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SHOULD WE EXPECT AID TO INCREASE ECONOMIC GROWTH?

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ABSTRACT

The orthodox view of aid's impact on growth sees aid as relieving either a savings or a foreign exchange constraint and so directly increasing growth through higher investment. However, empirical studies have found little evidence of such a relationship: there has hence been some pessimism about aid's ability to increase growth. It is argued here that these findings are not surprising, given both our uncertainty about the determinants of growth and aid's changing nature. It is better to concentrate analysis on aid's impact on variables that are important to the growth process. Attempts to do this in the case of savings have been flawed by their partial framework. The simultaneous macroeconometric model presented here for Sri Lanka shows aid has in fact had a very strong impact on investment and output.

1 INTRODUCTION

It has been known for some time that there is no correlation between the amount of aid that a country receives and its rate of economic growth. Using recent data gives a figure little (and insignificantly) different from zero, specifically 0.04.[1] Indeed, growing aid to sub-Saharan Africa during the 1980s was matched by a deteriorating growth performance on the part of many recipients.

But many factors affect growth - including, inter alia, adverse movements in the terms of trade, climatic conditions, war, and the level of economic activity in the developed countries. It is therefore no surprise that there is no correlation, or (which is exactly equivalent) no significant relationship between aid and growth in a simple regression of the latter on the former.

In principle multiple regression techniques should enable us to get around this problem. Indeed, much empirical work has been done in this vein. As discussed in Part 2, this is an estimation of the Harrod-Domar model, which formed the

original economic rationale for aid. But this model, and its extension into the two gap model, has made many enemies - the most numerous of which go under the banner of "the savings debate". A part of this debate has shifted to look specifically at aid and public savings - I call this the "fiscal response literature". Part 3 looks at these arguments in the savings debate and summarises criticisms.

Parts 4 and 5 move the paper towards a neglected area in the analysis of the macroeconomics of aid: examining a range of relationships in the context of a full (rather than partial) macroeconomic model. This is done to consider the impact of aid on investment (and so growth), with an empirical analysis of the Sri Lankan experience in Part 5. Part 6 concludes.

2 WHY SHOULD AID INCREASE GROWTH?

An economic theory of aid's macroeconomic impact upon its recipients was developed from the late 50s by writers such as Rostow, Chenery, Rosenstein-Rodan and McKinnon. Their answer to the question addressed in this paper - "Should we expect aid to increase economic growth?" - was an unequivocal "yes". The basis for this view was the elaboration of the Harrod-Domar equation into the now well-known two-gap model. Rostow (notably in The Stages of Economic Growth) had expounded the idea that the critical constraint on growth in the developing world was a shortage of capital: aid would increase investment and therefore accelerate growth. This notion is summed up in the Harrod-Domar equation:

$$\frac{\Delta Y}{Y} = \frac{1}{k}\,\frac{\Delta K}{Y} \qquad (1)$$

where **Y** is output (Δ indicates a change, so ΔY/Y is the rate of growth), **K** is the capital stock and **k** the incremental capital output ratio (ICOR). Aid was seen simply as an increment to the capital stock:

$$\Delta K = I = S_d + A + F \qquad (2)$$

where **I** is investment, $\mathbf{S_d}$ domestic saving, **A** aid and **F** net private foreign capital inflows.

Most empirical studies have been based on the above model - though it has been common to include additional variables on the right hand side. These have usually reflected changes in quantity and/or quality of the labour force and exports (either as a ratio to GDP or their growth rate). There is not a complete consensus; but certainly there is not overwhelming evidence that aid increases growth and some, such as Paul Mosley (e.g. Mosley et al. 1987), are quite sure that the results tell us there is no significant relationship between aid and growth.

However, there is good reason to question the results of such studies. The models used to estimate the aid-growth relationship are misspecified on three counts: (i) omitted variable bias; (ii) single equation estimation of simultaneous relationships; and (iii) parameter instability.

First, we have a very imperfect understanding of the growth process. But it is not difficult to make a long list of variables that have at one time or other had growth regressed upon them (military expenditure, instability of export earnings, policy orientation and various social indicators, to name but a few), many of which have been found to have a "significant" impact on growth. To the extent that aid is correlated with any of these omitted variables (as in mnay cases it is, e.g. military expenditure) then the equation is subject to a specification error that will cause the estimate of the aid coefficient to be biased.

But, secondly, it is not sufficient simply to include some of the more important omitted factors. Consider, for example literacy, which is included in the model of Mosley et al. (1987). Its inclusion holds literacy constant whilst analysing aid's impact on growth. Yet increasing literacy may be one of the channels through which aid affects growth. This effect will not be captured by including literacy in the equation, since a single equation is being used to estimate what is, in fact, a simultaneous system.

This brings us to perhaps a more serious question still: "what are the channels through which aid may affect growth?". During the 1960s it may have been the case (but was not entirely so) that aid was used for investment in industry and

infrastructure. But since that time aid has expanded into the social sector, there has been increased use of technical assistance and aid explicitly tied to policy reforms intended (after a period of restructuring) to facilitate growth. All these things may well contribute to growth - but both the extent and the period over which they do so will be very different in each case. It would be foolhardy to claim that a textile factory, a feeder road, a primary health clinic and a student pursuing a masters degree in the UK are all going to have the same return, and what's more, within the same time frame. Yet this is precisely what is claimed by studies that regress aid on growth. Few such studies have tried to incorporate the lags that will occur between aid-financed activities and their eventual impact on growth. But such efforts are, anyhow, futile, since the required lag structure will change as the sectoral composition of aid changes. We would therefore expect that the aid coefficient in an aid-growth regression would be unstable (in both cross-section and time series studies) - as indeed has been found on the occasions when structural stability has been tested (e.g. White 1992b).

The empirical results in the aid-growth literature suffer from a further shortcoming in their weak theoretical underpinnings. Is the macroeconomic impact of aid captured through the above two equations? There is a substantial literature that replies "no" to this question. Indeed, the two-gap model propounded during the 1960s (e.g. Chenery and Strout 1966) argued that aid could increase growth in one of two ways - either by supplementing domestic savings or, if there were a binding trade gap, by increasing the imports necessary to increase output. Even in the two gap model the impact of aid on growth varies (according to which of the savings and trade gaps is the larger) - this is the problem of parameter instability that we have seen is not allowed for in most empirical studies. However most of the literature in the macroeconomics of aid concern channels through which aid's beneficial impact on growth will not be as described by the two-gap model. It is to such views that we now turn.

