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The Effects of Foreign Assistance on Growth and
Other Variables in Latin America

An Essay in

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<u>Table of Contents</u>		<u>Page</u>
I	Introduction	2
II	One Sector Growth Models	3
	A) Harrod and Domar	3
	B) Solow	6
III	Foreign Exchange and Savings Gaps	15
IV	Empirical Review	18
	A) Perspectives on Aid	18
	1) Effectiveness	18
	2) Motivations of Donors	19
	B) Effects of Aid on:	20
	1) Growth	20
	2) Savings	25
	3) ICOR	27
	4) Consumption	29
	5) Exports	31
V	Technical Progress	32
VI	Conclusions	35
VII	Appendix A	39
VIII	Appendix B	40

Introduction

The debate over the purpose and effectiveness of foreign assistance has raged on despite an outpouring of both theoretical and empirical work over the last two decades. On the one side there are those who believe the effects of aid are minimal or even negative (through its effects on the recipient's domestic prices) and that aid is in reality a foreign policy tool employed by the developed countries to gain leverage and influence in the recipient country. On the other side there are those who believe that foreign assistance is capable of relieving foreign exchange or savings constraints, and can do much to boost economic performance. Some writers even believe that inadequate aid would lead to "sudden death" of most underdeveloped countries (Fei, 1962). Despite this debate, most economists feel that aid has the potential to be beneficial, if it is used to increase domestic investment and not diverted into consumption goods (although increasing consumption may be beneficial as well, as we will discuss).

It is oftentimes difficult to isolate the exact effects of aid on growth rates and other variables, because for most countries aid is a very small percentage of overall growth in GNP. Most researchers use Aid/Y (aid divided by GNP) instead of simply the aid level when analyzing the impact of aid on growth. This takes into account the relative magnitude of aid's influence in the recipient country's economy. However, this also assumes that the relationship between aid and GNP (Y) is linear, and most believe this is simply not the case, especially when aid

is able to remove a foreign exchange or savings bottleneck. Many people have found that the marginal impact of aid on growth increases as the proportion of aid increases, so that if aid is treated as additional investment the linearity of the aid-GNP relationship is questionable. When adding a variable to account for a possible quadratic effect of aid on growth (Aid-sq), I found that the relationship between aid and growth is not significantly quadratic (t-ratio = .97), or that it is linear. (The entire model and results will be described more fully in the second half of this paper).

The conclusion of most economists who have tested the effectiveness of foreign assistance empirically has been that aid does not have a significant impact on growth (Griffen, 1970; Mosely et al, 1987). However, economists have yet to devise a model which consistently explains economic growth in developing countries, so the magnitude of aid's impact is not fully understood. If aid is highly correlated with a variable which significantly affects GNP growth and has been left out of the model, then both the magnitude and the significance of the coefficient on aid comes into question. That is, by adding a previously omitted variable to the model, the standard errors of the other variables as well as their coefficients in the model will change if they are correlated with the omitted variable. Therefore, the t-ratios of the original explanatory variables correlated with the omitted variable will change.

This paper will examine first the theoretical framework surrounding growth and how aid can speed up the growth rate of

GNP either by increasing the rate of savings (and therefore investment) or by adding to a country's stock of foreign exchange. Next, a review of the major empirical work will be presented along with my own results for selected countries in Latin America during the 1970's.

One Sector Growth Models

When analyzing the way in which foreign inflows affect a developing economy, it is important to begin with some of the fundamental concepts of economic growth. R.F. Harrod and E.D. Domar were among the first to analyze economic growth, and the results of their models were so similar that they have been lumped together and commonly referred to as the "Harrod-Domar" Model. This model was not specifically meant to apply to developing countries, but because it formed the basis of so much of post-WWII thinking on economic growth, and has influenced development policy tremendously in the 1950's and 1960's, it is appropriate and important to consider their model and its implication for development (see Higgins, 1968).

There are four critical assumptions which underlie the Harrod-Domar Model. The first is the assumption that the marginal propensity to save (s) is some fixed proportion of income (Y), such that $S=sY$. The second is the assumption of inflexible factor prices, or in actuality, a fixed interest rate. This produces a capital/output ratio (v) that is fairly stable over time, where $v = K/Y$. The third assumption is that national

savings (S) equals total domestic investment (I), where all savings (as defined in assumption 1 above) is invested, and investment is defined as the change in K. The last assumption is the one with which most economists take issue, and that is the assumption of a constant rate of technological change. This assumption grows out of the Keynesian view of a fairly stable interest rate, but as we shall see it is the assumption which causes the model to be unstable. Using these assumptions the model is simply derived, and the conclusion becomes:

$$(1) \quad \frac{\Delta Y}{Y} = \frac{s}{v} - \delta, \quad \text{where } \delta = \text{depreciation rate}$$

Because v is assumed fixed, the only way to increase the rate of growth in an economy is by increasing the rate of savings, or by increasing the durability of capital (decreasing δ). Starting from the point of a low capital stock K , where the capital stock is a small factor in production and labor is the dominant input, increased savings will now have an even greater impact on growth, as the savings is invested into scarce and much needed capital equipment. Although capital/output ratios are hard to calculate, most economists believe they are commonly between 3.0 to 5.0. A ratio of 3 would mean that in order to produce a growth rate of say 5.0%, s would need to be 15% of GNP. This is precisely the way in which Rostow described the necessary conditions for a country to reach the "take-off" stage (see Cassen et al., 1986). In this view, the trick to development is simply to increase the savings rate - the more a country sacrifices present consumption and saves to invest its resources, the higher the growth rate it can achieve. Foreign aid and foreign investment can contribute

to growth rates as they are lumped on top of the domestic savings and investment to produce even more growth. In our simple model, to create one more percentage point of GNP growth would require additional foreign inflows amounting to 3% of GNP. This is the Harrod-Domar Model in its most simple form.

In hindsight, which is always considerably more accurate than foresight, the model has several problems. The assumption of a constant capital/output ratio seems inappropriate, especially for the long run and when considering the large fluctuations in interest rates experienced in the late 1970's and early 1980's. For example, if the interest rate increases, we would expect K/Y to decrease as labor is now the relatively cheaper input. However, the major problem with this model is more serious. For capital to be fully employed, output must grow at the warranted rate, that is, the rate desired by the entrepreneur, given by $s/v - \delta$. For labor to be fully employed output must grow at the natural rate (n), determined mainly by the population growth rate. Thus for a stable growth path to emerge the two rates must be equal, even though both rates are determined exogenously. Both s (determined by consumer and government spending habits) and v (determined by new technologies and fixed by assumption) are exogenous, as well as population growth and employment. Therefore, stable equilibrium growth will occur only by the natural rate being equal to the warranted rate, which will only happen by chance. In other words, the model is overdetermined because everything is exogenous.

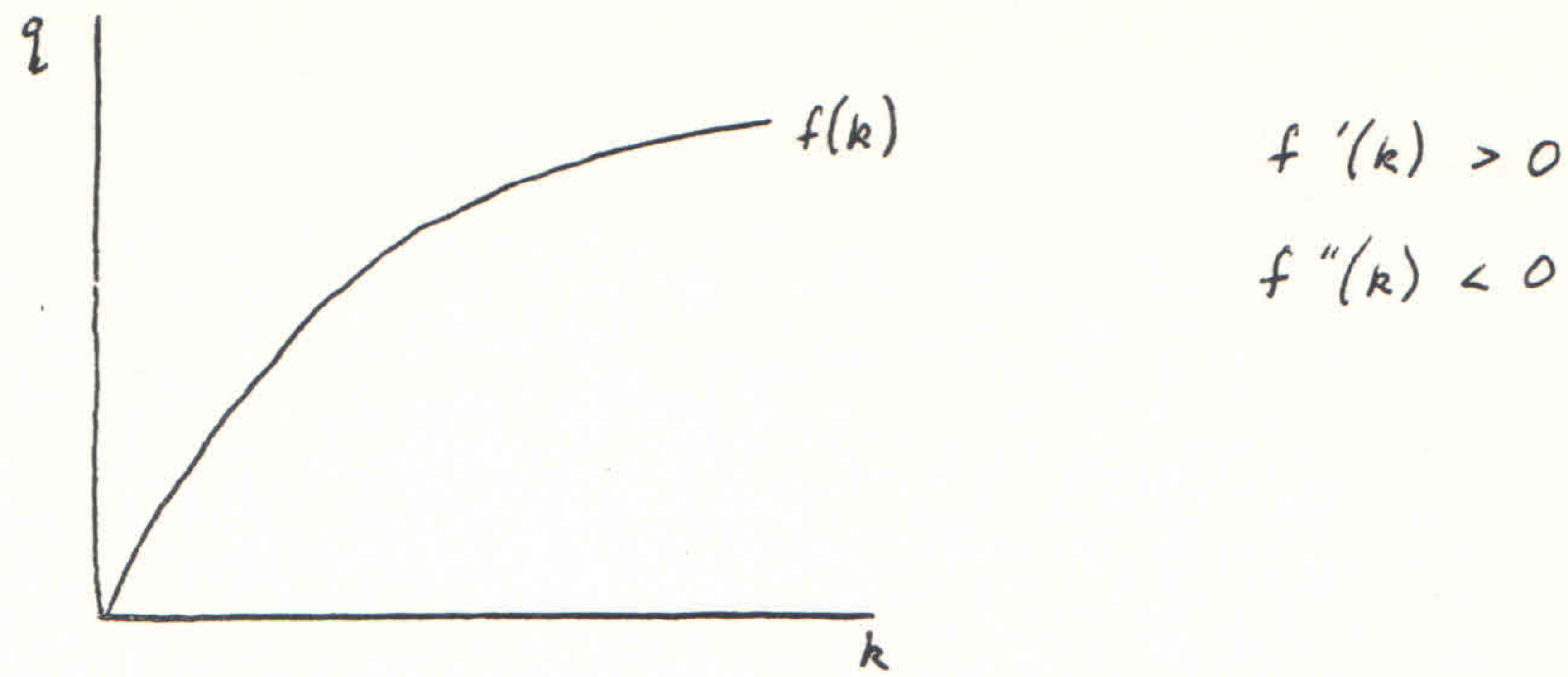
In addition to this, several writers have pointed out that

