error is small, particularly as the balance of payments is not a major development constraint.

level of demand and as there is no scarcity of foreign exchange there is no reason for imports to make corresponding changes, so that the fluctuations are reflected in GDP. As most of these export changes are from enclave sectors with no supply constraint (such as aluminum), and as such are not the result of investment in the immediately preceding year, the fluctuations show up in the apparent or realized incremental capital-output ratios. As mentioned above the essential part of the analysis is the overall long-run growth of output and thus the overall growth of personal and public consumption. These are dependent on the original, skill-limited, estimates of the capital-output ratios. Those that appear on Table 5 are more of the nature of ex post ratios.

35. Having now determined income and all the GNP aggregates, it remains to consider the remaining operations of the public sector.

36. Given the actual levels of GDP projected for 1968-1973, we now have a base for public sector revenues, and we can look at the financing picture of the public sector. The revenues of this sector (and we are actually talking just of the central government - the local governments have virtually no significant independent sources of income) can be roughly classified in six categories. Under the general heading of taxes we have personal income taxes, corporate income taxes, customs and excise (these two items are treated as one because of the substantial shifts, particularly in petroleum, that have been encountered during the process of import substitution), and other taxes (these are items like licenses, royalties, etc.). In addition there are miscellaneous items of non-tax revenue, such as earnings of government departments, and capital revenues (which are largely the earnings on investments and sinking funds).

37. For each of the six categories a regression estimate was made over the previous five-year period of the elasticity of the revenue item with respect to GDP. In certain cases GDP is probably not the appropriate base, but the errors arising from this source were thought to be less than those that would be encountered in projecting other bases. For personal income tax the derived elasticity was about 1.5 and it was felt that with continuing increased coverage that this elasticity could be expected to continue. Corporate income taxes on the other hand showed an elasticity of 0.7, largely because of the increasing use of tax holidays as industrial incentives. It was felt that during the period in question this phenomenon would probably continue and thus the projection assumes 0.7 for corporate taxes. Customs duties and excise taxes produced an elasticity substantially in excess of unity, but in view of the obvious effect these taxes have had on the rate of increase in prices, and the general reluctance of the government at present to contemplate additional increases in indirect tax rates, the model uses an estimate of 1.0 for this elasticity. The other three items, other taxes, non-tax revenue, and capital revenue, were found to have elasticities of 1.25, 1.25 and 1.0 respectively over the historical period; these elasticities were used for the projections. The projections of these revenue items together with the elasticities can be found in Table 9. Starting with the 1968 base each item was calculated with the following formula.  $R_{it} = R_{it-1}(1 + e_i g_{yt})$  where  $R_{it}$  is the revenue from the  $i^{\text{th}}$  source in the  $t^{\text{th}}$  period, and  $e_i$  is the elasticity of that revenue item while  $g_{yt}$  stands for the estimated actual growth in income between time  $t-1$  and time  $t$ .

38. At this point having the possible revenues for the five-year period, it was necessary to return to the expenditure items of Table 8 and calculate the total expenditure including interest on public debt. This latter item was calculated on a year-by-year basis. To begin with we had a projection of the principal and interest due on debt existing as of the beginning of the model period. In each year of the calculation of the model we arrived at an amount that had to be borrowed in order to finance the capital budget. Assuming (after discussing with the government and the Central Bank) that all the borrowings would be 20-year money at seven percent, we could then calculate the addition to the public debt charges for subsequent years.<sup>1/</sup> Thus we could arrive at an estimate of probable current expenditures for each year.

39. One more minor adjustment will be noted on Table 8. At present the capital budget of the government of Jamaica includes about £2.2 million in subsidies to the agricultural sector. The mission felt it was desirable that these expenditures should be phased out over the five-year period. Thus we projected them to decline by £0.4 million per year, and in addition we shifted them from the capital account to the current account, where they seem more properly to belong. Thus the penultimate line in Table 8 reflects these subsidies.

