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## Foreign Assistance and Economic Development Revisited

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CENTER DISCUSSION PAPER NO. 41

FOREIGN ASSISTANCE AND ECONOMIC DEVELOPMENT REVISITED

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## Foreign Assistance and Economic Development Revisited

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The importance of foreign aid and its relationship to economic development will not be denied by either theoretician or practitioner. Nevertheless, the treatment in the literature on this subject has been far from satisfactory to date. In recent years, however, the work of Chenery and his associates, culminating in the recent article by Chenery and Strout in this Review [1], has promised to deliver "a theoretical framework designed to analyze the process of development with external assistance in quantitative terms"[1, p. 680]. It is the purpose of this paper to examine rigorously this framework, and to evaluate its validity and operational usefulness.

The essence of the Chenery-Strout (C-S) paper is a proposed method for the estimation of the foreign aid "needed" by a typical less developed society in the course of growth. The two main building blocks of their theory are, first, the recognition that foreign aid can be used to fill either a savings gap or a foreign exchange gap; and second, the proposition that the typical less developed country (LDC) must move through three distinct consecutive stages of growth characterized by a difference in the gap-filling function of aid, i.e., a skill-limited phase, a savings-limited phase, and a trade-limited phase.<sup>1</sup> Furthermore, C-S claim, on the basis of data from 50 countries, that this three-stage thesis of growth is supported by the inductive evidence available.

In order to be in a position to evaluate carefully the merits of the C-S proposition which has become very popular in one form or another in recent years we found it necessary to try to distinguish between two basic elements which are somewhat intermingled in the C-S presentation: the first is their

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formal model structure; the second is their attempt to justify that structure with the help of more informal extra-model considerations. In section I we shall try to present a precise and straightforward statement of the formal model structure in such a way as to bring out the full logical implication of that structure. We are then ready, in Section II, to evaluate the C-S ideas of the "typical" life cycle of growth. Finally, in Section III, their attempt to provide an empirical test of the model is scrutinized.

## I. Model Structure

The C-S model structure consists of the differentiation among different growth regimes, the linking of these regimes in a stages theory of growth, and of the different adjustment mechanisms within each regime.

Growth Regimes. The C-S model is based on the postulation of an aggregate national income accounting system formed of eight planning variables, i.e.,  $V$ (GNP),  $I$ (Investment),  $C$ (Consumption),  $S$ (Savings),  $K$ (Capital Stock),  $M$ (Imports),  $E$ (Exports), and  $F$ (Foreign Aid)--bounded by any three of the following four independent static accounting equations (1 abcd)<sup>2</sup> and one dynamic accounting equation (1 e).

- |     |                     |   |
|-----|---------------------|---|
| 1a) | $M + V = I + E + C$ | (equality of supply and demand for total resources)     |
| b)  | $V = C + S$         | (disposition of income between consumption and savings) |
| c)  | $M = E + F$         | (sources of import financing)                           |
| d)  | $I = S + F$         | (sources of investment financing)                       |
| e)  | $dK/dt = I$         | (investment as the increment of the capital stock).     |

The behavioristic equations employed by C-S are selected from the following set: (using notation  ${}^n x = (dx/dt)/x$  to denote the rate of growth of  $x$ ):

- 2a)  $n_I = B$  exogenously postulated constant growth rate of investment (absorptive capacity)
- b)  $n_V = r$  exogenously postulated constant growth rate of GNP (target rate of growth)
- c)  $n_E = \epsilon$  exogenously postulated constant growth rate of exports (export growth rate)
- d)  $\frac{dS}{dt} = \frac{dV}{dt} \alpha'$  implying  $S = (\alpha_0 - \alpha') V_0 + \alpha' V$  where  $\alpha_0 = S_0/V_0$ <sup>3</sup> (marginal saving function)
- e)  $\frac{dM}{dt} = \frac{dV}{dt} u'$  implying  $M = (u_0 - u') V_0 + u' V$  where  $u_0 = M_0/V_0$ <sup>3</sup> (marginal import function)
- f)  $K = V k$  (production function based on constancy of capital-output ratio k).

Thus there are three exogenously postulated growth rates ( $B, r, \epsilon$ ), two marginal propensities (to import  $u'$  and to save  $\alpha'$ ) and a capital-output ratio ( $k$ ).

These six parameters appearing in the behavioristic equations in (2) may be summarized as: ( $B, r, \epsilon, \alpha', u', k$ ).

A special word of explanation with respect to the meaning of  $B$  (in 2a), the only somewhat unconventional parameter in this group, may be helpful. In C-S parameter  $B$  reflects a definition of absorptive capacity in terms of "the skill formation required of managers, skilled labor and civil servants in order to increase productive investment" [1, p. 686]. Thus the "skill" in their skill-limited phase refers specifically to the ability to blueprint and carry out investment projects. The postulation of a constant growth rate of investment  $B$  in (2a) must then be based on the view that the ability to invest is augmented through time as the result of a secular learning-by-doing process inherent in the act of investment. In other words, the magnitude of  $B$  describes the rapidity of the learning process. Such a relatively unfamiliar notion would have been more convincing had it been supported by some positive arguments related to the theory of learning.