this is also a "knife-edge" model. If the necessary variables have not produced an equilibrium, the economy will actually move away from equilibrium, not towards it (for a good summary, see Branson, 1979). Most authors agree that it is the rigidity of the assumptions that produces the instability in this important but unrealistic model. Even if K and L could be substituted for each other, the basic result would remain the same, due to the assumption of fixed interest rates. The only way out of the "knife-edge" problem is through allowing technical progress to change. This is exactly what R.M. Solow did in his brilliant work in 1957, which eventually won him the Nobel Prize in 1987. Solow began his analysis with the assumption of constant returns to scale, which means that with a production function

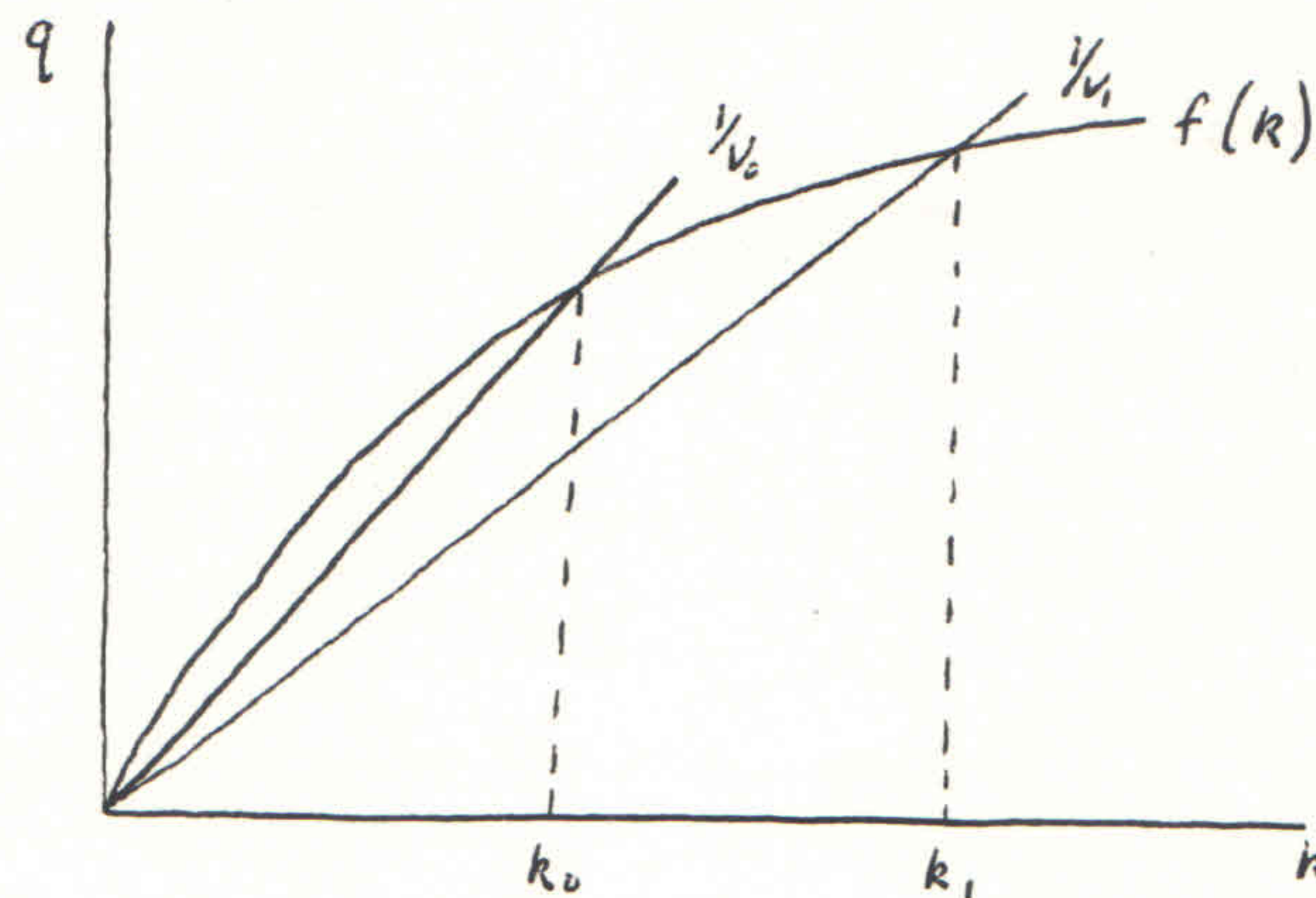
$Q = f(K, L)$, doubling the amount of both K and L will exactly double output, such that $Q = f(\alpha K, \alpha L) = \alpha f(K, L)$ (in this case, $\alpha = 2$). By letting $\alpha = \frac{1}{L}$, we can rewrite the production function in a per capita form, which will give output per worker as a function of only capital per worker.

$$(2) \quad q = \frac{Q}{L} = f\left(\frac{K}{L}, 1\right) = f\left(\frac{K}{L}\right) = f(k), \text{ where } k = \frac{\text{capital}}{\text{worker}}$$

Thus, proportionally increasing K and L to increase the scale of operation will not change Q/L, the inverse of the labor/output ratio. Graphically, this per capita production function is shown below, where additions to capital per worker will increase output but at a decreasing rate, due to diminishing returns.



Solow, in his attempt to arrive at a steady state equilibrium growth path allows for the capital/output ratio to change as the growth process varies, either by substitution between K and L or by technical change. The slope of the ray (given by $1/v$) from the origin to any point on the production function determines v at that point. As an economy increases its capital stock relative to labor, v will increase and $1/v$ will decrease, thus showing diminishing returns.



By introducing the neoclassical production function where v is allowed to vary as k varies from substitution or technological change, the rigidity of the Harrod-Domar Model has been done away with. In short, s/v can now equal s/v , and tends to do so in the long run, thus producing a long run trend equilibrium growth path. But before showing how this occurs, let's discuss how technological change as well as substitution between K and L can vary the capital/output ratio (v).