3 WHY MAY AID NOT INCREASE ECONOMIC GROWTH?

There is view, most closely associated with the name of Keith Griffin (1970 and Griffin and Enos 1971), that, whilst equations (1) and (2) are correct, they must be supplemented with two further relationships:

$$S_d = \alpha - \beta A \quad 0<\beta<1 \tag{3}$$

$$\frac{1}{k} = \gamma - \delta A \tag{4}$$

Equation 3 tells us that aid will not result in a one-for-one increase in investment since it will, to some extent, displace domestic savings. Equation 4 makes the further claim that aid-financed investment is not as productive as the domestically-financed investment that it displaces. Combining these two claims gives the possibility that growth may fall in response to a higher aid inflow. Griffin presented a numerical example of this, assuming a value of β of 2/3 (his empirical estimates lay between 0.67 and 0.84) and a ten per cent fall in the IOCR (from 1/3 to 0.3): growth falls from 4.0 percent to 3.9 percent in response to an aid inflow of 3% of GNP.

Equation (3) has been the subject of a substantial empirical literature. Griffin's estimates appear to be robust in cross-section data, but not so for time series analysis (for which positive coefficients have been observed). But equation (3) suffers from misspecification - even in terms of Griffin's own model. He presented his argument as follows (Griffin, 1971). Consumption is given by:

$$C = \sigma + \tau(Y+A) \tag{5}$$

where C is consumption. Since savings are given by:

$$S = Y - C \tag{6}$$

it follows that:

$$\frac{S}{Y} = (1-\tau) - \sigma\frac{1}{Y} - \tau\frac{A}{Y} \tag{7}$$

demonstrating the negative relationship between aid and

savings. In a peculiar disregard for his own theory, Griffin "suppresses" (i.e. ignores) the 1/Y term to derive his estimated equation. Assuming equation (7) actually is the true model then his estimate of the coefficient on aid will be biased. We can go further and say that we expect this bias to be downwards (i.e. it overstates the extent to which aid displaces savings).

The reason for believing the bias to be downwards are as follows. The direction of the bias is the product of two relationships: (i) the sign on the omitted variable in the "true" model; and (ii) the sign of the correlation coefficient between the omitted and included variable. We may see from equation (7) that the first of these is negative. What about the correlation between 1/Y and A/Y? The omitted variable, 1/Y, will be small for two reasons - if a country is either big or rich. Small countries are known, on average, to receive disproportionately more aid than large ones. Also rich countries may expect to receive less aid than poor ones.[2] For both these reasons, as income rises (so 1/Y falls) the aid ratio (A/Y) will also fall. The correlation between 1/Y and A/Y is therefore positive and the sign of the omitted variable bias (the product of a negative and a positive) is negative.

The presence of downward bias is shown in results I have presented elsewhere (White 1992b), in which cross-section data gave an estimate of -0.87 for β in equation (3) - but the equivalent from using Griffin's correct model, i.e. equation (7), was only -0.40. Using this value, rather than that of 2/3, in Griffin's simulation reported above means that the aid inflow causes growth to rise (to 4.1 percent) rather than fall.

But we should not be content to conclude that there <u>is</u> a negative impact of aid and savings, albeit one that is rather less than Griffin claimed. Equations (6) and (7) cannot be the whole story about aid's impact, since they hold income constant. (There are two equations and the two endogenous variables are consumption and savings - income as well as aid must be exogenous). Income may be endogenised in one of two ways - in either a static or a dynamic model.

Dynamically, equations (5) and (6) may be combined with

equations (1) and (2) to give a fully closed model in which current output is given by lagged output plus incremental output (which depends on the previous period's investment). Higher future output will allow higher domestic savings and we may expect that, in time, this positive effect will offset any displacement effect from aid on savings. This was precisely the argument of the original proponents of the two gap model, who argued that aid-financed growth would raise the savings rate, and hence lead to "self-sustained growth".[3] This point is demonstrated in the simulation shown in Table 1 and Figure 1.[4] Table 1 shows the value of the different variables at certain intervals in the twenty-one year simulation. Parameter values were chosen so that the first year replicates the numerical simulation of Griffin cited earlier (but with the ICOR now held constant). Income grows at a steadily increasing rate in this model with a constant aid flow. Comparing the resultant level of savings with that without aid (shown in the last column of Table 1) shows that the former overtakes the latter in year 12. This result may also be seen in Figure 1. That is, despite the fact that aid is displacing savings at a high rate, savings with aid are still higher than those without it.

As an alternative to the analysis of the preceding paragraph, income may be endogenised in the current period. In this case an obvious candidate to close the model is the national accounting identity:

$$Y = C + I \tag{8}$$

Solving the model given by equations (5), (6) and (8) gives the following reduced form expressions:

t	Y	S	A	S/Y	S (no aid)
0	100.0	10.0	3.0	0.10	12.0
1	103.9	11.3	3.0	0.11	13.2
2	108.2	12.7	3.0	0.12	14.5
3	112.9	14.2	3.0	0.13	15.9
11	171.9	33.7	3.0	0.20	33.9
12	183.0	37.4	3.0	0.20	37.3
13	195.1	41.4	3.0	0.21	41.0
19	297.2	75.2	3.0	0.25	72.3
20	321.2	83.0	3.0	0.26	79.4

Table 1. Dynamic Simulation of Griffin's Model of the Relationship Between Aid and Savings