The behavioristic assumptions in (2) are used by C-S in different combinations to construct three distinct models--to be denoted by  $M_1$ ,  $M_2$ , and  $M_3$  below--as three alternative ways to calculate the needed foreign aid flow through time. The three models are then viewed as three growth regimes which appear in a definite sequential order ( $M_1$ ,  $M_2$ ,  $M_3$ ) and constitute the three phases of a three-stages growth thesis. This central thesis of C-S is depicted in diagram 1 in which time is measured on the horizontal axis and the three phases ( $M_1$ ,  $M_2$ ,  $M_3$ ) are marked off by the (dotted) vertical lines as indicated. With the aid of this diagram, the causal order for the determination of the needed volume of foreign aid in each phase can now be briefly and succinctly stated.

C-S refer to  $M_1$  as the Skill-Limited Phase, for which assumptions 2a, 2d, and 2f are selected to close the system. Given the constant absorptive capacity limitation  $B$  of assumption (2a) (horizontal line through point "B" in diagram 1a) we can determine the time path of investment (diagram 1b). This gives the time path of the capital stock (by 1 e) and hence the time path of capacity GNP (by 2f) (diagram 1b). With the aid of the saving function of assumption (2d), we can then determine the needed foreign aid through time (line  $F_0^S$  b in diagram 1b) as the gap between investment and saving.<sup>4</sup>

Since, in the Skill-Limited Phase ( $M_1$ ), the time path of capacity GNP ( $V$ ) is determined, the growth rate of GNP (i.e.,  $\eta_V$ ) can be easily calculated as (see appendix):

$$3a) \quad \eta_V = \frac{\frac{I_0}{\theta + \phi}}{\frac{I_0}{\theta + \phi}} \quad \text{where } \theta = K_0 - I_0/B \text{ and } \phi = I_0/B$$

$$b) \quad \lim_{t \rightarrow 0} \eta_V = \frac{\frac{I_0}{\theta + \phi}}{\frac{I_0}{\theta + \phi}} = I_0/K_0$$

$$c) \quad \lim_{t \rightarrow \infty} \eta_V = \frac{\frac{I_0}{\phi}}{\frac{I_0}{\phi}} = B$$