Solow recognized that the model implied that when an economy is growing along the long run trend equilibrium growth path, output, capital, and the labor force must all be growing at the same rate, such that: $\dot{Q} = \dot{k} = \dot{L} = n$. However, when looking at the data over decades of time it becomes evident that output and capital were consistently growing faster than n , such that $\dot{Q} = \dot{k} > \dot{L} = n$. In an attempt to explain this phenomenon, Solow did away with the Harrod-Domar assumption of fixed technical progress, and in his model he let technical progress increase with productivity. In a sense, we can now differentiate the labor force (which grows at rate n) from the effective labor force (E) (which grows at rate $[n + \lambda]$), where λ is the technical progress factor. The production function can now be defined as $Q_t = f(k_t, E_t)$, where:

$$(3) \quad E_t = L_t e^{\lambda t} = L_0 e^{(n + \lambda)t}$$

And we find a long run equilibrium growth trend where: $\dot{Q} = \dot{k} = \dot{E} = n + \lambda$. (As an aside, in equilibrium the value of k is constant at k^* , so that the real wage rate must grow at λ , the measure of the increase in labor productivity. This will become important later as we attempt empirically to account for the effect of technical progress on growth rates of output or GNP). Using this newly defined production function $Q_t = f(k_t, E_t)$, we can derive easily the basic dynamic equation of the neoclassical model, along the same lines as our derivation without technical change. Dividing both sides by E and substituting $L_t e^{\lambda t}$ for E (the exogenously determined effective labor force growth rate), we obtain the output function $q = \frac{Q}{E} = \frac{Q}{L_t e^{\lambda t}} = f\left(\frac{k}{E e^{\lambda t}}\right) = f(k)$, where k , which was

defined before as K/L , can now be redefined as K/E , and $\dot{k} = \dot{K} - \dot{E}$. The output function can now be rewritten as:

$$(4) \quad \dot{k} = \frac{sQ}{k} - (n+\lambda) = \frac{sq}{k} - (n+\lambda) = \frac{sf(k)}{k} - (n+\lambda)$$

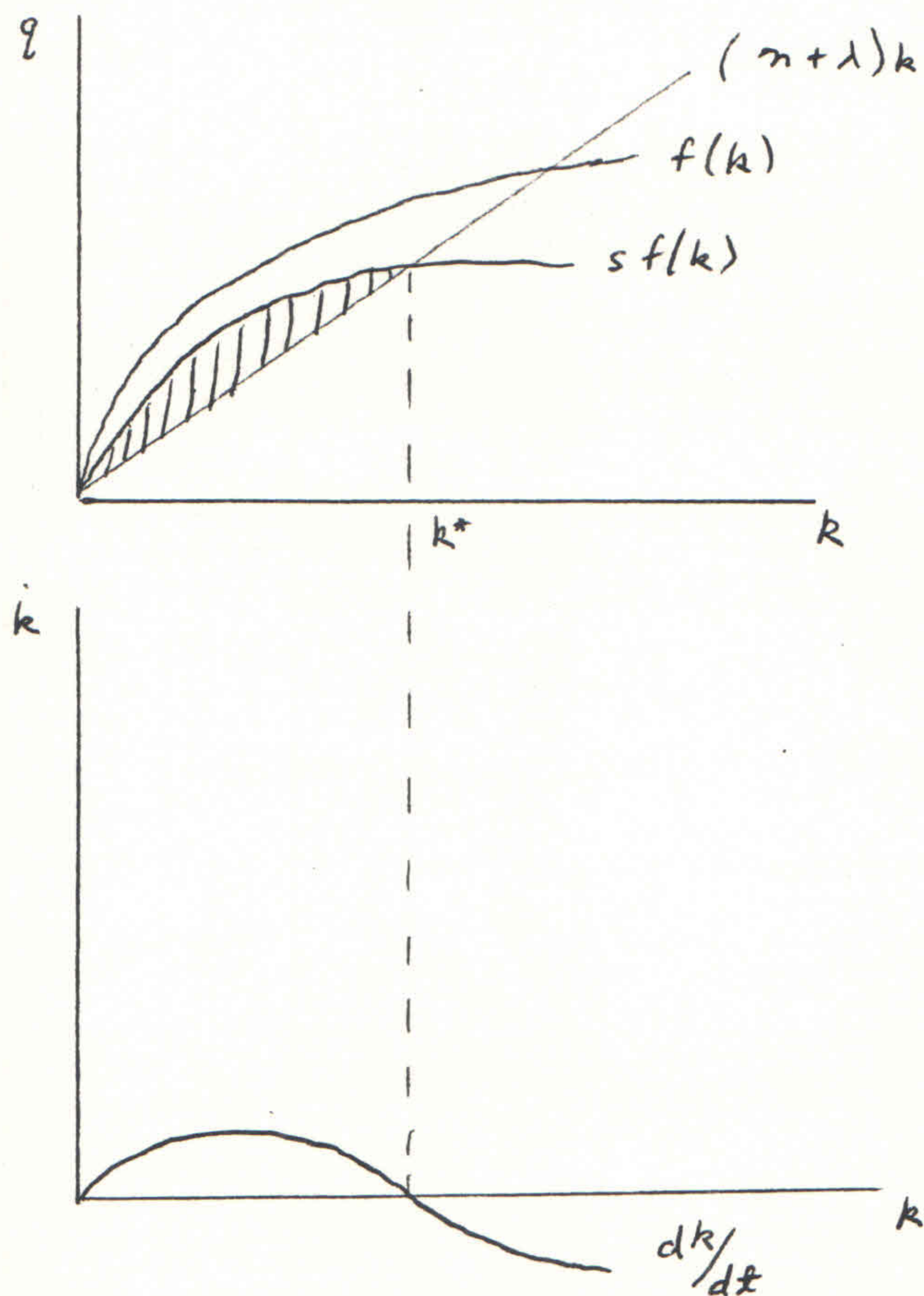
By setting $\dot{k} = 0$, we can locate the equilibrium value of k^* ,

$$\frac{sf(k^*)}{k^*} = (n+\lambda) \quad . \quad \text{Multiplying through by } k^* \text{ yields:}$$

$$(5) \quad sf(k^*) = (n+\lambda)k^* \quad , \quad \text{or, } \dot{k} = sf(k^*) - (n+\lambda)k^* \quad ,$$

where \dot{k} is the growth rate of capital per effective worker, $sf(k)$ is the savings per worker (or the flow of investment per worker), and $(n+\lambda)k$ is the amount of investment required to keep k constant, given E is growing at $(n+\lambda)$.

Graphically we have:

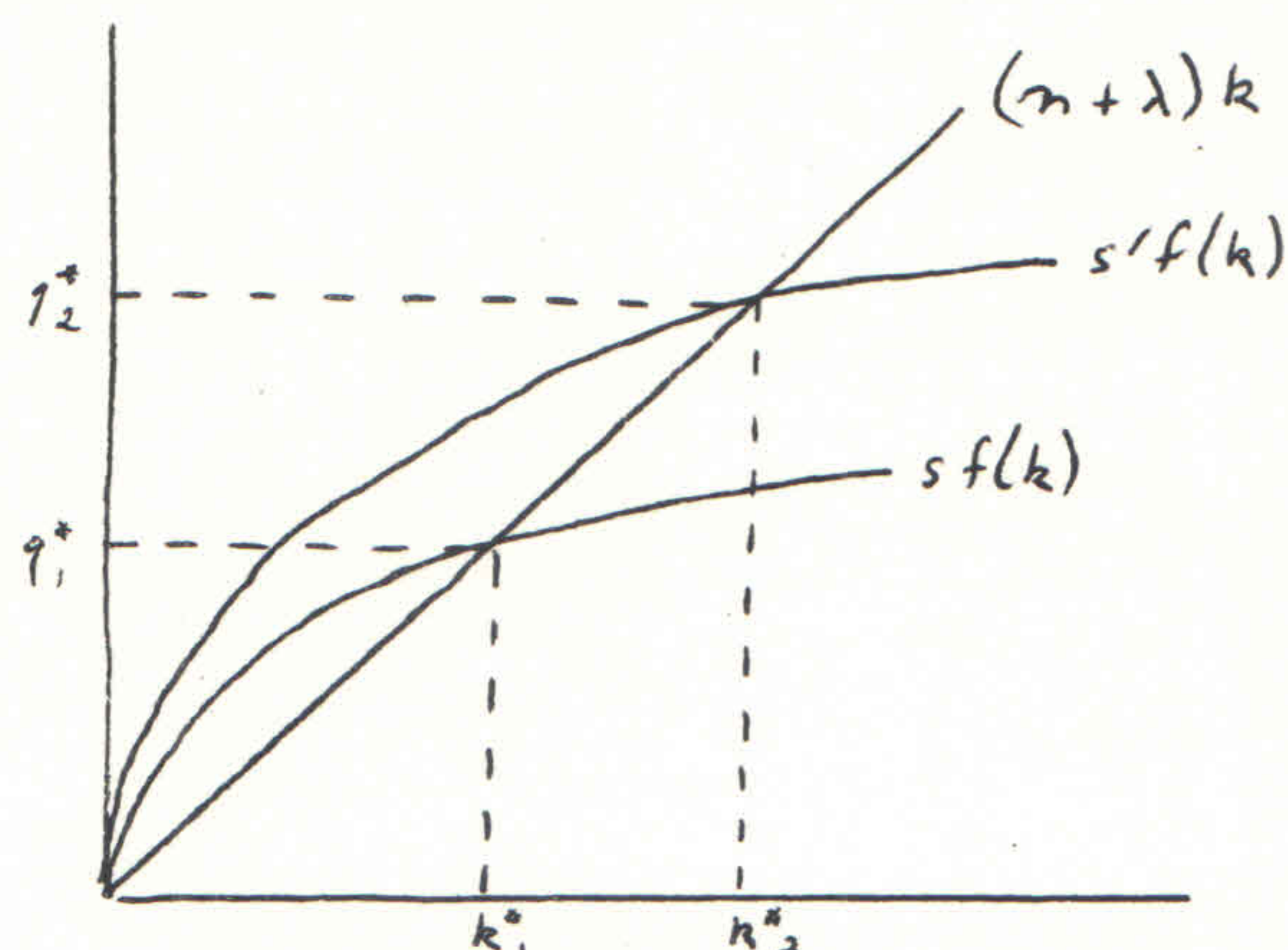


This analysis shows why the equilibrium k^*, q^* is stable. If the economy is operating below k^* , then $sf(k) > (n+\lambda)k$. That is,