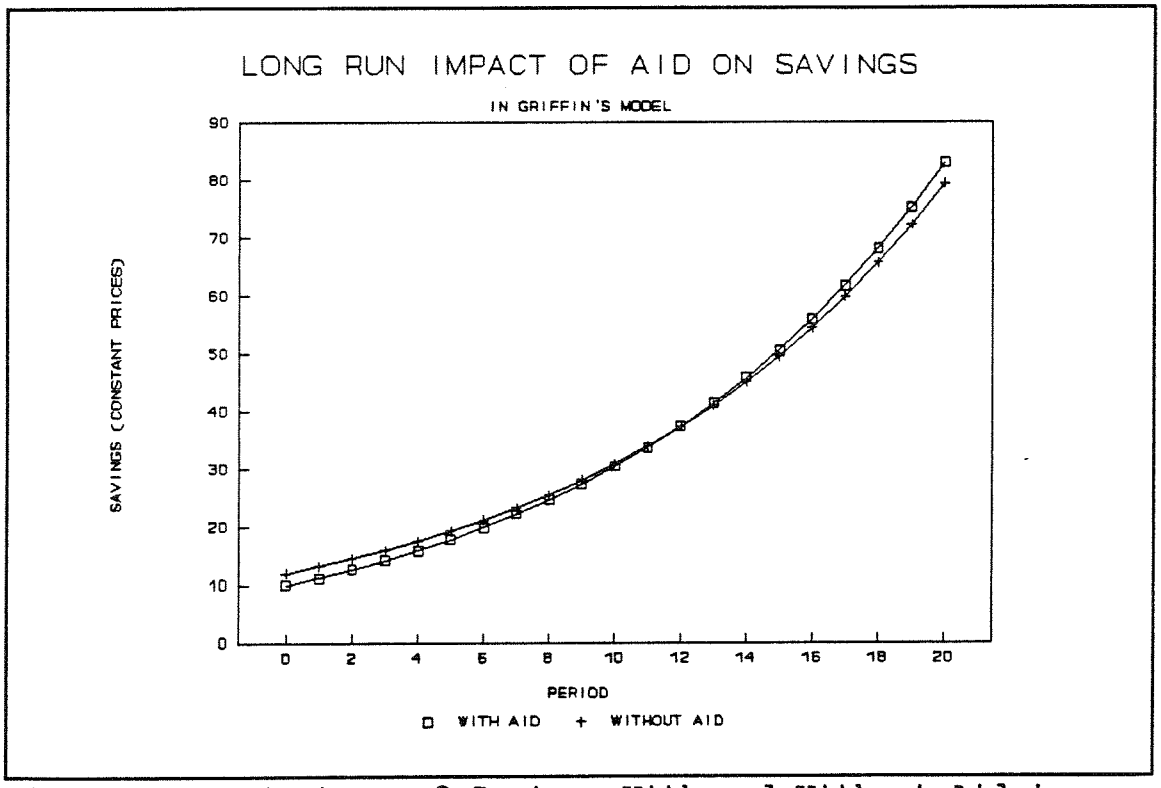

Figure 1. Trajectory of Savings With and Without Aid in Dynamic Simulation of Griffin's Model of the Impact of Aid on Savings

$$C = \frac{\sigma + \tau I + \tau A}{1 - \tau} \qquad (9)$$

$$Y = \frac{\sigma + I + \tau A}{1 - \tau} \qquad (10)$$

$$S = I \qquad (11)$$

Savings are a function simply of the exogenously determined level of investment - they are unaffected by the other exogenous variable, aid! What has happened to the negative relationship given in equation (7)? This is only a <u>partial</u> relationship, since it holds income constant, whereas we would not expect income to be constant in the face of an aid inflow. To pursue the spirit of the Keynesian model suggested by Griffin's own analysis, we might expect there to be multiplier effects from aid on income, and therefore savings.[5] Higher aid, through higher income, will have a positive impact on savings. It appears that in the model as specified here these positive feedback effects exactly offset the adverse ones discussed by Griffin, so that there is no net impact from aid on savings. Other specifications may well admit to the possibility that aid can increase savings in the current period (see below).[6]

I have dwelt on Griffin's arguments at some length here for three reasons.[7] First, Griffin himself still stands by his views, having recently written that

> "there is an economically meaningful negative correlation between aid and savings and this correlation is strong and significant" (1991 p.664).

Second, these views have spawned a substantial empirical literature with little attention having been paid to the (very weak) underlying theory. Third, recent advances in the macroeconomics of aid (the fiscal response literature) fall prey to the same criticisms made above of Griffin's work. It is to this last point that I now turn.

Whilst Griffin listed some possible channels through which aid may have an adverse impact on savings, these were

not, as seen above, incorporated in his model of the process (which operated simply through the consumption function). A more recent literature models the impact of aid on public savings. This fiscal response literature makes the important issue of fungibility central to its analysis, that is the notion that aid is not in effect used to finance the activity to which it is nominally attached. If the recipient were going to spend money on that activity anyhow then, in an economic sense, the aid money is being used to finance the incremental activity. Griffin's argument is an application of fungibility. In the fiscal response model of Heller (1975; and developed in Mosley 1987, Mosley et al. 1987, and White 1992a and 1992c) aid may be used for one of five activities. It may, as intended by the donor, increase government investment or recurrent government expenditure of a developmental nature. On the other hand, it may be used to offset taxes or borrowing or to increase government non-developmental expenditure. Empirical estimation of a number of these effects have found that aid does indeed appear to have an adverse impact on government savings.[8] However, these studies do not take account of the possible multiplier effects discussed above. This is even the case for the model of Mosley et al. (1987) which appends the original Heller model to a Harrod-Domar equation (rather in the manner done above for Griffin's model). Yet the authors fail to analyse the dynamic aspects of their specification. In an earlier paper (White 1992c) I present a simple fiscal response model embedded in a Kenynesian model. The result that aid offsets taxes (and so leads to a less than one-for-one increase in government expenditure) is replicated when only partial effects are considered. However, feedback effects through higher income mean that aid may lead to higher, not lower, taxes, and a consequent increase in government expenditure in excess of the value of the aid inflow.

The case that aid may displace savings - either generally or more specifically public savings - is not proven. Such prove would require that the result be shown to be robust in

macroeconomic models that incorporate a wider range of economic variables (and such analysis as there is suggests that it is not robust in this way). Unfortunately, analysis of the macroeconomics of aid has been short of models that incorporate a wide range of macro issues. More fortunately, I believe this is changing and that a "new macroeconomics of aid" is emerging. The first part of this new literature is the fiscal response approach just discussed - despite its shortcomings it is a considerable advance on the preceding largely empirical literatures on aid, growth and savings. The second area of the new macroeconomics is the literature on "aid as Dutch disease" (see, for example, van Wijnbergen 1986).

Here I address the issue just raised - that of richer modelling of aid's impact. Drawing on existing literature, Part 4 discusses the relationship between aid and investment. The rationale for this is that investment is an important part of growth. Even if we cannot measure aid's impact on growth directly, it is reasonable to argue that if aid leads to higher investment then, at the very least, this is a channel through which it is providing a prerequisite for sustained growth.[9]

4 AID AND INVESTMENT

The original link between aid and growth was seen to run through the increase in investment. Even Griffin agreed there would be such an increase, although it would be less than the value of the aid inflow. So can we just regress investment on aid? This has been done in a few studies (e.g. Massell et al. 1972, Chaudhuri 1978 and Levy 1987) which find a positive impact. However, the same arguments advanced against the radicals in the savings debate in Part 3 apply to these regressions. We need to identify the channels through which aid may increase (or decrease) investment.