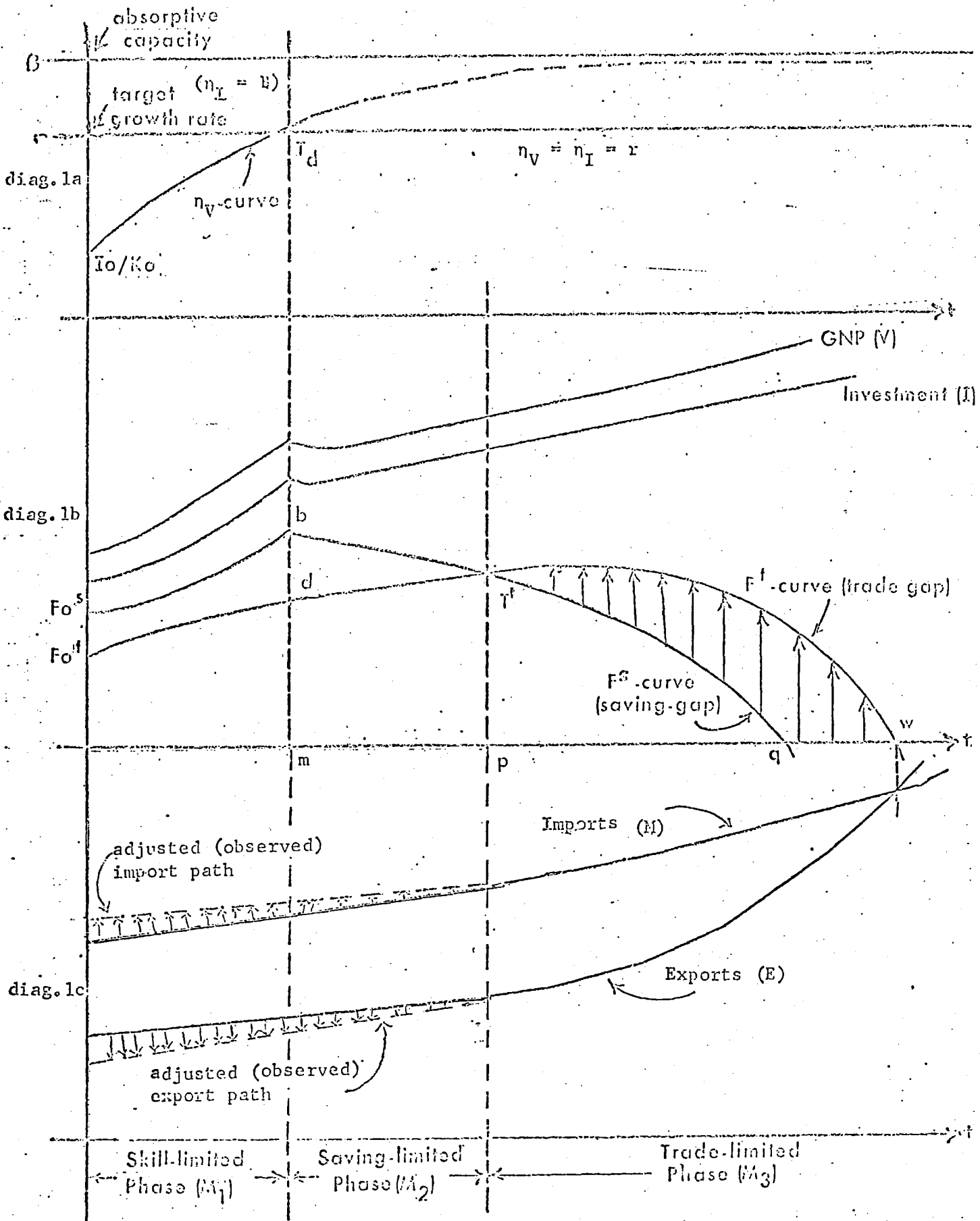


Diagram 1

Thus the constant growth rate of investment  $B$  leads to the phenomenon of "income acceleration" in Phase I whereby the rate of growth of GNP monotonically increases from its initial value  $(I_0/K_0)$  to a long run stationary value equal in magnitude to  $B$ , the measured absorptive capacity. (See the  $\eta_V$  curve in diagram 1a.) It should be noted that this income acceleration phenomenon is not only interesting in its own right<sup>5</sup> but is absolutely essential for the C-S "stages of growth thesis"--as will be demonstrated later. For this reason, we feel that the necessary and sufficient condition for income acceleration in  $M_1$ , i.e.,

$$4) \quad I_0/K_0 < B$$

should have been explicitly stated by the authors.

Moving on to  $M_2$ , the Saving-Limited Phase, assumptions 2b, 2d, and 2f are now expected to hold.<sup>6</sup> Given  $r$ , the target growth rate of GNP (assumption 2b), represented by the horizontal line through " $r$ " in diagram 1a, we can determine the time path of GNP (diagram 1b) as well as the saving path, with the aid of the saving function (2d). Based on the constant capital-output ratio (assumption 2f), we can then determine the needed capital stock and thus the needed investment through time (diagram 1b). Foreign aid in  $M_2$  is then determined as the gap between needed investment and the available domestic saving depicted by the  $bT'$  curve (in diagram 1b).

Finally in  $M_3$ , the Trade-Limited Phase, assumptions 2b, 2c, and 2e are in effect. Once the time path of GNP is determined, with the help of assumption (2b) i.e., a target growth rate,  $r$ , (as in  $M_2$ ), we can, by using assumption 2e, determine the required volume of imports (solid curve in diagram 1c). With the time path of exports (solid curve in diagram 1c) determined by the exogenously postulated growth rate (assumption 2c), the foreign trade gap is determined as the difference between imports and



exports. (In diagram 1c, the trade gap can thus be represented by the vertical distance between the two solid curves.)

Thus, for each of the three phases taken separately, we can easily deduce (see appendix) the time path of needed foreign aid:

$$5a) F^S = (F_0 + m e^{Bt}) - m \quad \text{Where } m = (\alpha_0 - \alpha')V_0 + \alpha'(K_0 - I_0/B)/k \quad (\text{for } M_1)$$

$$b) F^S = (kr - \alpha')V_0 e^{rt} - (\alpha_0 - \alpha')V_0 \quad (\text{for } M_2)$$

$$c) F^t = (u_0 - u')V_0 + u'V_0 e^{rt} - E_0 e^{Et} \quad (\text{for } M_3)$$

The superscripts in (5) serve to remind us of the fact that while the needed aid is determined in the form of filling a saving-investment gap ( $F^S$ ) in  $M_1$  and  $M_2$ , it is determined as filling a trade-gap ( $F^t$ ) in  $M_3$ .

These equations represent the basic instruments proposed by C-S for the purpose of estimating the needed foreign aid over the entire life cycle of growth. In order to prepare ourselves for an examination of this three-phased thesis, some pertinent technical matters must first be disposed of:

1) For each model, separately presented above, there are seven equations<sup>7</sup> postulated for the eight variables. Thus each model is only partially determined. Our discussion of the causal order above shows that imports (M) and exports (E) are undetermined in  $M_1$  and  $M_2$  while saving (S), investment (I), and consumption (C) are undetermined in  $M_3$ .

2) Two additional conditions are used, in each model, to determine the values of the above undetermined variables. For  $M_1$  and  $M_2$  the values of imports (M) and exports (E) are determined with the aid of the import function (2e) and the export function (2c). For  $M_3$ , the values of C, S, and I are determined with the aid of the saving function (2d) and the production function (2f). In this way a trade gap,  $F^t$ , can be determined for  $M_1$  and  $M_2$  while a

saving gap,  $F^S (= I - S)$ , can be determined for  $M_3$ . Thus for each model, two gaps  $F^t$  and  $F^S$  can be defined. This is shown in diagram 1b in which the  $F^S$ -curve and the  $F^t$ -curve extend through all three phases.

3) There thus exists over-determinacy in C-S in each phase since nine equations are used to determine a system of eight variables. This over-determinacy can be seen directly from the fact that, in each phase, the saving gap ( $F^S$ ) is not the same as the trade gap ( $F^t$ )--although they clearly must always coincide ex-post. In short a gap ( $F^S - F^t \neq 0$ ) between the two gaps exists generally throughout the three phases, as seen from the vertical distance between the  $F^S$ -curve and  $F^t$ -curve in diagram 1b.

This famous gap between the two gaps of the Chenery School, which can be clearly depicted in this fashion, is crucially involved in two ways. First, it relates directly to the turning points between phases in the three-phased growth thesis. Second, inherent in the notion of over-determinacy is the notion of disequilibrium analysis according to which the gap ( $F^S - F^t$ ), and thus the overdeterminacy, are eliminated. It is to these two aspects of the C-S paper that we shall now turn.