40. Moving to Table 9, once we had the revenues and the current expenditure, the gross savings of the public sector could be calculated, and knowing the amortization payments due, the savings net of amortization

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<sup>1/</sup> We assumed that repayment of principal and interest would begin in the year following the borrowing, but longer grace periods could have been built in had we felt that it was at all likely Jamaica would be able to borrow on softer terms.

could be estimated. The final line in Table 9 illustrates the extent to which net savings in this sense cover the capital expenditure of the government exclusive of debt repayment. The question then was one of how to finance the rest of the capital budget. The mission had estimated that in the coming six-year period external sources, market and official aid, would provide about £14.6 million (\$35 million) per year. In addition the National Insurance Scheme (a kind of social security) could be expected to provide about £4 million per year. The residual was assumed to be borrowed locally, generally by market issues.

41. Thus Table 9 outlines the entire financing picture for the private and public sectors of the Jamaican economy over the next six years. It also points out some potential problems that may arise in the financing of the latter. If we look at the period 1968 through 1973, we get the following summary for public capital formation:

Table 3: FINANCING OF PUBLIC SECTOR INVESTMENT 1968 THROUGH 1973

	£ Million	Percent
Investment	180.5	100
Financed by:		
Foreign Borrowing	88.0	49
Public Savings	29.8	17
N.I.S.	24.0	13
Domestic Borrowing/ <u>a</u>	38.7	21

/a Residual.

In the previous six-year period the picture was as follows:

Table 11: FINANCING OF PUBLIC SECTOR INVESTMENT  
1962 THROUGH 1967

	£ Million	Percent
Investment	97.6	100
Financed by:		
Domestic Borrowing/a	46.7	48
Foreign Borrowing	19.4	20
Public Savings	31.5	32

/a Includes 4.0 of N.I.S. in 1967.

42. A comparison of the two tables shows a definite shift in the sources of financing, in particular a more than fourfold increase in foreign financing. This of course, as mentioned earlier, is contingent upon the successful preparation and execution of projects, suitable for external financing, by the public sector. A similar proportion of foreign official capital appeared in the Independence Plan (1963-1968) but a lack of project preparation by the public sector caused a substantial shortfall of resources from this source. Total spending was maintained close to the level envisioned in the Plan, but this was done by investing in "easy" projects of doubtful priority, and was largely financed from non-project capital markets. The result was the emergence of severe bottlenecks in the economy as the crucial social overhead investments were not made.

43. To the extent that the public sector continues to fail to carry out projects in these key areas, the economy will continue to experience a severe constraint to growth. The lack of sufficient social overhead

investment, e.g. in roads, power and water will prevent the attainment of the high rate of growth of which Jamaica is capable. This will have a marked effect on the path of the economy. For example, for lack of water, roads and power, a lot of planned investment will never materialize. Furthermore, continual shortages will discourage tourists from coming and will keep hoteliers from expanding. Finally, the amount of investment necessary for a given output will rise as investors are forced to invest in the lacking infrastructure themselves and as these lacks cause delays and increased costs.

44. To conclude this paper, let us try and quantify this type of situation. Let us assume, for example, that instead of the long-run growth outlined in Table 1, we project the economy as follows:

1. Let the incremental capital-output ratio rise from 4.5 to 5.0 during 1968-73 instead of falling to 3.5.
2. Simultaneously let public sector investment be less by £14.6 (\$35 million) per year. This amount represents the amount of foreign funds that would be forthcoming were the necessary public sector projects properly prepared and executed.
3. Let private investment fall to 80 percent of its projected value.
4. Let the 24.5 percent investment ratio be reduced by the shortfall in (2) and (3).

This represents what we shall term the "pessimial" case and its characteristics are displayed in Table 5.