The first distinction we must make is between public and private investment. The impact of aid on these two categories will differ (and so the coefficient from regressing investment

on aid will be unstable as their respective shares vary). The relationship between aid and public investment hinges around the issue of fungibility on the one hand and possible feedback mechanisms (either static or dynamic) on the other. Aid's impact on private investment will be mostly indirect (though some aid is channelled to the private sector through credit schemes) - these indirect effects taking the form of either crowding out or in. Private investment may also be affected by a variety of feedback mechanisms. Each of these is now discussed in more detail.

The impact of aid on government investment will, in the first instance, be a function on fungibility. There may, as shown in the fiscal response literature, be a diversion of aid funds into non-developmental activities or to reduce taxes and borrowing. However, the components of government expenditure (both consumption and investment) may well, in turn, depend on taxes (that is government expenditure is to some extent "supply driven"). Therefore if aid directly increases government expenditure this will (through the national accounting identity) increase income and thus taxes. The effect on taxes will feedback into a "second round" of impacts on government expenditure patterns.

Private investment may be linked to public investment (and thus to aid) through a number of channels. First, there may a direct complementarity between the two types of capital formation. Some projects stimulate private investment through their demand for inputs. Others have a stimulating effect via facilitating investment that would not otherwise have been profitable but become so with improved access or services. Second, there may be crowding out via credit rationing or the real interest rate. As shown in White and McGillivray (1992), this effect depends on aid's impact on government savings. If aid relaxes the fiscal deficit it will cheapen the cost of credit (or the quantity constraint) so that private investment may rise. Third, empirical studies find that changes in output are typically one of the main determinants of private investment in developing countries (see Serven and Solimano,

1992) - this is the accelerator principle. Thus aid may initiate a "virtuous circle" with the initial aid-financed investment (and hence growth) stimulating private investment which then fuels growth. Fourth, aid may discourage investment in tradable goods' production if, as suggested by the aid as Dutch disease literature, it induces an appreciation of the real exchange rate.

Based on the above discussion, aid may have little effect on investment, a mixed effect (increasing public but reducing private) or strong beneficial effects on both. Which of these actually occurs can only be determined by reference to the experience of aid recipients.

5 AID AND INVESTMENT IN SRI LANKA

Since initiating a liberalisation programme in November 1977, Sri Lanka has been in receipt of a substantial volume of aid. At the same time there has been an investment boom. Both of these trends are shown in Figure 1.

Using national accounts data, aid may appear in one of two ways: either in the current account as an official transfer or on capital account as a loan. In the case of the latter it is not possible to distinguish between aid, non-concessional official flows (OOF) and commercial loans. The category used is that of net long-term loans on the assumption that most non-grant aid will be of a long rather than short-term nature. For Sri Lanka a high proportion of this item is likely to be aid.

The sum of official transfers and long-term loans grew from around 4% of GNP in the first part of the 1970s to over 10% in the early eighties (though it had subsided somewhat by the end of the decade). Meanwhile the investment rate doubled from 15% to 30% over the first decade, also falling back (to around 23%) in the late eighties. The investment boom has clearly not been entirely aid financed - both the level of the aid is insufficient and the timing of the increase delayed beyond the initial post-liberalisation boom. Nonetheless, aid may have played an important role through the mechanisms

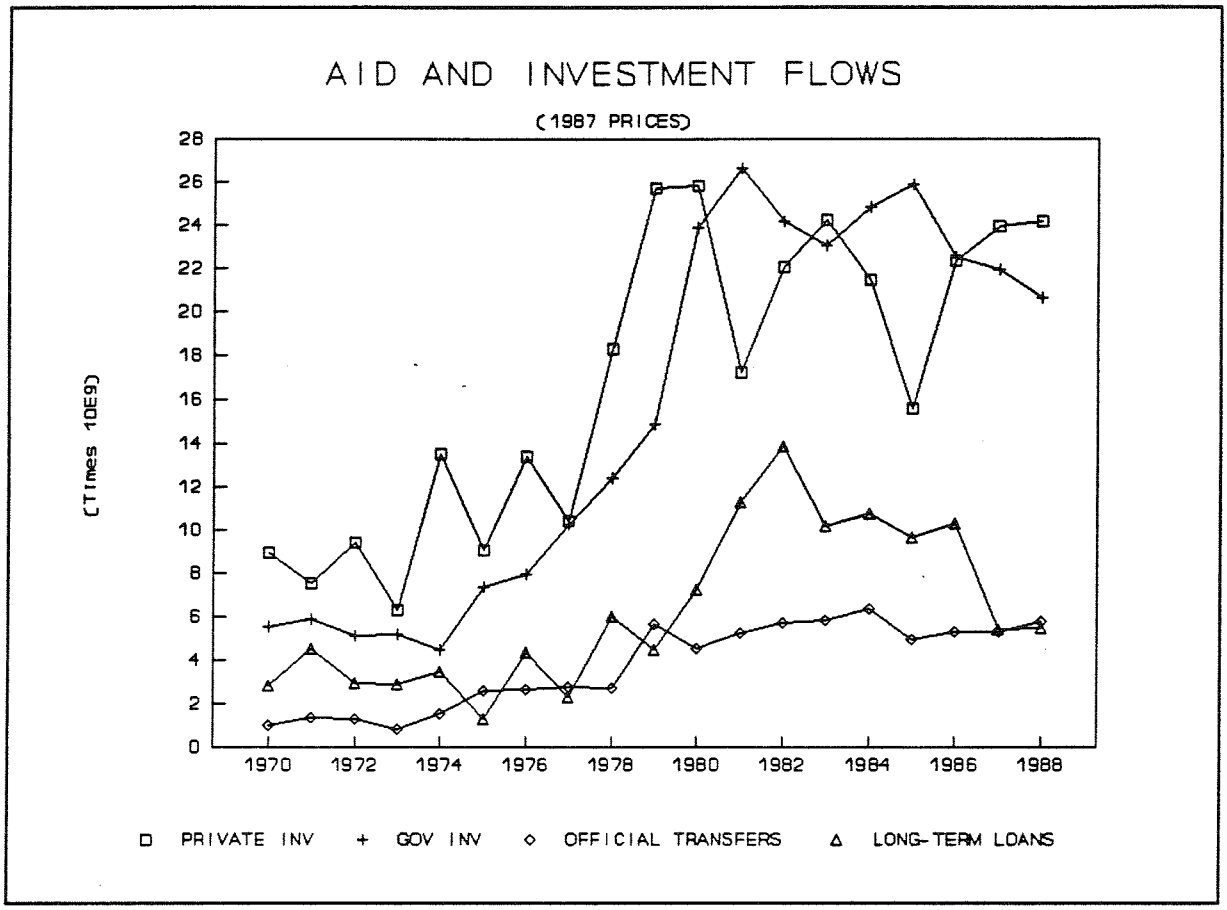

Figure 2. Aid and Investment Levels in Sri Lanka, 1970-88
(Billions of 1987 Rupees)