### Stages of Growth Thesis

The above three independent growth regimes represent the building blocks with the aid of which the C-S theory of consecutive stages of growth ( $M_1, M_2, M_3$ ) is to be constructed. It is intuitively obvious that, in any such "stages of growth thesis," the crucial matters are always the turning points (marking off two consecutive regimes) and the contrasting rules of behavior between any two regimes. The exposition in the C-S paper is most unsatisfactory in this area in that these crucial matters are dealt with only informally, leaving the reader to find his way with the help of a number of hidden

assumptions mixed with casual empiricism. This lack of definite and explicit commitment makes it next to impossible for us to present more than a "maximum likelihood" interpretation of their three-stages thesis.

To begin with, C-S assume that the needed foreign aid is at all times determined by the larger of the two gaps, i.e.,

$$6) \quad F = \text{Max} (F^S, F^T) \text{ for all time.}$$

In diagrammatic terms, the aid needed by a typical aid-receiving country over its life cycle is depicted by the time path  $F_0^S bT'w$  in diagram 1b. Together with the equations in (5), a procedure to estimate the aid needed emerges which is based on a stages-of-growth thesis marked off by two turning points. Furthermore, C-S also seem to be willing to make certain judgments as to the general shape of some of these curves thus revealing, somewhat hesitantly, their view on the contrasting behavior of needed aid in each phase.

A typical aid-receiving country, according to C-S, usually starts in a skill limited phase ( $M_1$ ) with the income accelerating characteristic defined in (4). The rate of growth of income,  $\eta_V$ , will increase and may therefore after some finite time span exceed the target rate of growth of income stipulated for the saving-limited phase,  $M_2$ .

The existence of such a point of intersection,  $T_d$ , between the  $\eta_V$  curve and the horizontal target growth rate curve in diagram 1a, in fact marks the demarcation between phases  $M_1$  and  $M_2$  in the C-S three-stages thesis.<sup>8</sup> It is easy to see from diagram 1a that the relevant implicit assumption is:

$$7) \quad I_0/K_0 < r < B \quad (\text{condition for existence of first turning point}).$$

In other words, the essential qualitative assumption concerning the existence of the first "turning point" is that the target rate of growth of income in

$M_2$  lies between the rate of absorptive capacity (B) and the initial growth rate of both capital and income ( $I_0/K_0$ ).

Once in the second phase ( $M_2$ ), this typical country will sooner or later move into the third phase ( $M_3$ ) at a turning point marked off by the point T' in diagram 1b. The implication is that at this turning point a saving-gap-dominated phase of growth (i.e.,  $F^s > F^t$ ) gives way to a trade-gap-dominated phase (i.e.,  $F^s < F^t$ ). The implicit assumptions of C-S on which this view of the world is based are as follows:

- 1) The saving gap ( $F^s$ ) increases in  $M_1$ <sup>9</sup> and decreases in  $M_2$  and  $M_3$ .<sup>10</sup>

It can be shown (see Appendix) that this is ensured by the following condition which C-S must have implicitly assumed

$$8) \quad r < \bar{n}_K < B \text{ where } \bar{n}_K = \alpha' / k \text{ (} F^s \text{ increases in } M_1 \text{ and decreases in } M_2 \text{ and } M_3 \text{).}$$

The implicit assumption is that  $\bar{n}_K$  must be less than the absorptive capacity (B) for  $F^s$  to increase in  $M_1$  and must be greater than the target growth rate (r) for  $F^s$  to decrease in  $M_2$  and  $M_3$ .

- 2) The trade gap ( $F^t$ ) lies below the saving gap in  $M_1$  and exceeds the latter sometime thereafter--in fact marking off  $M_2$  from  $M_3$ .<sup>11</sup>

- 3) The trade gap ( $F^t$ ) is increasing in  $M_1$ <sup>12</sup> and decreasing thereafter.<sup>13</sup> The fact that the  $F^t$  curve is inverse U-shaped is assured by the condition (see Appendix):

$$9a) \quad r < \epsilon < r \quad (u' / (E_0/V_0)) \quad (F^t \text{ inverse U-shaped})$$

$$b) \quad u' > E_0/V_0$$

Thus  $F^t$  is inverse U-shaped when and only when the exogenous export growth rate exceeds the target growth rate but not by too large a margin (9a).

A necessary condition for this to occur is that the country has a low initial propensity to export ( $E_o/V_o$ ) and a high marginal propensity to import. (9b).<sup>14</sup>

The above, in brief, represents a recapitulation of the logical content of the two turning points in the C-S three-phased thesis--as well as an exposition of certain qualitative aspects of the system in each phase. While C-S clearly will not deny that some individual aid-receiving countries may deviate from the above pattern--both in respect to the demarcation between the phases and in respect to the major qualitative aspects within each phase--it is nevertheless true that this pattern is to be regarded as "normal" or "typical." In evaluating their thesis, one should of course remember that this must be done in terms of their general view of how a "typical" country behaves, while we are in full agreement with them that individual cases can be expected to stray from that normal pattern. One major weakness of their stages of growth thesis is, however, already apparent, namely, the assumed long run stability of all the parameters of their model. It is most unlikely that, as the typical country moves through its life cycle, its basic production structure will not change sufficiently to modify at least some, if not all these parameters. While the stability of parameters can be taken as an approximation in short run analysis, we feel that a stages of growth thesis should not realistically accept this convenience. However, in what follows, we shall disregard this rather basic defect.