output per effective worker exceeds the rate of output necessary to keep k constant, the difference being the shaded area. In other words, there is too much capital per worker for k to remain constant. However, since s is the ratio of output saved, (assuming all savings is invested) there will be enough investment not only to maintain the old capital per effective man (K/E) but also to increase it. Therefore \dot{k} will be positive and k will increase, moving us towards k^* . If instead the economy is operating to the right of k^* , there is not enough capital per effective worker to outfit each new worker at the same K/E ratio, because the q level is too low to produce enough new savings and therefore new investment. In this case \dot{k} will be negative and k will fall, moving the economy back towards k^* where the q^* level produced results in just enough investment given the marginal propensity to save to maintain k constant as E grows.

There are two basic conclusions that spill out of this analysis. The first is that a steady state growth model does exist and is stable in the sense that given any initial values of variables in the model, the economy moves steadily along a balanced growth path. If the warranted rate of growth s/v is different than the effective rate $(n+\lambda)$, the warranted rate will move towards it, producing a stable effective rate of growth k^* . The second conclusion is that this effective growth rate is determined by $(n+\lambda)$, and is independent of $sf(k)$. A one shot increase in investment per man will shift up $sf(k)$, but in the long run will not affect the growth rate, because the long run

growth rate is determined not by saving but by n and λ , which make up the effective growth rate.



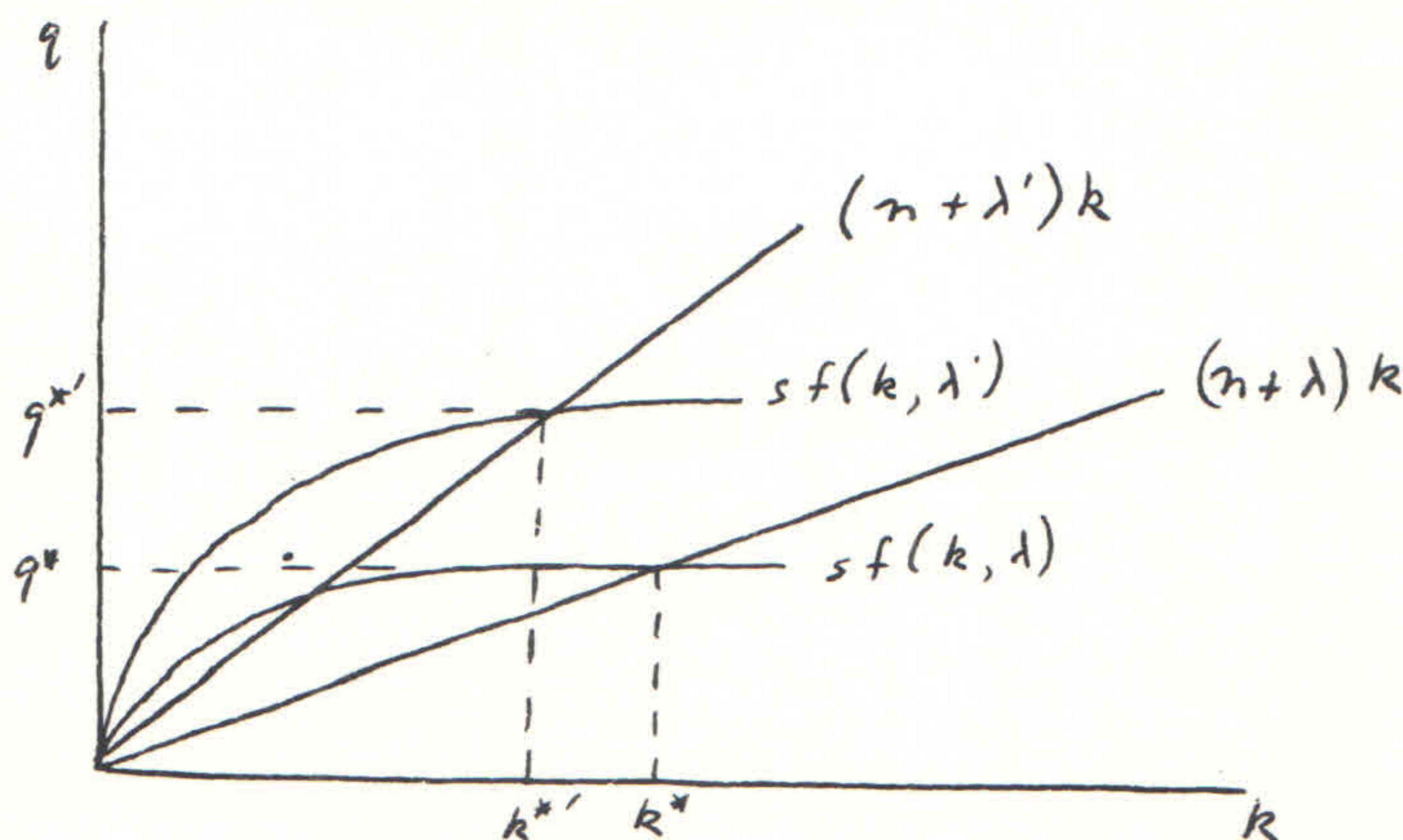
Notice that although both q^* and k^* changed, q^*/k^* did not. In short, the level of k^* is not important but only its growth rate, which is constrained by $(n + \lambda)$. A one shot increase in savings will increase the level of q in the short run, but will leave unaffected the long run growth rate. That is, the rate of savings should equal the rate of growth of the effective labor force, so that the amount of capital per worker remains constant. This instead of savings becomes the limit to long run growth. For a country to maximize the growth rate, $sf(k)$ should equal $(n + \lambda)k$. (For a more detailed analysis of the above, see Branson, 1979, chapters 22-25).

In relating the Solow Model to the Harrod-Domar Model, it can be shown that Harrod and Domar are not necessarily incorrect in their analysis, but that it turns out to be a short run special case. In fact, it is easily shown that the Solow Model can reduce to the Harrod-Domar Model:

$$\begin{aligned}
 sf(k) &= nk & s \frac{Q}{k} &= n \\
 s \frac{Q}{L} &= n \frac{k}{L} & \frac{s}{v} &= n \\
 sQ &= nk
 \end{aligned}$$

These two can thus be reconciled by viewing the Harrod-Domar Model as more a short run model, where K and L can't be easily substituted for each other and technical change can't occur in such a short period, and Solow's Model as more a long run scenario, with v able to vary as a result of both substitution and technological change. The roughly constant capital/output ratio that has been observed throughout time does not have to be viewed as a necessary assumption.

Until now we have treated technological change as only labor augmenting, which has been termed "Harrod Neutral". Education is a good example of this type of technical progress. If it is only labor augmenting, an increase in the growth rate of technical progress will cause $MP_L > MP_K$, and the $(n + \lambda)k$ rotates to the left. However, if technical progress is viewed as both labor and capital augmenting (referred to as "Hicks Neutral"), we would expect the $\frac{MP_K}{MP_L}$ to remain constant as technical progress increases. This would be represented as a shift in the production function.



Solow's equation now becomes: (6) $\dot{k} = sf(k, \lambda) - (n + \lambda)k$.

(see Jones, 1976).

Until now we have been talking about increasing the amount of capital per existing effective worker, something referred to as capital deepening. However, it is important to mention that we can also provide new workers with capital at the existing k ratio, which is called capital widening. Capital deepening can only affect growth to a certain point, because of diminishing returns. In these terms, then, it is necessary to "widen" the capital stock in order to achieve increased growth, and it is the natural growth rate of the labor force which constrains this effort. As was alluded to earlier, capital deepening can produce at least a spurt of growth in the short run. The length of this spurt will depend on the elasticity of the growth rate of full employment output (\dot{Q}) to changes in the growth rate of the capital stock (\dot{K}). And in turn, the degree of elasticity between \dot{K} and \dot{Q} will depend on the nature of the technical progress. If the technical progress is embodied in the labor force (Harrod Neutral), then increasing investment will produce a smaller, or less elastic \dot{Q} response. If instead some of the increase in savings is embodied in the capital stock (Hicks Neutral), this will mean not only more but newer and more productive capital, and the elasticity of \dot{Q} with respect to \dot{K} will be high (see Nelson, 1964).