Table 5: ALTERNATE GROWTH PATH

	1968	1969	1970	1971	1972	1973
GDP (£ million)	390.7	405.5	420.5	435.7	451.1	466.7
Investment Ratio	.174	.174	.173	.173	.172	.172
I (£ million)	68.1	70.5	72.8	75.3	77.8	80.3
ICOR	4.5	4.6	4.7	4.8	4.9	5.0

A comparison with Table 1 is striking. Even taking into account the very rough nature of both tables, it is evident that though the impact of each of the four propositions above seems minimal, taken together they produce a serious negative impact on the economy. This pessimal case represents perhaps an extreme, but it is quite feasible given a continued failure to create infrastructure. Under optimal assumptions about the ability of the public sector to invest in significant infrastructure that are implicit in Table 1, we get a growth rate of just over 6 percent. Under "pessimal" assumptions of an inability to do this that are implicit in Table 5 we get a growth rate of about  $3\frac{1}{2}$  percent, a shortfall of 40 percent from the level that the mission felt would be feasible and desirable for the economy. On a per capita basis the difference is even more dramatic, the pessimal assumptions only achieving less than half the desirable growth rate in income per head. Even granting that the actual outcome will be better than the "pessimal projection," it would appear that the role and performance of the public sector is crucial in the future growth of the economy.

Table 6: PUBLIC SECTOR CURRENT ACCOUNT

 (£ million, constant 1963/64 prices)<sup>/1</sup>

	1963/64	1964/65	1965/66	1966/67	1967/68	1968/69	Percent Growth Per Annum	
							Past	Future
<u>General</u>								
General Administration	4,114	5,773	4,740	5,291	5,608	5,514	6.0	2.0
Defense	1,523	1,514	1,465	1,480	1,519	1,628	1.3	1.3
Justice and Police	3,526	3,627	3,530	3,640	4,088	3,999	2.5	2.5
<u>Social</u>								
Education	6,779	6,984	7,130	7,683	7,811	8,226	3.9	6.0
Health	5,023	5,213	5,335	5,451	5,602	5,696	2.5	4.5
Other Social and City	1,514	1,441	1,964	1,944	2,385	2,265	8.4	2.5
<u>Economic</u>								
Transport & Communication	4,605	4,804	4,517	4,513	4,551	4,717	0.5	4.0
Water	71	111	159	154	146	139	14.4	15.0
Agriculture	2,039	2,266	2,151	2,321	2,814	4,472	17.0	0.0
Power and Fuel	79	69	50	50	42	43	-13.0	4.0
Minerals	65	65	83	94	88	108	10.7	4.0
Other Economic	521	508	636	895	1,194	1,196	18.1	4.0
<u>Other</u>								
Public Debt Charges	3,389	4,163	4,968	5,560	6,735	8,367	19.8	/2
Transfers to Local Gov't.	2,999	3,246	3,229	3,359	3,717	4,137	6.6	0.0
Current n.e.c.	1,332	1,618	1,573	1,686	1,702	1,889	7.2	2.5
Total	<u>37,579</u>	<u>41,402</u>	<u>41,530</u>	<u>44,121</u>	<u>48,002</u>	<u>52,396</u>	<u>6.9</u>	

/1 Public administration deflator for wages and salaries, GDP deflator for the residual.

/2 Determined by debt profile.

Table 7: HISTORICAL DATA  
(£J million, Current prices)

	1962	1963	1964	1965	1966	1967	1962-67/5
GDP	262.1	278.7	302.6	328.0	354.3	371.1	
Gross Investment	52.0	49.9	60.4	64.5	75.8	88.3	
Investment Ratio (%)	19.8	17.9	20.0	19.7	22.0	23.8	
ICOR/1	-	3.1	2.1	2.4	2.5	4.5	
Public Investment	12.3	12.3	14.8	17.9	18.9	21.4	97.6
Private Investment	39.7	37.6	45.6	46.6	56.9	66.9	
Mining	6.8	10.5	3.2	5.7	10.5	25.0	
Other	32.9	27.1	42.4	40.9	46.4	41.9	
Public Local Borrowing/2	4.2	8.5	6.0	5.1	10.4	12.5	46.7
Public Foreign Borrowing/3	2.9	0.4	4.9	3.7	3.4	4.1	19.4
Total Public Borrowing	7.1	8.9	10.9	8.8	13.8	16.6	66.1
Public Current Expenditure	36.2	37.8	43.6	45.7	51.3	58.5	
Public Revenue	42.6	42.9	50.8	56.5	58.8	67.2	
Taxes	36.1	37.0	44.5	49.3	51.8	57.6	
Personal	5.0	5.6	6.1	6.7	7.3	8.4	
Corporate	10.1	8.6	10.8	12.6	11.7	13.7	
Customs and Excise	18.5	19.8	24.4	26.5	28.5	31.4	
Other	2.5	3.0	3.2	3.5	4.3	4.1	
Non-Tax Revenue	4.9	4.4	5.0	5.9	5.5	7.6	
Capital Revenue	1.5	1.5	1.3	1.4	1.5	2.0	
Gross Public Savings	6.4	5.1	7.2	10.9	7.5	8.4	45.4
Debt Amortization	1.2	1.7	3.3	1.8	2.4	3.5	13.9
Net Public Savings/4	5.2	3.3	3.9	9.1	5.1	4.8	31.5
N.P.S. as % of Capital Expenditure	42.3	26.8	26.4	50.8	27.0	22.4	