#### Disequilibrium Adjustment Process

Since we know that the magnitude of the saving gap and of the trade gap must be the same ex post (i.e., since, after the fact, foreign aid must be able to plug both gaps simultaneously), the existence of a gap between the two gaps implies that some ex ante behavioristic assumption is not really

effective in each phase.<sup>15</sup> The assumed availability of aid to plug the larger of the two gaps led C-S to assume that in  $M_1$  and  $M_2$  the restrictive nature of one or both of the trade assumptions (2c and 2e) may be relaxed, while, in  $M_3$ , the saving assumption (2d) may be relaxed.

In  $M_1$  and  $M_2$ , imports may, in fact, be more than what is needed and/or exports may be less than capacity. This ex post adjustment possibility can be indicated in diagram 1c by the dotted curve representing an upward adjustment of the import curve and/or a downward adjustment of the export curve by such amounts that the (increased) ex post trade gap at each time will be exactly the same as the saving gap.

Conversely, in Phase III, because foreign aid is assumed to be adequate to plug the larger trade-gap, the domestic saving capacity will not be fully utilized--i.e., some potential saving will, in fact, not be realized. In diagram 1b, this is shown by an upward shift of the  $F^S$ -curve until it coincides with the  $F^t$ -curve in  $M_3$ --indicating that a smaller part of investment is financed by domestic saving than what would have been the case had foreign aid been not so liberal.

If the aid giver really is so generous as always to provide the needed aid according to the principle of filling the maximum gap (6), aid recipients will encounter little difficulty in adjusting via the pleasant route of higher imports, lower exports, and lower saving. The situation--which, unfortunately, is more likely to occur in the real world--arises when the aid giver is willing to donate less than the maximum gap and hence the aid recipient is forced to make the unpleasant kind of adjustment in the opposite direction. C-S do not deal with this more realistic type of adjustment to disequilibrium. This, we believe, is a basic weakness of their analysis of the "demand" for aid.

## II. The General C-S Thesis

What we have presented above is the formal part of the stages-of-growth thesis presented in the C-S paper. Actually, the validity of this thesis is based, not so much on the internal logical structure of the model, as on their intuitive view of the process of development in long run historical perspective. In order to appreciate the formal portion of their thesis it is essential to share their general vision which is largely extra model in nature.

C-S believe that a typical aid-recipient country initially finds itself limited by its deficiency in the skills required to undertake investment projects--a deficiency which can only be removed by education and a secular learning-by-doing process. The investment skill in this initial phase is the development bottleneck in the sense that the implied demand for funds for investment is small relative to the combination of available domestic saving and projected foreign aid. Moreover, the implied needed amount of imports--in spite of limited export capacity--is even smaller.

Over time growing skill levels lead to a continuous expansion of the rate of growth of GNP. However, the expansion, if unchecked, would lead to an unreasonably high level of demand for foreign aid. The government then seeks to adopt self-disciplinary measures, symbolized by some given target rate of growth of GNP to curb the rate of expansion of the demand for foreign aid.<sup>16</sup> Simultaneously, domestic austerity measures are adopted to ensure that the demand for foreign aid satisfies the criterion of self-help (i.e.,  $\alpha'/k > r$  in 8) which implies the downward movement of needed aid towards an ultimate termination date (point q in diagram 1b).

In spite of such relative domestic austerity and other self-help efforts, the country is once again faced with a pressing demand for foreign aid from another source, this time the inflexibility in the productive structure which manifests itself via a country's inability to reduce its import demand through import substitution and/or to expand its exports through export promotion. This non-flexibility between domestic and foreign resources then becomes the effective limiting factor determining the volume of needed foreign aid. The resulting trade gap can be closed in the long run only when the potentiality of export expansion (coupled with import substitution) is larger than the growth target (i.e.,  $\epsilon > r$  in 9a).<sup>17</sup> Provided this condition is satisfied, the country can be said to move through its life cycle to ultimate termination of aid.

This consecutive stages of growth thesis ( $M_1, M_2, M_3$ ) can be judged, first of all, on the basis of the reasonableness of the above theoretical vision. The essential content of any stages of growth thesis (with well-defined phases of growth marked off by turning points) must lie in the justification of the inevitability of the transition from one stage to the next, i.e., why do the forces operating in one phase necessarily lead to the dominance of other rules of growth in a later phase? On closer scrutiny, in the present C-S three stages thesis, the occurrence of two turning points appears to be attributable to a host of forces--social-political, technological, and economic--the operation of which conforms to a rather peculiar historical view of growth:

(1) The turning point between  $M_1$  and  $M_2$  occurs when, threatened with the unwillingness by foreigners to continue to underwrite a rising growth rate, the government intervenes by the adoption of a reasonable target rate of growth to suppress the uninhibited growth rate propelled by the ever-rising



ability to invest. This is, at best, a hybrid turning point thesis. It is composed in part of social-political arguments of external feasibility with respect to the willingness of foreigners to underwrite the cost of rising growth rates and in part of the feasibility of an internal consensus on the appropriate controlled growth target. It also entails a particular view of technical factors since the abandonment of investment ability as the dominant constraint signifies that the country is sufficiently mature technically to be able to absorb all domestic and foreign saving likely to be made available and channel them into efficient investment outlets.

(2) The turning point between  $M_2$  and  $M_3$  occurs when the deficiency in the flexibility of the economy's production structure becomes more of a bottleneck than the deficiency in its saving capacity. The underlying C-S view appears to be that, in the course of the maturing process, the country acquires an aptitude for austerity earlier than an aptitude for the exploration of foreign markets.