Foreign Exchange and Savings Gaps

In order to understand fully the impact of foreign aid and foreign investment on a developing country's economy, it is

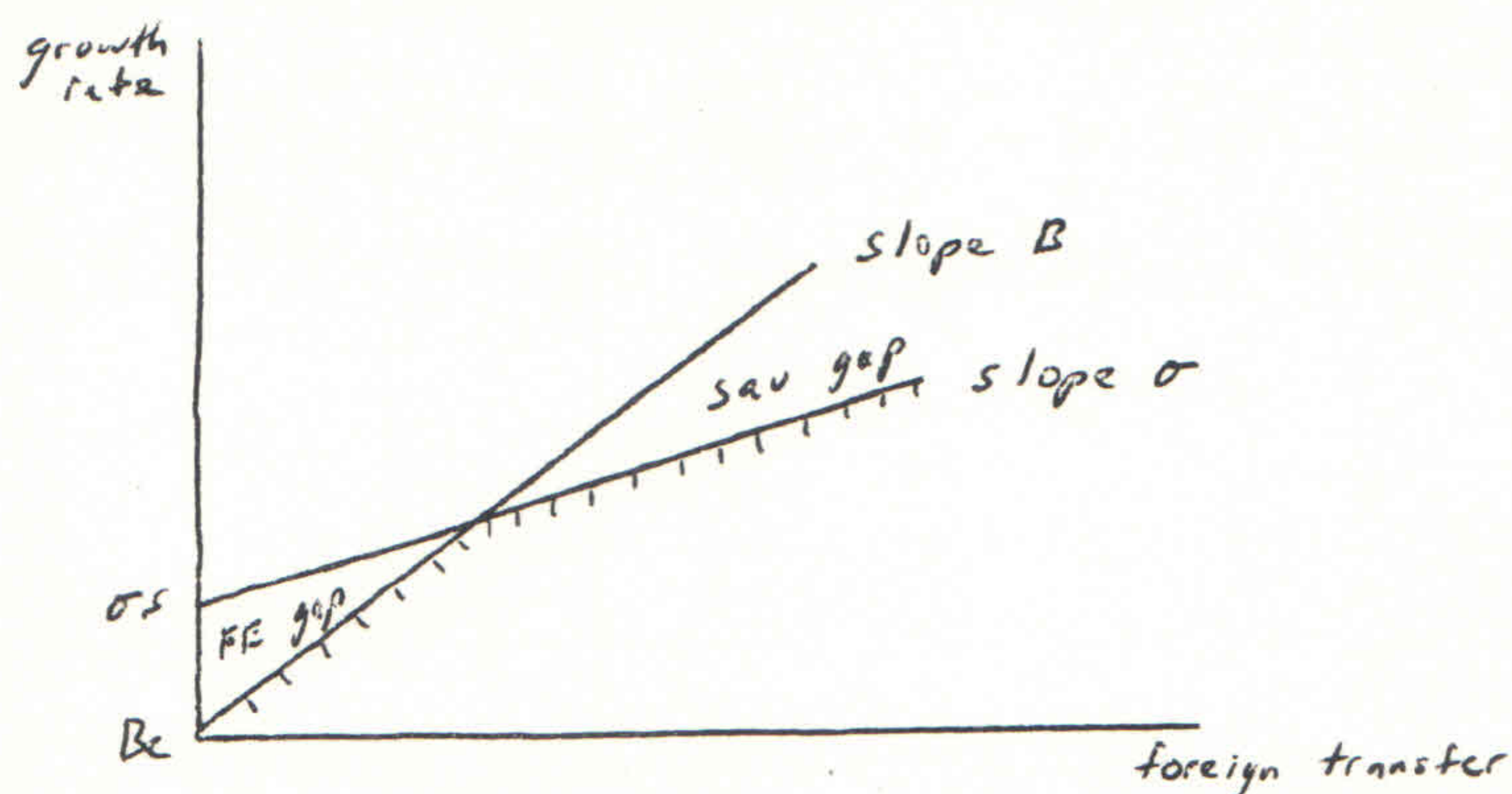
necessary to review what has been called the Two Gap Model. Two of the most significant papers outlining this concept have been by Ronald McKinnon (1964) and Chenery and Strout (1966). McKinnon focused on the role of foreign aid in relieving two types of constraints to growth: the need for more foreign exchange to purchase more imports and the need for increased savings to generate domestic investment. In his model, P represents output capacity. One unit of capacity needs $1/\alpha$ units of K_d (domestically produced capital) and $1/\beta$ units of K_f (foreign produced capital), requiring $1/\alpha + 1/\beta$ units of domestic output for new investment. Thus, the change in output capacity

$$\frac{dP}{dt} = \frac{I}{1/\alpha + 1/\beta}$$

where I = the total amount of investment, and $I = sY = S$ as in the Harrod-Domar Model. McKinnon then lets $\sigma = \frac{1}{1/\alpha + 1/\beta}$ where $1/\sigma$ corresponds to the capital/output ratio (v) in Harrod-Domar, so that $\frac{S}{v} = \sigma S$. σS will be the growth rate if there are unlimited export possibilities to obtain foreign capital goods at the given terms of trade, and as $\beta \rightarrow \infty$, $\sigma \rightarrow \alpha$.

McKinnon defines E = total exports, where a given country will Max. $E = eP$ and e is the country's ability to export ($0 < e < 1$). Intermediate capital goods bought with foreign exchange in time t must be less than the max. E for the growth rate of the country to equal σS , and not be constrained by a lack of foreign exchange. If this is the case, then $\beta e > \sigma S$. An economy will grow at whichever is the binding constraint. If $\beta e > \sigma S$, the economy will grow at σS ; if instead $\beta e < \sigma S$, the economy will grow at βe . McKinnon believes that a

young economy will at first be constrained by its ability to export and therefore generate foreign exchange. But as it begins to grow, foreign inflows increase its capacity to export, thus increasing B_e and the savings constraint σ_s becomes binding. This can be represented by the following graph:



Foreign aid will thus have a proportionally greater impact on an economy whose growth is constrained by its ability to generate foreign exchange, than on an economy which is bound only by its ability to save.

Chenery and Strout (1966) have taken a slightly different approach to the two gap model. They believe that the FE (foreign exchange) gap is simply made up of imports (M) minus exports (X), while the savings gap is not total investment times the mps (as McKinnon states), but simply the amount of savings that was never invested (S doesn't necessarily equal I). Germany is a good example of a country which after the war had sufficient savings, but needed foreign exchange to build its economy. Its growth rate was constrained by its inability to generate exports. On the contrary, the OPEC nations in the 1970's are a good example of the opposite, countries which had plenty of foreign exchange through oil exports, but were constrained by their lack of savings. Chenery and Strout believe that if the FE is the

binding constraint, an increase in the savings rate will not affect growth. This contradicts Harrod and Domar, who believe that only increasing the marginal propensity to save will help a country achieve a higher rate of growth.

In summary, aid will be added to a country's stock of savings in the Harrod-Domar Model, which they believe is the only way to achieve higher rates of growth. However, Solow demonstrated that it is the growth rate in the labor force which may constrain the growth rate of GNP. In his model, aid will only increase the growth rate if $sf(k) < (\lambda + \lambda)k$, where savings per effective worker is not high enough to maintain k constant as E grows. McKinnon, Chenery, and Strout have all theorized that a developing country may be constrained not only by its ability to save but also by its ability to earn foreign exchange. Aid has the dual purpose of filling both gaps, and can help to relieve whichever gap is constraining growth.

This concludes the simple theoretical framework needed to effectively analyze the major empirical work done on the effect of foreign aid transfers from developed to less developed countries. In the next section we will attempt to interpret the effect of aid not only on growth, but also on savings, consumption, exports, and the incremental capital/output ratio.

Empirical Review

Perspectives on Aid

Hollis Chenery and Nicholas Carter (1973) have put into outline form the objectives of aid and development programs as they were formulated in the early 1960's. They summarize four basic goals of Official Development Assistance (ODA):

1) External resources can produce a significant acceleration of investment and growth, by filling either the foreign exchange or the savings gap and thus reducing the constraints to higher growth.

2) Maintaining these higher growth rates will require changes in the structure of production and trade.

3) External capital is beneficial in that it can enhance resource mobilization and help stimulate structural transformation of production and trade.

4) The need for concessionary aid will decline after an economy has been helped through this structural transformation.