Source: World Tables

discussed in the preceding section. Which of the above theoretical scenarios corresponds most closely to what appears to have happened is examined here using a macroeconometric model.

This model (presented in full in the appendix) incorporates many of the above relationships. It allows for the fact that aid may increase not only government investment, but also government consumption or have an effect on taxes. The consequent impact on the fiscal deficit may, via real interest rates, have an impact on private investment. Private investment is also affected by aid through two further channels. First, there is direct crowding in (or out) from the change in government investment. Second, the private investment function allows for an accelerator process; hence if aid raises growth it will increase investment. National

accounting identities are also included so the usual static Keynesian expenditure multiplier will operate. A dynamic aspect is built into the model at the estimation stage, since general-to-specific modelling allows the data to determine the appropriate lag structure in any behavioral relationship.

The following aspects are not included. There is little attention to price - indeed, apart from using the real interest rate this is a fixed-price model. It therefore does not allow for the aid induced real exchange rate appreciation discussed by White and Wignaraja (1992). In fact, all current account items are taken as exogenous. While further work will be done on endogenising some of these aspects, the focus here is on fungibility and investment in the presence of feedback multiplier effects. It may seem particularly surprising to omit an import function (say, imports as a function of income, aid and the real exchange rate). However, endogenising imports would add nothing to the economic mechanisms currently described in the model.

Imports would be important if the model were to incorporate supply-side considerations, since there may be foreign exchange constraints on either investment or capacity utilisation. But this is a demand driven model - there are no supply constraints. Moreover, there is no feedback from higher investment into higher potential output. These aspects are clearly also important, and should be the subject of future work. Yet even with these limitations, the model gives interesting insights into the interactions between public and private investment and aid.

Estimation is problematic for two reasons. The model has twelve endogenous variables and twelve equations. Of these, six are behavioral relationships, each of which is over-identified. This suggests that two stage least squares, or a more sophisticated full information estimation procedure, should perhaps be applied, even though there is a danger of bias in a sample of this size (nineteen years at most, less if lags are included). However, plotting the data reveals most of the series are almost certainly <u>not</u> stationary (see, for

example, the aid and investment series in Figure 2), so that 2SLS, or other simultaneous estimation technique, would not be consistent even in large samples. (The strong trend in nearly all variables gives a further problem of multicollinearity, which is severe for some of the regressors). If, however, the variables in an equation turn out to be cointegrated then OLS may be applied to get a (super)consistent estimate of the long-run relationship (but again with a danger of bias in a sample of this size). The modelling strategy adopted was therefore an ad hoc compromise of the above techniques. First analysing the order of integration of the variables, intending to proceed with 2SLS if all variables in an equation were I(0) (in practice, none were). If they were I(1) they were tested for cointegration and, if possible, an error correction model estimated (this was possible for all behavioral relationships). These stages were combined with techniques of data analysis and GSP modelling - a pre-specified functional form was not imposed on the behavioral equations. The resulting equations are presented in the appendix, here I discuss the results and their implications for aid's impact.

Both categories of aid have a direct positive impact on government investment. Through this channel they also increase private investment, since there is strong complementarity (crowding in) between public and private investment. There is no crowding out via the real interest rate because, even though private investment is sensitive to this rate the latter is unaffected by the government's fiscal position. The order of magnitude of these various effects may be gauged from Figures 3 and 4. These graph the base case in which the exogenous variables, including the two aid flows, are given their actual values. Each figure then shows the levels if investment predicted by the models if official transfers and net long-term capital flows had only been half of their actual values. Private investment would only have been two-thirds of its actual level, and government investment less than half. The evidence therefore strongly supports the view that aid has played an important role in financing Sri