It is clear that any such three-phased thesis represents a specific and relatively inflexible view of the metamorphosis of a less developed country, i.e., that it will acquire first an aptitude for organizing and investing, second, for austerity, and finally for achieving technological flexibility--in that order. The authors, it is true, are careful to point out (in a footnote) that the three phases described "can follow each other in any order if we allow the structural parameters to change at random over time. With fixed parameters, the commonest sequence is from phase I to either phase II or phase III" [1, p. 690, fn. 23]. But the particular "normal" metamorphosis presented is built, as we have shown, on a string of rather arbitrary assumptions which are not deduced from accepted hypotheses in economics or elsewhere. The simple truth is that the theory of economic transition is still in an embryonic

stage. It is probably unsafe to describe a particular development sequence based on aptitudinal change as typical for all--or even most--underdeveloped countries.

The injection of a politically based target growth rate,  $z$ , moreover, raises questions of a different nature as well. It is not clear whether a politically controlled growth target has to be introduced early, late or at all in the course of the growth process. It is certainly doubtful that such a target, if introduced at all, will ever be used to suppress investment ability, as C-S seem to be claiming. Finally, even when a target growth rate is announced, there is a basic question as to whether the typical underdeveloped "mixed economy" has the necessary socio-political machinery to implement the planned target effectively.

In short, we find the C-S three-phased growth thesis rather unconvincing on a priori grounds. The question then naturally arises as to whether the thesis can be tested empirically. The C-S paper is certainly impressive in terms of its abundance of statistical data and the impression is strongly conveyed that such a test has, in fact, been performed. Let us now examine the nature of this empirical work.

### III. Empirical Analysis

Ideally, inductive evidence can be used to support or refute the central thesis of any legitimately constructed economic model. As far as the three-stages thesis of C-S is concerned, this means that we should be able to verify its validity by looking at the historical experience--as measured, for example, by sufficiently long statistical time series for the variables  $V$ ,  $I$ ,  $S$ ,  $C$ ,  $M$ ,  $E$ ,  $F$ ,  $K$ --of some underdeveloped countries which have presumably moved through all three phases of the life cycle. C-S did not attempt such an historical approach and, we believe, for a very good reason, namely, that it cannot be done.

Because of the shortness of the post World War II foreign aid experience, it is probably true that not very many contemporary underdeveloped countries have, in fact, completed all three stages of the kind of a life cycle put forward here. Pakistan, which is treated by C-S as the "model case" throughout their paper, is described as "for the past 8 to 10 years following the sequence envisioned in our Phase I." [1, p. 691]. No other country is proposed by C-S as a typical country which has gone through all three phases in the past and for which a historical verification of their thesis is attempted. Thus, verification based on the experience of a contemporary underdeveloped country is difficult.

However, we suspect that the three-phases thesis, in its present form, is not amenable to historical verification even, say, fifty years from now when some country surely will have completed the alleged life cycle. This is basically due to the fact that the C-S thesis depicts only a partial picture restricted to the demand for foreign aid. The other half of the picture, i.e., the supply of foreign aid, is completely absent from the framework of the analysis. Historical verification in fact cannot be undertaken at any time for the simple reason that the ex post experience of growth is bound to be the product of the interaction of demand and supply conditions.

To illustrate this, we can imagine that in addition to the saving gap curve ( $F^s$ -curve) and the trade gap curve ( $F^t$ -curve) in diagram 1b there exists an  $F^a$ -curve which denotes the supply (or the availability) of foreign resources. We can then define an excess of  $F^s$  over  $F^a$  as an inflationary gap--in accordance with Keynesian terminology--and an excess of  $F^t$  over  $F^a$  as a balance of payments gap. The actual international transfer mechanism has to involve the simultaneous adjustment of all three curves to eliminate any ex post difference among them through changes in the level of employment

and the growth rate, the price level, the exchange rate, as well as the supply of foreign aid.

It is evident that unless the demand analysis of C-S has also accurately anticipated supply--which is extremely unlikely except under conditions of an unlimited supply of foreign aid--their framework just cannot be used to analyze historical experience in foreign assistance.

Thus we see that the central three-phases thesis of C-S cannot be supported by empirical evidence of the "backward looking" or historical variety. The empirical justification, in fact, attempted in the paper employs inductive evidence in the relatively more modest task of implementing the C-S model in the econometric sense, i.e., to estimate the major parameters of the model and to make foreign aid projections on the prior assumption that the model is, in fact, descriptive of the real world. In this fashion alternative sets of parameter values are first estimated for some fifty countries [1, Tables A<sub>1</sub>-A<sub>3</sub>]. Presumably, these parameter values can then be substituted in the following "necessary conditions" in order to determine whether the "typical" case (depicted in diagram 1) will or will not result:

$$(10) \quad I_0/K_0 < r < \alpha'/k \quad B \text{ and } r < \epsilon < r(u'/(E_0/V_0)) \quad (\text{by (7), (8) and (9)}).$$

If these conditions are satisfied, foreign aid projections can then be made for the "typical" country--with the help of (5) and (6).

As a result of implementing the model in this fashion, C-S claim to have discovered that the "same phenomenon [i.e., the switching from Phase I to II to III] occurs in the projections for the majority of developing countries." [1, p. 695]. It is only in this sense that they claim the support of inductive evidence for their thesis.