However, the decade of the 1970's produced a substantial body of literature criticizing some aspects of aid policy and performance, beginning with Griffin (1970), Griffin and Enos (1970), and Weisskopf (1972). They have all asserted that aid's effectiveness is often offset by increased domestic consumption, that aid reduces the overall savings rate instead of increasing it, that aid is only a "band-aid" in that it helps relieve short-run economic problems but can also block necessary long-run

structural transformation, and that aid donors negatively interfere with national goals and interests. This next section will attempt to sort out these problems by investigating the major empirical studies of the last 30 years, in trying to understand what effects Official Development Assistance and foreign capital inflows have had on growth, savings, consumption, and the ICOR in less developed countries.

Foreign assistance is primarily an economic phenomenon because it involves resource transfers from one country to another, but it is important to realize that it operates in a highly political arena. Before looking at the purely economic consequences of foreign aid, it is worthwhile to highlight some of the political philosophies associated with ODA. In a very critical remark, Hollis B. Chenery, a one-time official in the Agency for International Development, has stated that "the main objective of foreign assistance, as of many other tools of foreign policy, is to produce the kind of political and economic environment in the world in which the United States can best pursue its own private goals" (Chenery, 1964). However, the overall feeling of most economists today, including Chenery, seems to be that despite the political strings attached to much of the ODA, it has a mildly positive effect on most LDC's. Griffin and Enos (1970) have stated that "as an instrument of policy, as a method for the strong to control the weak, foreign assistance may be less iniquitous than some of the other policy devices...our reason for believing so is that foreign aid is more destructive in its effects than the other major political

$$(9) \quad Q_{t+1} = 12.5 - 0.047A_t ; \quad R\text{-sq.} = 0.62 \\ (4.7)$$

where Q = % change in GNP/capita

There are several weaknesses with this study. They never offer any explanation as to why Latin America may be different than other developing countries. Another weakness is their use of Aid/Y as the only independent variable. This rules out the possibility that aid may be correlated with other variables that affect growth. Still another weakness is their use of the deficit on the current account as their measure of aid, which would not distinguish between private investment and ODA.

This distinction has been made by Gustav Papanek (1973), who found strikingly different results. In a cross country regression analysis of 34 countries in the 1950's and 51 countries in the 1960's, he found that:

1) savings and foreign inflows of capital and aid explain over one-third of growth, and

2) foreign aid has a substantially greater impact than the other variables.

$$(10) \quad \text{Growth} = 1.5 + 0.20\text{Savings} + 0.39\text{Aid} + 0.17\text{Foreign Inv} + \\ (2.5) \quad (6.0) \quad (5.8) \quad (2.5) \\ 0.19\text{Other foreign inflows} ; \quad \text{Adj R-sq.} = 0.37 \\ (2.1)$$

Papanek, in criticizing his own work, states that "Any reasonably complete model would need additional variables to explain growth" (pg. 121), and yet the above model seems to be the standard one

used by nearly everyone on this topic (although most researchers divide through by GNP). This omitted variable problem is serious, and we cannot hope to fully understand aid's impact on growth until we have developed a model which seems to consistently explain growth fluctuations in less developed countries. Papanek also points to the fact that low growers are typically high aid receivers, and vice-versa, so that there may be a simultaneous equations problem which a simple ordinary least squares regression ignores (see Papanek, 1972). In all the empirical work done on this topic, only Mosely (1980) and Mosely et al. (1987) have attempted to analyze this problem. Mosely, conceding that it is plausible intuitively, has found no evidence of any simultaneity between aid and growth. (For a complete summary and comparison of results using 3SLS and OLS methods, see table 4 in Mosely, Hudson, and Horrell [1987]). Therefore, we can move forward with the standard analysis, leaving Papanek's fears of simultaneity behind.

Constantin S. Voivodas, in a paper written in 1973 covering 22 countries world wide during the late 50's and 60's, found using the same basic model that foreign capital inflow had had an insignificant effect on growth, conflicting with Papanek's conclusions but supporting the findings of Griffin and Enos. Voivodas suggests that the effect on growth is neutralized by either a spillover into consumption or by increasing the incremental capital/output ratio (ICOR), or both (which will be discussed shortly).

The most recent paper as of this writing that tests the

relationship between aid and growth has been done by Paul Mosely, John Hudson, and Sara Horrell in 1987. Their conclusions lend support to nearly every other empirical study except those of Papanek. They conclude that "Aid in the aggregate has no demonstratable effect on economic growth in recipient countries" in either the 1960's or the 1970's, finding that the impact of aid was negative and just significant in the 1960's, but negative and insignificant in the 1970's.

Their model is fairly unique and worth analyzing in more detail since it goes beyond the standard model most writers have used. In addition to accounting for aid, savings, and foreign investment, they also include the growth rate of exports and the growth rate of literacy of the general population in the growth equation, attempting to account for a Harrod Neutral type technological change or change in human capital. Their findings are summarized below for the periods 1960-1970 and 1970-1980, for both samples of all developing countries and of just those countries in Latin America.

Table 1

sample	year	const	A/Y	I/Y	S/Y	Exp	lit	adj R-sq
ALL	1960-	3.13*	-.05*	-.02	0.04	0.16*	0.09*	; 0.34
	1970	(4.14)	(2.12)	(0.68)	(1.11)	(3.74)	(2.18)	
ALL	1970-	2.65*	-.03	-.08	0.09*	0.23*	.005	; 0.37
	1980	(3.06)	(0.32)	(1.58)	(1.98)	(4.61)	(0.13)	
L.A.	1960-	1.52	0.02	0.02	0.15	0.18	0.07	; 0.11
	1970	(0.59)	(0.06)	(0.25)	(0.96)	(1.63)	(0.70)	
L.A.	1970-	2.50	1.01	-0.02	0.10	0.08	-0.15	; 0.00
	1980	(0.79)	(1.19)	(0.18)	(0.99)	(0.50)	(1.77)	

"*" values indicate significance at 5%.

As is clear from the insignificance of all the variables for Latin America and the low adjusted R-sq values, even by adding two other variables to the basic model, they are still unable to explain much (if any) of the growth in Latin America.

My own empirical research used United Nations data for nine selected countries in Latin America during the period 1970-1981. The basic model that was estimated included a set of country dummy variables and a set of year dummy variables, along with the structural variables (see Appendix A for definitions and means, and Appendix B for a basic discussion of the model). The results reported below present coefficients for variables other than country and time dummies. Analysis of the effects of aid, investment, and savings yielded the following results:

$$(11) \quad dY/Y = 0.70 - 0.0007Aid/Y + 0.002Inv/Y - 0.00Sav/Y ;$$

(0.46)	(-0.10)	(1.71)	(0.33)	adj. R-sq. = .23
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Investment was the only variable which significantly affected growth, and its impact was positive. Aid was found to have almost no impact on growth. The correlation coefficient between aid and growth is low, but positive ($r = 0.15$). The impact of savings is also positive and insignificant. These results coincide with nearly every other study except Papanek, who found aid positively and significantly influenced growth. Robert Cassen and Associates, an Oxford based think tank, have concluded in a report to an intergovernmental task force entitled Does Aid Work?, that "Inter-country analyses do not show anything conclusive - positive or negative - about the impact of aid on growth. Given the enormous variety of countries and types of

aid, this is not surprising."

The effect of aid on savings

The impact of aid on overall rates of growth is the most important relationship we can study, but because the findings of most researchers show that aid seems to have a small or negligible effect on growth, it is useful to try and understand just exactly what aid is affecting. Every major study has found that aid has a negative impact on savings, including Papanek (1973) who found a correlation coefficient between aid and savings of $-.56$. However, in my own study I found aid and savings uncorrelated ($r = 0.028$). It was Griffin (1970) in particular who pointed out that theoretically if aid depresses the savings rate (or raises the capital/output ratio) to a sufficient extent, aid may actually cause "immiserizing growth" (pg. 467). However, this should be taken with the following comments in mind. Chenery and Carter (1973) write that "the proper test for the effectiveness of aid, however, is its effect on growth or other social objectives rather than on savings...The negative coefficient in a regression of savings on capital can be taken as indicators of inefficiency in transforming the capital inflow into increased investment" (pg. 467). This was a problem that was assumed away by Harrod, Domar, and Solow (savings = investment), but has been dealt with considerably by Chenery and Strout (1966). In other words, reducing aid may increase

savings, but domestic investment could still fall (if S didn't equal I), reducing growth.