Note: Government operations on fiscal year beginning in calendar years.

/1 Overall (1962-67) ICOR is 2.78.

/2 Includes use of government deposits, and National Insurance Scheme (1966, 1967).

/3 Includes grants.

/4 Net of amortization.

/5 See Table 4.

Table 8: PUBLIC CURRENT ACCOUNT, 1968-1973

(£J '000, 1968/69 constant prices)

	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74
<u>General</u>						
Administration	7,076	7,218	7,362	7,509	7,659	7,812
Defense	2,089	2,116	2,144	2,172	2,200	2,229
Justice and Police	5,131	5,259	5,390	5,525	5,663	5,805
<u>Social</u>						
Education	10,556	11,189	11,860	12,572	13,326	14,126
Health	7,309	7,638	7,982	8,341	8,716	9,108
Other Social and Community	2,906	2,979	3,053	3,129	3,207	3,287
<u>Economic</u>						
Transport and Communications	6,053	6,295	6,547	6,809	7,081	7,364
Water	178	205	236	271	312	359
Agriculture	3,473	3,473	3,473	3,473	3,473	3,473
Power and Fuel	55	57	59	61	63	66
Minerals	138	144	150	156	162	168
Other Economic	1,535	1,596	1,660	1,726	1,795	1,867
<u>Other</u>						
Current n.e.c.	2,424	2,485	2,547	2,610	2,675	2,742
Local Government	<u>5,309</u>	<u>5,309</u>	<u>5,309</u>	<u>5,309</u>	<u>5,309</u>	<u>5,309</u>
Sub-Total	54,232	55,963	57,772	59,663	61,641	63,715
Plus: Expenditure Financed by Appro- priations-in-Aid	<u>2,868</u>	<u>3,037</u>	<u>3,228</u>	<u>3,337</u>	<u>3,459</u>	<u>3,485</u>
Total (except debt)	57,100	59,000	61,000	63,000	65,100	67,200
Public Debt Charges (Interest)	<u>6,000</u>	<u>7,300</u>	<u>9,200</u>	<u>10,900</u>	<u>12,400</u>	<u>13,700</u>
Total Current Expenditure	63,100	66,300	70,200	73,900	77,500	80,900
Agricultural Subsidies	<u>2,200</u>	<u>1,800</u>	<u>1,400</u>	<u>1,000</u>	<u>800</u>	<u>400</u>
Public Current Expend- iture (Table 9)	65,300	68,100	71,600	74,900	78,300	81,300

Table 9: PROJECTIONS, 1968-1973  
(£J million, 1968 constant prices)