But even with this much more limited statistical implementation effort, there are formidable problems to be overcome since the parameters

which must be estimated cannot, in fact, be identified. C-S assume that the time series available for a typical country are produced as a country moves through phase I (i.e.,  $M_1$ ).<sup>18</sup> It is then obvious that, for  $M_1$ , the export growth rate ( $\epsilon$ ), the initial export ratio  $E_0/V_0$ , and/or the import coefficient ( $u'$ ) cannot really be identified. This is due to the fact that, according to the C-S disequilibrium adjustment thesis, the observable actual imports (represented by the dotted line in diagram 1c) are greater than the needed imports (represented by the solid line in the same diagram)--and it is the latter which is needed for purposes of identification. Similarly it is impossible to estimate the initial export ratio  $E_0/V_0$  and the exogenous growth of exports ( $\epsilon$ ), as actual observable exports may be less than the value of potential exports which is needed for identification.

C-S do not face the identification problem openly but seem to have made some quite arbitrary assumptions in attempting to get around it. Their two main assumptions are hidden in footnote c of table four [1, 694]. First, in the disequilibrium adjustment process in Phase I, all adjustments are assumed to be made by imports. Thus the initial export ratio  $E_0/V_0$  and the export growth rate  $\epsilon$  can be identified. Second, for phase I (i.e., for the period 1956-1962 used for estimation purposes), the saving gap is simply assumed to be equal to the trade gap (i.e.,  $F^s = F^t$ ). (In terms of diagram 1b, the assumption is that the point  $F_0^t$  and  $F_0^s$  on the vertical axis coincide.) This enables them to estimate the import coefficient ( $u'$ ).<sup>19</sup> There is no justification whatsoever on theoretical grounds for the year picked to be precisely such a year--and why this should be true for all the countries studied. In other words, for identification purposes, an essential aspect of their very thesis--i.e., the existence of a gap between the two gaps--must be sacrificed!

Thus, while the theoretical part of the C-S thesis is based on somewhat indefinite behavioristic assumptions marginal to the domain of economic theory, the empirical part of the analysis is saddled with an as yet unsolved identification problem. But even if we waive all these problems, the fact that a three-phased phenomenon can be produced in the laboratory of planners does not mean that the three-stages thesis is supported by historical fact. It is, in fact, a non-testable thesis for which no amount of historical evidence can ever tell whether it is right or wrong!

The really essential issue of any viable growth promotion policy is how to facilitate the various learning processes (learning to save, to invest, to export, to engage in efficient import substitution) with the help of foreign aid, rather than how to calculate foreign aid requirements if we know these parameters. We cannot help but feel that, by overemphasizing the materialistic or resources aspect of development, C-S have diverted our attention from the really important issues surrounding changing behavior patterns in the course of economic growth.

References

1. H. B. Chenery and A. M. Strout, "Foreign Assistance and Economic Development," Am. Econ. Rev., Sept. 1966, 56, 679-733.

# Appendix

For the first model  $M_1$  (defined by (1) and (2adf) ) of the skill-limited phase, we can determine the time path of capital  $K$ , and hence  $V$ , from the time path of investment, by integration. Formally:

$$\text{A1a)} \quad I = I_0 e^{Bt} \text{ ----- by 2a}$$

$$\text{1b)} \quad K = \int I dt = \theta + \phi e^{Bt} \text{ ----- by (A1a) where } \theta \text{ and } \phi \text{ are defined in (3a) in the text.}$$

$$\text{1c)} \quad V = K/k = \theta/k + (\phi/k) e^{Bt} \text{ ----- by (2f) and (A1b)}$$

The rate of growth of  $V$  (i.e.  $\eta_V$ ) in (3a), is obtained directly from (A1c).

By differentiating  $\eta_V$ , we have

$$\text{A2)} \quad \frac{d\eta_V}{dt} > 0 \text{ if, and only if, } \theta > 0 \text{ i.e., } B > I_0/K_0$$

which is the condition of income acceleration of (4) in the text. We can next calculate the time path of savings from (A1c) and (2d) as:

$$\text{A3)} \quad S = (\alpha_0 - \alpha')V_0 + \alpha' (\theta/k + (\phi/k)e^{Bt}) \text{ ----- by (A1c) and (2d)/}$$

The savings-gap,  $F^S$ , for  $M_1$ , as listed in (5a) in the text, is calculated as:

$$\text{A4)} \quad F^S = I - S \text{ for } I \text{ in (A1a) and } S \text{ in (A3).}$$

To investigate the direction of change of  $F^S$ , we differentiate (5a) in the text to obtain:

$$\text{A5)} \quad dF/dt = (F_0 + m)Be^{Bt} > 0 \text{ if, and only if, } F_0 + m > 0 \text{ or } B > \alpha'/k$$

which is a part of the condition listed in (3) in the text.

For the second model  $M_2$  (defined by (1) and 2bdf) of the saving-limited phase, we can calculate  $V$ ,  $I$ ,  $S$ , and  $F$ , following the causal order discussion in the text. To summarize, we have:



$$A6a) \quad V = V_0 e^{rt} \text{ ----- by (2b)}$$

$$b) \quad I = dK/dt = d(kV)/dt = krV_0 e^{rt} \text{ ----- by (2b), (1e) (2f)}$$

$$c) \quad S = (\alpha_0 - \alpha')V_0 + \alpha'V_0 e^{rt} \text{ ----- by (A6a) (2d)}$$

$$d) \quad F^S = I - S \text{ for } I \text{ defined in (A6b) and } S \text{ defined in (A6c).}$$

The last equation (A6d) leads to the savings-gap expression,  $F^S$ , for  $M_2$  listed in (5b) in the text. Differentiating  $F^S$ , we have:

$$A7) \quad dF^S/dt < 0 \text{ if, and only if, } \alpha'/k > r$$

which is the condition of "self help" (i.e., declining  $F^S$ ) in  $M_2$  as listed in (8) in the text.