Earl Grinols and Jagdish Bhagwati (1976) have devoted an entire paper to this issue alone. In attempting to measure the importance of reduced domestic savings that result from foreign inflows, they construct a variable called "recovery time" for various LDC's. The variable is a measure of how long it takes a country's output/capital ratio to return to its "normal" level, or that level it would have achieved without aid. In general, they found that a country that was initially saving a large fraction of its GNP will be less affected by aid inflows, so that an economy which is a higher saver will fare better, or will have its output/capital ratio recover faster. This seems to make intuitive sense. A country that has a higher mps will be a more disciplined saver, and will not be as tempted to take ODA and substitute it for its own domestic savings. In this way, Grinols and Bhagwati conclude that it is possible for aid to have a negative effect on savings in the short run and yet promote such self-reliance in the long run, self-reliance being their term for a country that has recovered its a priori output capital ratio.

Papanek (1972) goes far to explain this negative aid and savings correlation, first by citing earlier work by Chenery and Strout (1966) and Weisskopf (1972) showing the dominance of the foreign exchange gap over the savings gap (reducing the importance of decreased savings on growth) and by elaborating in detail on the various and at times dubious accounting conventions used to calculate savings in the first place. But, perhaps more

importantly, Papanek points to the difference between correlation and causality. Again, it is typically low savers and therefore low growers who are associated with high inflows of aid (although there are exceptions, such as Israel). Low savings will then not be caused by aid inflows, but instead by a deteriorating economic or political situation, in which high aid inflows are associated.

Chenery and Carter (1973) sum up the relationship between aid and savings perhaps better than anyone. They state that if a country's ability to grow is constrained by its ability to generate foreign exchange, then we should not expect a positive relationship between savings and aid. Thus the relationship between a savings decrease and an aid increase (to help raise FE) is not direct.

The Effect of Aid on the ICOR

Along with aid's impact on savings we must consider its impact on the incremental capital/output ratio. The capital/output ratio was assumed fixed by Harrod and Domar, but by letting it vary Solow demonstrated that the Harrod-Domar Model becomes stable and a long run steady state solution will exist. Both Voivodas (1973) and Griffin and Enos (1970) demonstrated that foreign capital inflow (including aid) is associated with a higher overall capital/output ratio. The implication is that the beneficial effect of foreign investment on domestic growth may be neutralized by an increase in the capital/output ratio. Thus aid may simply influence the choice of more capital intensive modes of production, and leave growth unaffected. The implications of this are significant. Even if aid does increase long run growth

rates by breaking a savings or foreign exchange constraint, in the short run it may be labor displacing and thus have a negative impact on the population as a whole, especially in poorer countries. In an attempt to better understand this, I have developed the model:

$$ICOR = b_0 + b_1 \text{Investment}/Y + b_2 \text{interest rate} + b_3 \text{Aid}/Y$$

to try to explain as much of the variation in the capital/output ratio as I could, using United Nations data. The following results were obtained:

$$(12) \quad ICOR = -31.6 + 0.03 \text{Inv}/Y + 0.4 \text{int rate} + 0.61 \text{Aid}/Y ;$$

(-1.25)	(0.52)	(0.73)	(1.61)
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adj R-sq = .12

where the only variable even approaching significance is Aid/Y. The correlation coefficient between Aid/Y and the ICOR is $r = 0.32$. This, then, confirms the results of Voivodas and Griffin and Enos. However, to say that aid necessarily destroys jobs would be a fallacy. The correlation coefficient between Aid/Y and the unemployment rate is only -0.04 , and between ICOR and the unemployment rate it is only 0.03 . In fact, Aid/Y and the real wage rate turn out to be highly correlated ($r = .26$), so if anything aid seems to be increasing the demand for labor, and thus reducing the unemployment rate.

The effect of Aid on Consumption

Aid has not only been criticized for its negative impact on saving, but for its positive impact on consumption as well. The argument is that ODA is either directly "pocketed" (such as the Marcos regime stands accused of doing) or it is invested in projects which would have been undertaken anyway, and the freed up domestic resources are then used for consumption. That is, there is a problem of fungibility. Voivodas (1973), in an attempt to explain why aid hasn't significantly impacted growth in his study, has cited both a positive relationship between aid inflows and the incremental capital/output ratio, and a spillover into consumption and away from investment. In the empirical research conducted for this paper, I have found a positive but weak link between aid and consumption ($r = 0.04$). When including consumption as a variable in the basic growth equation, it turns out to be slightly negative but insignificant ($t\text{-ratio} = -0.10$).

Although there are few studies that have looked directly at this relationship, Chenery and Carter (1973) conclude that there are not many cases in which an "unnecessary diversion to consumption can be demonstrated". They have chosen their words carefully here, because using aid for consumption purposes rather than as savings and investment may at times be not only frugal but necessary. This is especially the case in poorer countries where a bulk of the aid money goes for spending on health, power, transportation, education, and other things which are normally classified as consumption goods but are necessary for any long run development and growth. The best example of this is food aid, which can only be consumed. Growth may be the sole

objective of aid, and a diversion to consumption may hinder short run growth, but unless a country can hold its social structure together and prevent revolution there can be no long run growth. In addition, it should be kept in mind that many of the so-called "consumption" goods also have value as investment goods, especially in the long run (for example, education). Therefore most economists conclude that aid money has not been diverted away from investment and into consumption to any significant extent despite the fears of donors, and even if it had, that may not be a strong argument against ODA, since the diversion may be a necessary one. This, then, raises the broader issue of the amount of time it takes aid to impact a country's economy. Most studies have utilized a one year lag (including my own), but if aid is used primarily for things which have a long term payoff (like education), then clearly aid impact studies with a one year lag structure will underestimate the effects of aid.

The effect of Aid on Exports

For a long time the ability to generate exports has been viewed in the trade literature as one of the key engines to growth. Aid has been praised for its ability to break the FE constraint, thus allowing countries to import (and export) more. But aid has also been criticized for its role in helping some countries restrict their need for imports, thus damaging their export capability. This is especially important for low income countries and in Latin America, where import substitution was the dominant policy of the 1970's.

Robert Cassen and Associates, in their report on aid effectiveness, cite three separate ways that aid can boost growth through the international trade sector. The first is through policy dialogue, in that aid can give leverage to groups like the IMF and the World Bank who will pursue policies of exchange rate devaluation, removals of subsidies and tariffs, relaxation of controls, etc. The second is that aid can give balance of payments support to a country that is undergoing trade liberalization, when imports are likely to be higher than exports. The third is through general export promotion, or by using aid money for investment in the production of exports specifically.

Mosely et al. (1987) were the first to include exports when looking at aid's impact on growth, and they found not surprisingly that exports play a significant role in growth. However, they have not investigated further the relation of aid to exports. Unlike Mosely, I have found a positive but insignificant relationship between net exports and GNP growth when including net exports in the basic growth equation developed earlier (t -ratio = 1.28). In addition I have found that aid and exports are negatively correlated ($r = -.37$). What is happening in reality doesn't seem to fit well with the theory we have established earlier. This suggests that in the 1970's most Latin American countries were unable to translate their aid inflows into the production of exportables, but instead produced either non-tradeables or domestic capital (to produce tradeables) which have not yet influenced exports. A quick look at the correlation

coefficient between investment and exports confirms this result ($r = -0.76$). Because this is such an unexpected result, I regressed investment on aid and found a coefficient far less than unity (0.0186), suggesting there is no FE gap for aid to fill (see Griffin, 1970 pg. 102 footnote for more on the methodology). Instead, a regression of savings on aid produced a negative coefficient, suggesting there is at least a slight savings constraint ($b = -.005$, $t\text{-ratio} = -2.35$). I believe this is due to the bias against exports that existed throughout the 1970's in Latin America, and the emphasis on import substitution as a program for development.

Technological Change

In order to better explain changes in the growth rate of GNP in Latin America in the 1970's, I have gone beyond the standard analysis that the previous section has just reviewed, and I have attempted to take account of technological change in the simple growth equation. We have seen in the theoretical overview that the ICOR can rise over time from either substitution towards more capital intensive technologies or from labor saving technological change (Harrod Neutral). Measuring technical change is extremely difficult, but is usually assumed to make up the unexplained variation in growth. However, with such low R-sq. values this would be futile, because there is a good chance the error term contains more than just technological change and white noise. Instead, I have employed the neoclassical assumption that a worker is paid his marginal

product of labor in equilibrium, so that the real wage rate can be used as a proxy for Harrod Neutral technological change. Because of various distortions in the labor market in third world countries, this may not seem like a plausible assumption. However, it is not important for the real wage rate (w) to equal the MPL, but only for w to be some roughly consistent percentage of the MPL, since we are using growth rates. In this way we can try to adjust for changes in human capital. Mosely et al (1987) have actually done a similar thing using changes in the literacy rate. They found the independent variable to be significant, but only for the 1960's. I have found adding the real wage rate to the basic equation that changes in human capital are positively and significantly related to growth (t -ratio = 2.97) in the 1970's. And, not suprisingly, aid appears to have played some role in this, as the correlation coefficient between aid and w is 0.26.