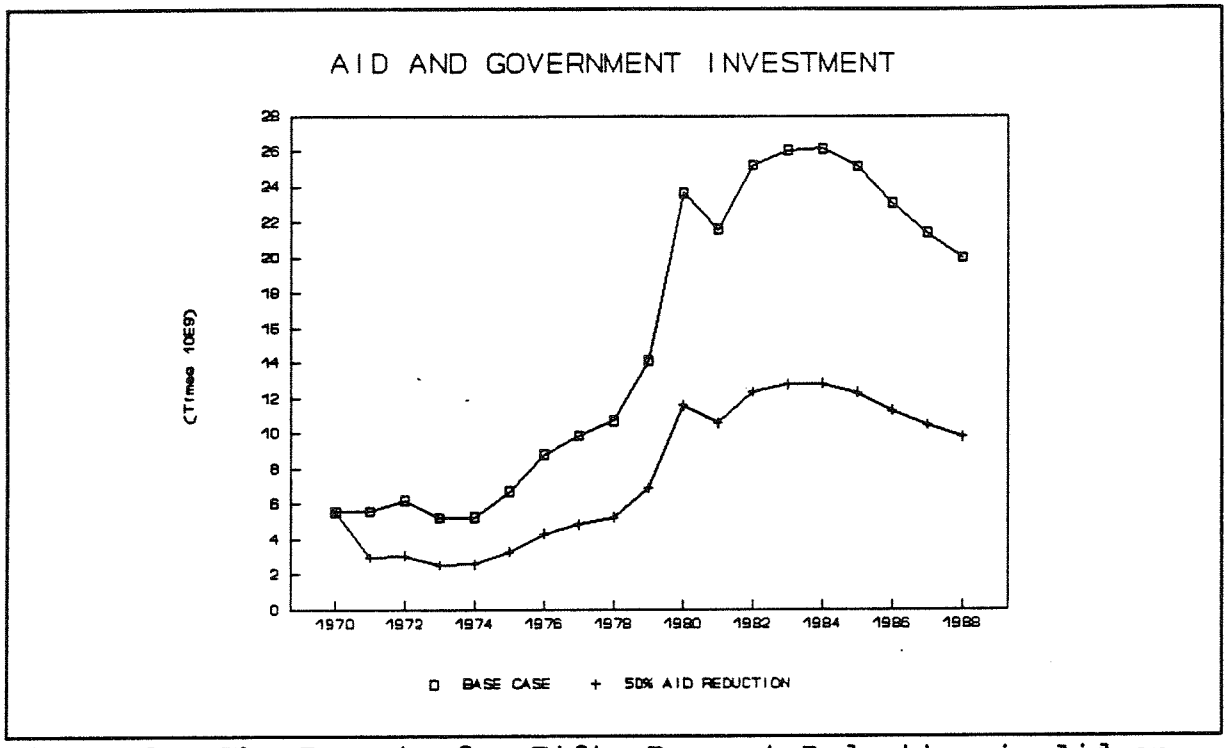

Figure 3. The Impact of a Fifty Percent Reduction in Aid on Government Investment

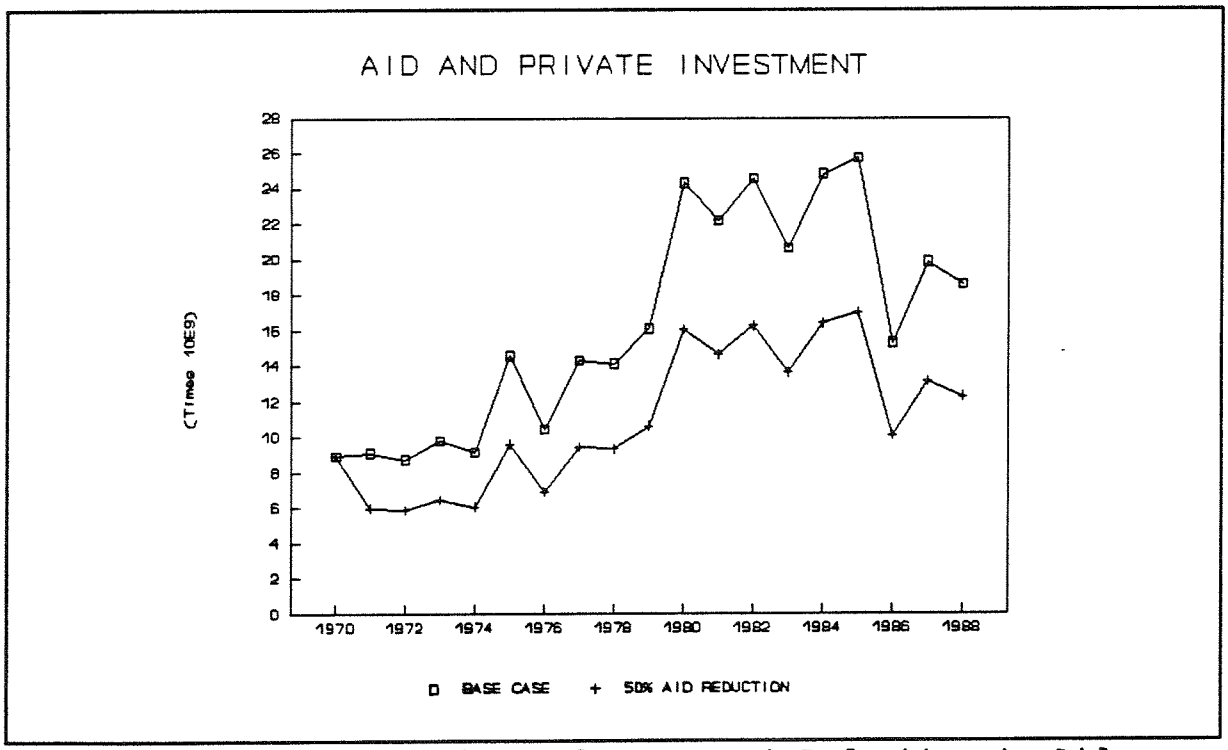

Figure 4. The Impact of a Fifty Percent Reduction in Aid on Private Investment

Lanka's investment boom.

Figure 5 shows how the reduction in aid would have affected GDP - it would have been, on average, ninety percent of its actual level. The magnitude of this effect is over double the value of the aid that would have been lost. This, then, is evidence of the "aid multiplier" in action. Aid is not a one-for-one increment to income (i.e. an aid multiplier of unity) as assumed by Griffin in his analysis (see White 1992a); it in fact appears to have been somewhat greater than two in Sri Lanka over this period.

Despite the positive impact on taxes through higher income, the aid inflow still worsens government savings (because of the strong positive effect on government investment and there is also an increase in government consumption from higher taxes). This result is consistent with that found in some of the empirical studies in the fiscal response literature (see the summary table in White and McGillivray 1992). The impact on private savings is not analysed in this model, but will be the subject of a future study.

6 CONCLUSION

The early optimism concerning the automatic link between aid and growth was broken by both empirical work and theoretical attacks. Empirical studies found little or no relationship between aid and growth. However, it was argued above that this is not surprising and that research ought, instead, to concentrate on analysing the impact of aid on variables that are important to growth (e.g. investment, savings and imports) rather than growth itself.

The savings debate was an attempt to do this - and to explain at the same time why aid did not increase growth. However, this debate tells us little, since it has been mostly of an empirical nature, paying insufficient attention to its inadequate theoretical underpinnings. A look at the theory shows that, once feedback effects are allowed for, the impact of aid on savings is not negative as claimed but ambiguous.