	1968	1969	1970	1971	1972	1973	1968-73/2
GDP	390.8	402.7	439.7	469.1	498.6	532.6	
Gross Investment	96.6	100.2	107.3	114.0	121.4	129.0	
I/Y (%)	24.7	24.9	24.4	24.3	24.3	24.2	
ICOR	4.7	8.3	2.7	3.6	3.9	3.6	
Public Investment	29.2	29.0	29.5	30.0	30.8	32.0	180.5
Private Investment	67.4	71.2	77.8	84.0	90.6	97.0	
Mining	20.0	20.0	20.0	15.0	10.0	5.0	
Other	48.0	51.2	57.8	69.0	80.6	92.0	
Public Local Borrowing	6.2	10.0	6.9	5.7	5.2	4.7	38.7
Public Foreign Borrowing	15.0	14.6	14.6	14.6	14.6	14.6	88.0
Borrowing from National Insurance	4.0	4.0	4.0	4.0	4.0	4.0	24.0
Total Public Borrowing	25.2	28.6	25.5	24.3	23.8	23.3	150.7
Public Current Expenditure	65.3	68.1	71.6	74.9	78.3	81.3	
Public Revenue	72.5	75.0	82.2	88.1	94.1	100.8	
Taxes (Elasticity)	62.6	64.7	70.8	75.8	80.8	86.5	
Personal (1.5)	9.5	9.9	11.3	12.4	13.6	15.0	
Corporate (0.7)	12.7	13.0	13.8	14.5	15.1	15.8	
Customs & Excise (1.0)	35.5	36.6	39.9	42.6	45.3	48.4	
Other (1.25)	5.0	5.2	5.8	6.3	6.8	7.3	
Non-Tax Revenue (1.25)	8.2	8.5	9.5	10.3	11.1	12.0	
Capital Revenue (1.0)	1.7	1.8	1.9	2.0	2.2	2.3	
Gross Public Savings	7.2	6.9	10.6	13.2	15.8	19.5	73.2
Debt Amortization	3.2	6.5	6.6	7.5	8.8	10.8	43.4
Net Public Savings/1	4.0	0.4	4.0	5.7	7.0	8.7	29.8
N.P.S. as % of Capital Expenditure	14.0	1.4	13.6	19.0	22.7	27.2	

/1 Net of amortization.

/2 See Table 3.

Table 10: PROJECTIONS, 1968-1973

	1968	1969	1970	1971	1972	1973
Personal Consumption						
Expenditure	274.5	290.7	307.9	326.1	345.3	365.7/1
Public Consumption	41.1	42.9	44.7	46.6	48.6	50.7/2
Investment	96.6	100.2	107.3	114.0	121.4	129.0
Exports	170.3	180.3	219.2	238.9	255.8	276.4
Imports	202.4	223.2	251.9	269.9	286.8	304.4
Net Transfers	-5.5	-5.5	-5.5	-5.5	-5.5	-5.5
GNP	374.6	385.4	421.7	450.2	478.8	511.9
Factor Income	16.2	17.1	18.0	18.9	19.8	20.7
GDP	390.8	402.5	439.7	469.1	498.6	532.6/3
Growth Rate GDP (%)	5.0	3.0	9.2	6.7	6.3	6.8/4
Investment Ratio (%)	24.7	24.9	24.4	24.3	24.3	24.2
Investment	96.6	100.2	107.3	114.0	121.4	129.0
Current Account Deficit	26.6	37.4	27.2	25.5	25.5	22.5
S National	70.0	62.8	80.1	88.5	95.9	106.5
S Public	4.0	0.4	4.0	5.7	7.0	8.7
S Private	66.0	62.4	76.1	82.8	88.9	97.8
ICOR	4.7	8.3	2.7	3.6	3.9	3.6

/1 Implicit growth 5.9 percent.

/2 Implicit growth 4.3 percent.

/3 Implicit growth 6.15 percent.

/4 Pattern of growth rates reflects recovery from 1967, then short-run bottleneck stagnation, then export boom, finally smooth growth.