What about Hicks Neutral technical change? If the technical progress affected both capital and labor, then we should not expect to see the ICOR change from technical progress since output is only the product of two factors. Since we have witnessed an increase in the capital/output ratio, this may be a clue that there has been little change in technology embedded only in the capital stock. I have hypothesized that nearly all of the technological improvement is coming from the developed countries, and is simply a part of the price of capital when it is imported into a country in Latin America. If this is correct then a developing country will share the technical progress in the capital stock of a developed country. Therefore, using the

average capital stock productivity increases for the United States (obtained from the Dept. of Labor) and from the United Kingdom (see McIntosh, 1986) for roughly the same period of time, I constructed a series starting from 100 which I then used as a measure of technical change in the capital stock variable. When I placed this variable into the simple model, it had a negative but insignificant effect on growth, and was only slightly correlated with investment. Foreign aid had very little correlation with this variable ($r = 0.06$). Either the type of technical change in Latin America is mainly labor augmenting, or the technical progress of the developed world is a poor proxy for it.

With these final additions to the basic model, the model in which I used to decipher the effect of aid on growth is the following:

$$dY = b_0 + b_1Aid/Y + b_2Inv + b_3Sav + b_4Exp + b_5Lab + b_6Cap$$

where Exp = net exports, Lab = human capital progress, measured by growth in the real wage, and Cap = Capital stock technological progress. Using this model I obtained the following results.

$$(13) \quad dY/Y = 1.72 + .003Aid/Y - .002Inv/Y - .0002Sav/Y - .0007Exp/Y \\ + .14Lab - 1.5Cap \quad ; \quad Adj \ R-sq = .34$$

The t-ratios are as follows: $Aid/Y = -0.38$
 $Inv = 1.19$

Sav	=	-1.48
Exp	=	0.29
Lab	=	2.92
Cap	=	-1.20

To help sum up the relationships between the variables, the following correlation matrix is informative.

Table 2

	dY/Y	Aid/Y	Inv/Y	Sav/Y
Aid/Y	.16	1.00	.79	.03
Inv	.23	.79	1.00	.03
Sav	.11	.03	.03	1.00
Exp	-.08	-.67	-.76	.09
Lab	.36	.26	.27	.09
Cap	-.07	-.04	-.02	-.15

Conclusions

In the final analysis I have found that aid has an insignificant effect on growth, and this is the conclusion of every major study on the effectiveness of foreign aid except those by Papanek. However, the low adj. R-sq. values indicate that there could be variables which significantly affect growth that are omitted from the growth models reviewed here, including my own. If aid is strongly correlated with any of these omitted variables, then aid's impact on growth will be misstated by the regression models. This is important to remember before prematurely concluding that aid insignificantly affects growth, as nearly everyone except Papanek has concluded. The regressions I did were a pooling of cross-section and time-series data, using

dummy variables to represent the different countries. This technique has its limitations, but is good for trying to understand broadly the impact of one variable (in this case, aid) on others.

In addition to aid's relationship with growth, aid has been criticized for its negative correlation with savings. Most writers have found this to be true, but I have found that aid doesn't seem to affect savings in either a positive or negative direction. I pointed out that a negative aid - savings correlation may not imply a direct causal relationship, since low savers will typically be high aid recipients. I also pointed out that in countries where the FE gap is the operative constraint, a negative aid to savings correlation would be our expectation. Also, since aid is strongly and positively correlated with investment ($r = .79$), a reduction in savings is not so worrisome.

Aid's tendency to increase the capital/output ratio may be a bit more serious, but only if that in turn causes unemployment. I have shown that this does not seem to be the case, since the ICOR had very little relation to the unemployment rate, and since aid strongly and positively affected the real wage rate. Although many critics of aid argue that aid is more often used for consumption rather than investment, most studies don't support this claim. Even if this were the case, we have discussed why this may be necessary in the short run to help hold the economy together, and that many times these consumption goods do have long run growth benefits.

I have also found that aid seems to be associated with a

decrease in exports, suggesting that it is the savings gap which was binding during the 1970's in Latin America, and that aid contributed towards the production of domestic goods rather than for the export sector. The negative and significant impact of investment on growth ($t = -3.41$) does not fit well with any of the theory previously discussed. There are at least three reasons which may explain this. First, the problem could stem from poor reliability of the data. However, using nine different countries makes this less likely than only using one. Second, it could be that the lag between investment and realized growth is much larger than one year, which was the lag time I used. The investment of the 1970's may not have translated into increased growth until the late 1970's or early 1980's. Third, investment may not cause decreasing rates of growth, but only be correlated with them. Surges of investment may have followed sagging growth in an effort to boost the economy.

Most of the empirical work done on the effectiveness of aid has been done using a large sample of countries from all over the world. Therefore, it is difficult in these studies to focus explicitly on Latin America as we have done, in order to see how Latin America may be different from the rest of the developing world. We do know, however, that the bias against exports in Latin America in the 1970's and towards import-substitution as a means of development has reduced the role of aid in the FE market. Even if the FE constraint was binding, aid may have deliberately been channeled into investment for domestic consumption. This severely limited the flexibility of aid to be

used where it would be most effective, and most probably reduced its impact in Latin America especially when compared with Asian countries. As McKinnon notes, most young economies are constrained primarily by their ability to generate FE, and so distorting import-substitution policies may be directly responsible for the impotence of aid in Latin America.

I have extended the basic model to include not only net exports, but measures for technical change which treat labor and capital separately. If technical progress was Hicks Neutral this would not be necessary, but the results seem to show that this is not the case. This extension was a step in the right direction, as this new model explained 34% of the growth in GNP for eight countries in Latin America, up from 11% achieved by Mosely et al. (1987), and 23% from my earlier model leaving technical change unaccounted for. But as Papanek has pointed out, the true impacts of aid will not be fully understood until a more complete model of economic growth is devised.

Appendix A

I Definitions

Aid/Y = Net disbursements of Official Development Assistance (ODA) from DAC member countries, multilateral agencies, OPEC and CMEA countries combined, divided by GNP. Reported in Geographical Distribution of Financial Flows to Developing Countries published by the Organization for Economic Co-operation and Development, Paris, 1981. GNP figures are reported in Economic Survey of Latin America, are lagged one year.

Aid-sq = Aid (as defined above) times itself. Lagged one year when regressed on dY/Y.

Lab = the real wage rate, cited in table 38 of Economic survey of Latin America, pg 56. Used as a proxy for labor augmenting technical change.

Inv/Y = Total foreign investment, divided by GNP, as reported in Economic Survey of Latin America. Lagged one year when regressed on dY/Y.

Sav/Y = Total domestic savings, divided by GNP, as reported in Economic Survey of Latin America. Lagged one year.

Exp/Y = Total net exports of goods and services, divided by GNP, as reported in Economic Survey of Latin America. Lagged one year.

Cap = changes in capital stock productivity for the U.S. obtained from the Dept. of Labor, cited in Norsworthy et al. (1979). Used as a proxy for changes in the capital stock productivity in Latin America (assuming most capital augmenting technological progress is imported).

II Means of key variables

Aid/Y = 0.144

Lab = .71

dY/Y = 4.6

Exp/Y = 50.57

Sav/Y = 25.65

Inv/Y = 225.75

Appendix B

The model used for my own empirical research is as follows:

$$dY/Y = B_0 + B_1Aid/Y + B_2Inv/Y + B_3Sav/Y + B_4Exp/Y \\ B_5Lab + B_6Cap + E_{aidi} + E_{ajdj}$$

where E_{aidi} = the sum of all eight country dummy variables
(Uruguay is used as the reference country)

and E_{ajdj} = the sum of all 9 year dummy variables, 1970-
1971, 1971-1972, ..., 1978-1979 (1979-1980 is
used as the reference year).

and all other variables defined in Appendix A.

The use of both time and country dummies in the same regression equation is referred to as the pooling of cross-sectional and time-series data. (See J. Johnston's Econometric Methods, 3rd ed. McGraw-Hill Inc., pgs. 396-407). The countries used were Columbia, Costa Rica, Paraguay, Peru, Argentina, Bolivia, Brazil, Chile, and Uruguay. Paraguay and Brazil were found to have significantly higher rates of growth with respect to Uruguay even after accounting for the other independent variables (t-ratios for the country dummies are: Paraguay = 3.72, Brazil = 1.89). When looking at year dummy variables, 1972, 1974, 1977, 1978, 1979 were found to have significantly higher rates of growth with reference to 1979-1980, whose effects were not captured by the other independent variables.

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