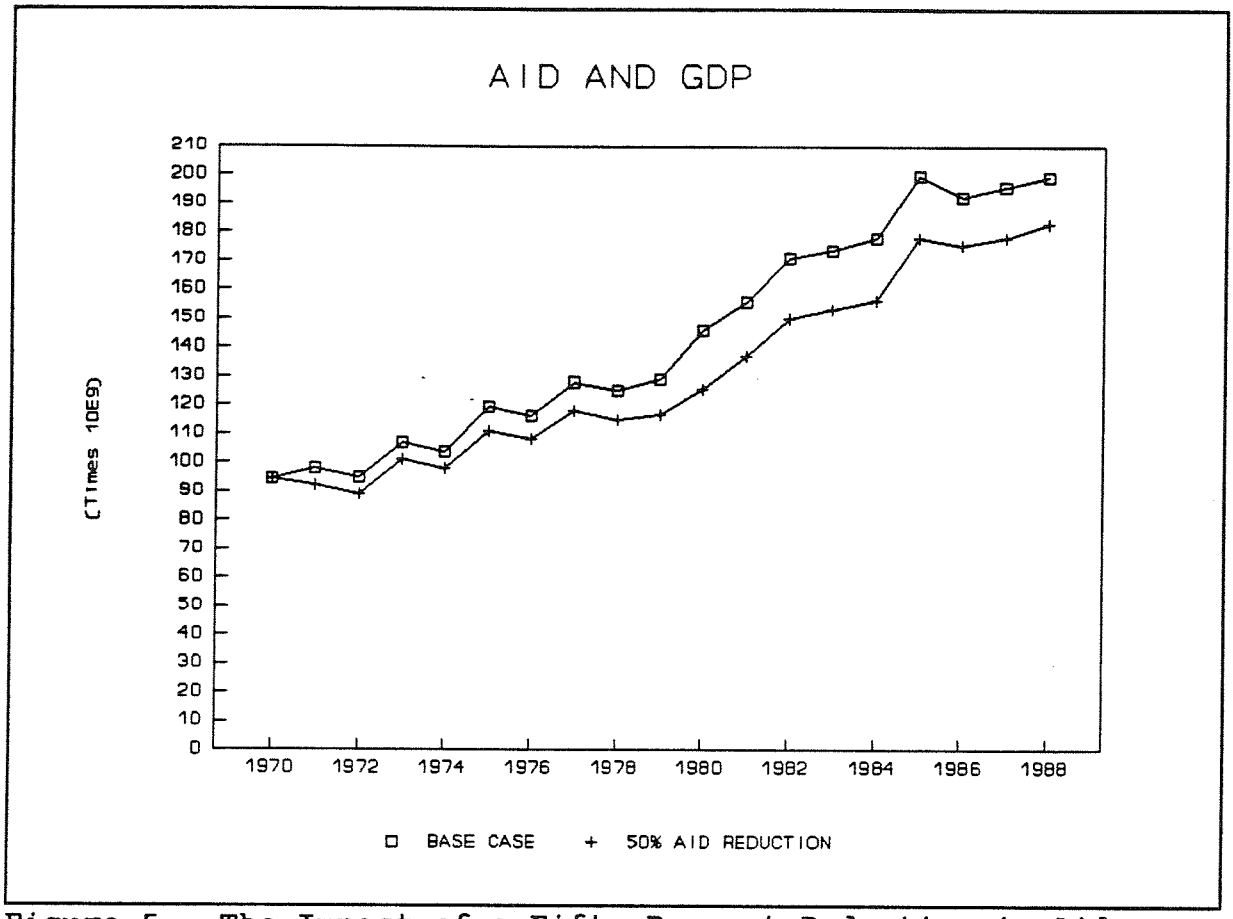

Figure 5. The Impact of a Fifty Percent Reduction in Aid on GDP

This criticism may also be levelled at the fiscal response literature, which concentrates the analysis on public savings. At the same time, this literature brings to the fore the important notion of fungibility. This paper draws on this literature, amongst others, to discuss the ways in which aid affects investment. It is argued that it is important to distinguish between public and private investment, and a number of channels through which aid may affect each of these are identified. These effects are then captured in a simultaneous macroeconometric model, which is estimated for the case of Sri Lanka. The model shows that, had aid been lower, then both government and private capital formation would have been substantially lower. The results also show a substantial impact on output. This is, however, a demand driven result. Further work should model this output effect from the supply side, including the possibility of a foreign exchange constraint on investment. However, the analysis presented here suggests that pessimism about aid's impact appears to have been misfounded. These results suggest that aid can indeed have a strong beneficial effect.

ACKNOWLEDGEMENTS

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NOTES

1. The data were the ratio of aid to GNP in 1988 (from Table 20, 1990 World Development Report) and real growth of GDP for 1988-89 (calculated from data from World Tables diskette).

2. Historically there has in fact been little relationship between aid receipts and income per capita - the high amount of aid received by some high income countries (notably Israel) meaning that there is a positive relationship between the two variables for some donors. However, aid ratios in Africa have increased dramatically in the 1980s. Since they are low income countries, a significant negative relationship has at last emerged (a negative correlation of -0.50 using the data referred to in the previous note).

3. Defined as growth financed by domestic sources, possibly supplemented by private capital inflows.

4. The results of a similar simulation were originally reported by Grinols and Bhagwati (1976).

5. This criticism of Griffin's argument was made at the time by Kennedy and Thirlwall (1971), and Eshag (1971).

6. But note there may still be a negative relationship of between aid and savings rates. As long as the MPC is greater than a half then income will increase by more than the value of the aid inflow, in which case the aid ratio falls. If income increases the savings rate rises (assuming a standard Keynesian linear savings function with negative intercept). A negative relationship between S/Y and A/Y is therefore observed.

7. Though space has not permitted me to detail all the attacks that have been made on his analysis - for further details see White (1992a and 1992b).

8. Results of these studies are summarised in White and McGillivray (1992).

9. Caution is expressed here on two grounds. Investment is not the only cause of growth, and investment alone may well be insufficient. Second, the productivity of investment, especially aid-financed investment, and especially in Africa, has been a matter of concern. Unfortunately, little empirical work has been done on this latter issue.

APPENDIX: A MACROECONOMETRIC MODEL OF AID AND INVESTMENT

The Model

Identities

$$GNP_t = GDP_t + NFP_t \quad \text{(A1)}$$

$$GDP_t = C_{p,t} + C_{g,t} + I_{p,t} + I_{g,t} + X_t - M_t \quad \text{(A2)}$$

$$G_t = C_{g,t} + I_{g,t} \quad \text{(A3)}$$

$$YD_t = GNP_t - T_t \quad \text{(A4)}$$

$$DEF_t = G_t - T_t \quad \text{(A5)}$$

$$GROW_t = \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}} \quad \text{(A6)}$$

Behavioral Relationships

Dependent Variable	Regressors	Equation
I_g	OT, LTL, T	A7
C_g	OT, LTL, T	A8
T	OT, LTL, GNP	A9
R	DEF	A10
C_p	YD, R	A11
I_p	I_g, R, GROW	A12

Endogenous variables: GNP, GDP, C_p (private consumption), C_g (government consumption), I_p (private investment), I_g (government investment), YD (disposable income), G (government expenditure), T (government revenues), DEF (government deficit, or minus public savings), GROW (real growth of GDP) and R (the real interest rate).