Table 11: EXPORT PROJECTIONS, 1969-1973  
(Values £J '000 f.o.b., prices £J per unit)

		1969	1970	1971	1972	1973
<u>Mining</u>						
Alumina:	Value	29,000	59,000	67,850	73,750	82,600
	Volume ('000 tons)	1,000	2,000	2,300	2,500	2,800
	Price	29.50	29.50	29.50	29.50	29.50
Bauxite:	Value	23,400	24,300	25,300	25,900	26,500
	Volume ('000 tons)	7,500	7,800	8,100	8,300	8,500
	Price	3.12	3.12	3.12	3.12	3.12
<u>Total Value Alumina and Bauxite</u>		<u>52,900</u>	<u>83,300</u>	<u>93,150</u>	<u>99,650</u>	<u>109,100</u>
Percent of Total		54.4	63.8	65.2	65.8	67.1
<u>Agriculture</u>						
Sugar:	Value	16,000	17,300	18,000	18,500	18,700
	Volume ('000 tons)	360	400	410	420	425
	Price (average)	44.50	43.20	43.90	44.0	44.0
Bananas:	Value	6,700	6,900	6,900	6,900	6,900
	Volume ('000 tons)	195	200	200	200	200
	Price	34.50	34.50	34.50	34.50	34.50
Molasses:	Value	1,300	1,400	1,450	1,500	1,500
	Volume ('000 tons)	130	140	145	150	150
	Price	10.0	10.0	10.0	10.0	10.0
Pimento:	Value	1,260	1,320	1,380	1,440	1,500
	Volume ('000 lbs.)	4,200	4,400	4,600	4,800	5,000
	Price	0.30	0.30	0.30	0.30	0.30
Canned Fruits:	Value	1,018	1,045	1,100	1,155	1,210
	Volume ('000 lbs.)	18,500	19,000	20,000	21,000	22,000
	Price	0.055	0.055	0.055	0.055	0.055
Fruit Juices:	Value	880	935	990	1,045	1,100
	Volume ('000 gal.)	1,600	1,700	1,800	1,900	2,000
	Price	0.55	0.55	0.55	0.55	0.55
Citrus:	Value	490	530	560	600	650
	Volume ('000 pkg.)	390	410	430	460	500
	Price	1.25	1.30	1.30	1.30	1.30
Coffee (Unroasted)	Value	240	256	266	285	304
	Volume ('000 lbs.)	1,300	1,350	1,400	1,500	1,600
	Price	1.85	1.90	1.90	1.90	1.90
Cocoa (Beans):	Value	176	170	180	190	200
	Volume ('000 lbs.)	1,600	1,700	1,800	1,900	2,000
	Price	0.110	0.10	0.10	0.10	0.10
Other Agricultural Products Value		1,136	1,244	1,324	1,335	1,436
<u>Total Value of Agricultural Exports</u>		<u>29,200</u>	<u>31,100</u>	<u>32,150</u>	<u>32,950</u>	<u>33,500</u>
Percent of Total		30.1	23.8	22.5	21.8	20.6
<u>"Other" Exports</u>		<u>15,100</u>	<u>16,200</u>	<u>17,500</u>	<u>18,800</u>	<u>20,000</u>
Percent of Total		15.5	12.4	12.3	12.4	12.3
Total Exports		<u>97,200</u>	<u>130,600</u>	<u>142,800</u>	<u>151,400</u>	<u>162,600</u>
Percent Change		+5.7	+34.4	+9.3	+6.0	+7.4
Average Annual Growth, 1969-73 (%)		-----		12.2	-----	

Table 12: IMPORT PROJECTIONS

(£ million)

	1968	1969	1970	1971	1972	1973
Food	24.7	26.5	28.4	30.4	32.6	34.9
Non-Durables	12.5	12.8	13.1	13.4	13.7	14.0
Durables	22.5	25.3	28.4	31.9	35.8	40.2
Raw Materials	35.9	39.4	43.2	47.4	52.0	57.1
Capital Goods	<u>42.5</u>	<u>48.6</u>	<u>53.9</u>	<u>55.1</u>	<u>55.6</u>	<u>56.7</u>
Total (c.i.f.)	138.1	152.6	167.0	178.2	189.7	202.9
Services	64.3	70.6	84.9	91.7	97.1	101.5
Transfers	<u>2.9</u>	<u>3.1</u>	<u>3.2</u>	<u>3.3</u>	<u>3.4</u>	<u>3.5</u>
Total	205.3	226.3	255.1	273.2	290.2	307.9
Total Excluding Transfers	202.4	223.2	251.9	269.9	286.8	304.4