Finally for the trade-limited phase  $M_3$  (defined by (1) and (2bce) ), the time paths of  $V$ ,  $E$ ,  $M$  and  $F^t$  can be calculated--following their causal order discussion in the text:

$$A8a) \quad V = V_0 e^{rt} \text{ ----- by (2b)}$$

$$b) \quad E = E_0 e^{\epsilon t} \text{ ----- by (2c)}$$

$$c) \quad M = (u_0 - u')V_0 + u' (V_0 e^{rt}) \text{ ----- by (A8a) and (2e)}$$

$$d) \quad F^t = M - E \text{ for } M \text{ of (A8c) and } E \text{ of (A8b)}$$

The last equation leads to the trade gap expression ( $F^t$ ) of (5c) in the text. To investigate the direction of change of  $F^t$ , we differentiate (5c) to get:

$$A9a) \quad dF/dt = u'rV_0 e^{rt} - E_0 \epsilon e^{\epsilon t} \text{ ----- by (5c)}$$

$$b) \quad \text{For } t = 0, dF/dt = u'rV_0 - E_0 \epsilon > 0 \text{ if and only if } \epsilon < ru'/(E_0/V_0)$$

$$c) \quad \text{For } t = \infty, dF/dt > 0, \text{ if and only if } r < \epsilon$$

The last two conditions ensure that  $F^t$  is inverse U-shaped--as indicated in (9a) in the text.

- <sup>1</sup>The skill limited phase represents a more recent addition to the Chenery School "two-gap approach".
- <sup>2</sup>The fourth can be deduced from the other three. Thus in (1), four independent accounting equations are postulated for the eight planning variables. The reader may be reminded of the fact that four additional behavioristic assumptions must be postulated to have a completely determined model.
- <sup>3</sup>Notice that  $\alpha_0$  is the initial average propensity to save and  $u_0$  is the initial average propensity to import.
- <sup>4</sup>The time path of saving is the vertical gap between the investment-curve and the aid-curve over time.
- <sup>5</sup>It testifies to the importance of the constant absorptive capacity assumption of C-S since, in the long run, the rate of growth of income ( $\eta_Y$ ) and capital ( $\eta_K$ ) are all dominated by, and in fact, equal in magnitude to the absorptive capacity limit ( $\eta_I = B$ ).
- <sup>6</sup>In diagram 1, this model applies to Phase  $M_2$ .
- <sup>7</sup>The seven equations include four independent accounting equations from (1) and three behavioristic equations from (2).
- <sup>8</sup>[1, p. 687], "Phase I ends in year  $m$  when investment reaches a level adequate to sustain the target rate of growth".
- <sup>9</sup>See reference to "rising capital inflow in Phase I" on both pp. 689 and 690 of [1].
- <sup>10</sup>[1, p. 688]. "In Phase II, ...in order for the rate of capital inflow to decline, the marginal saving rate must exceed the investment rate  $kr$  required by our growth target". This is a part of the condition stated in (8) in the text.
- <sup>11</sup>[1, p. 690]. "...the trade limit may replace the saving limit as a determinant of the capital inflow in either Phase I or Phase II...it is more likely to be during Phase II."

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<sup>12</sup>[1, p. 690] "... (In Phase I), the rising capital inflow does not usually require exports to increase as fast as imports" resulting in an increasing trade gap.

<sup>13</sup>[1, p. 690]. "Once a target growth in GNP is attained, however, exports must rise more rapidly than imports if aid is to be reduced."

<sup>14</sup>If (9b) is not satisfied the trade gap increases monotonically.

<sup>15</sup>See our earlier discussion on over-determinacy.

<sup>16</sup>[1, p. 686]. In fact there is an abrupt curbing of the expansion of the economy at the turning point (between  $M_1$  and  $M_2$ ). This can be visualized in diagram 1a in at least two ways. First the increasing trend of  $\eta_v$  in  $M_1$  gives way to a constant value of  $\eta_v$  in  $M_2$  (i.e., income acceleration phenomenon ceases in  $M_2$ ). Second, the constant rate of investment at the value  $\eta_I = B$  in  $M_1$  is replaced by a lower value  $r$  (i.e.,  $\eta_v = r$ ) in  $M_2$ .

<sup>17</sup>This long run adjustment to bring about structural flexibility is considered to be a modification of the "short run model" which is the basic model of C-S. C-S acknowledge the possibility of searching out a "more efficient growth path" under the assumption of "coordinated development policies and a planned adjustment of the trade gap and savings gap" [1, p. 697] for the purpose of reducing the projected aid requirement.

We shall limit our discussion to the short run limited flexibility model of C-S which they used to evaluate current performance as well as to make 5-10 year projections. In our view, the art of foreign aid projections is not sufficiently advanced to render anything more than 10-years' projections very meaningful.

<sup>18</sup>We may add that this is, of course, the only legitimate assumption--otherwise the predictive value of their three-phase-thesis is lost.

<sup>19</sup>For then ex ante equals ex post and there is no adjustment problem.