Exogenous variables: NFP (net factor payments), X (exports of goods and services), M (imports of goods and services), OT (net official transfers) and LTL (net long-term loans).

Equations (A7) to (A12) were estimated as linear equations in both levels and, excepting GROW and R, in logs. With appropriate restrictions and lags, each was fitted to an error correction model (see below).

All data are in constant (1987) prices and are taken from the

1991 World Tables diskette (except share of public and private investment, which is from Pfeffermann and Madarassy 1992).

Results

A "d" before a variable name indicates a first difference and a "L" a natural log. DUM79 and DUM80 are impulse intercept dummies.

Government investment

$$dLI_{g,t} = \underset{(4.04)}{0.54} + \underset{(1.65)}{0.24}\ DUM80 + \underset{(2.44)}{0.26}\ dLOT_t + \underset{(2.01)}{0.15}\ dLLTL$$

$$\underset{(-3.90)}{-0.88}\ (LI_{g,t-1} - 0.71\ LOT_{t-1} - 0.32\ LLTL_{t-1}) \quad R^2 = 0.70$$

Government consumption

$$dC_{g,t} = \underset{(3.34)}{7.42} + \underset{(1.29)}{0.23}\ dLT_t - \underset{(-1.81)}{0.17}\ dLOT_t$$

$$\underset{(-3.34)}{-0.77}\ (LC_{g,t-1} - 0.78\ dLT_{t-1} + 0.22\ dLOT_{t-1}) \quad R^2 = 0.47$$

Tax function

$$dLT_t = -8.49 + 0.21\ DUM79 - 0.28\ DUM80 + 0.09\ dLGNP_{t-1}$$

$$- 0.61\ (LT_{t-1} - 1.47\ LGNP_{t-1}) \quad R^2 = 0.71$$

Crowding out: no significant relationship could be found between the real interest rate and the government deficit. The former was therefore exogenised for the purposes of the simulation exercise. Figures in parentheses are t-statistics

Private investment

$$dLI_{p,t} = \underset{(3.72)}{13.29} + \underset{(1.39)}{0.67}\ dLI_{g,t} - \underset{(-2.33)}{1.95}\ R_t$$

$$\underset{(-3.70)}{-1.34}\ (LI_{p,t-1} - 0.58\ LI_{g,t-1}) \quad R^2 = 0.63$$

Private consumption

$$dLC_{p,t} = \underset{(-3.07)}{-3.00} + \underset{(5.70)}{0.92}\ dLYD_t$$

$$\underset{(-3.07)}{-0.57}\ (LC_{p,t-1} - 1.2\ LYD_{p,t-1}) \quad R^2 = 0.74$$

Simulation: for simulations it is important that the model tracks the actual values of the endogenous variables in a reliable manner. The more endogenous variables there are the more tenuous the links become. The above equations all have good R^2s for difference equations. However, in simulations the consumption terms were consistently underestimated. Since they are not directly variables of interest and are little directly affected by the aid variables they were exogenised for the simulation exercise (the model still has nine endogenous variables). Figure A.1 shows that the model base case GDP (i.e. with all exogenous variables assuming their actual values) tracks actual GDP very closely.

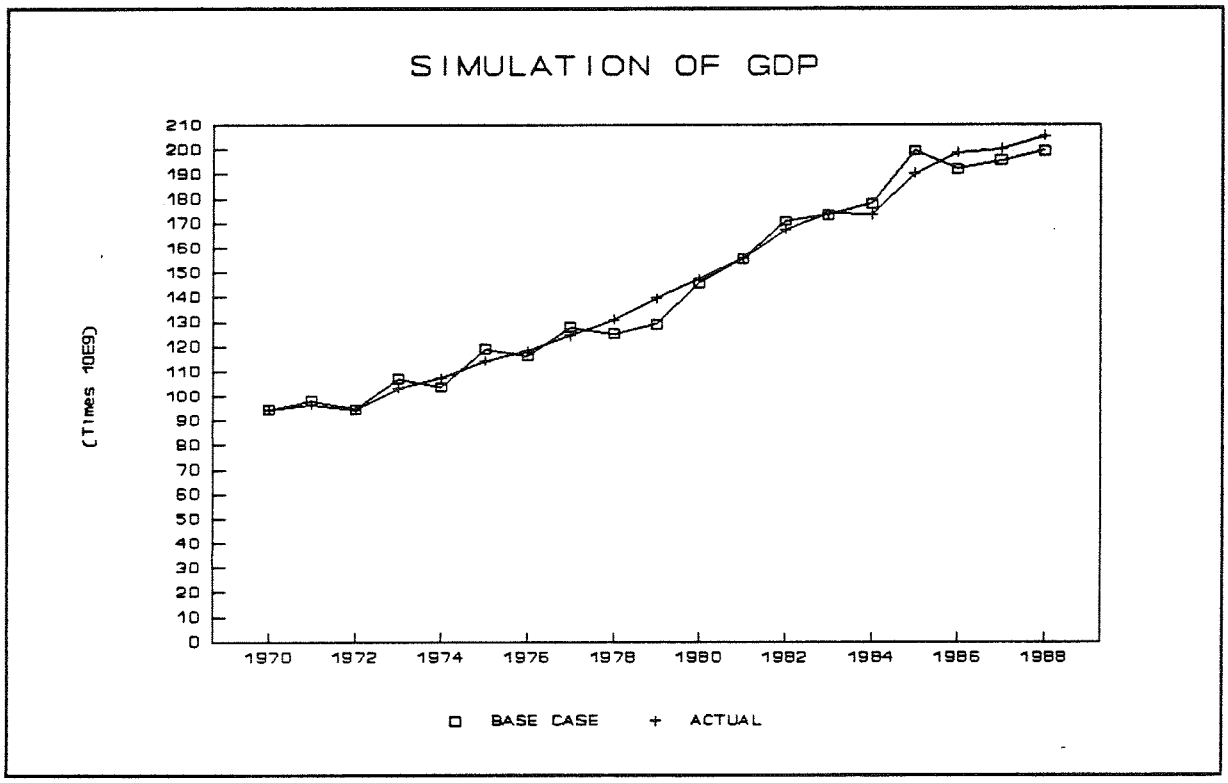

Figure A.1. Simulated and Actual GDP

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