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Are There Negative Returns to Aid? A Comment

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Abstract

Amid controversies surrounding aid effectiveness, an increasing number of empirical studies find support for the idea that aid can spur growth and that the aid-growth relationship is nonlinear. Lensink and White propose a model to illustrate the possible existence of what has been labeled an "aid Laffer curve." This short paper highlights the model's weaknesses and suggests that the model does not fulfill the purpose of illustrating the possible existence of negative returns to aid.

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I. Introduction

In a past issue of the *Journal of Development Studies*, Lensink and White presented a theoretical model aimed at illustrating that aid may not merely have diminishing returns but that, after a certain level, returns become negative (Lensink and White, 2001; thereafter, LW).[2] Since the 1990s, researchers and policymakers have devoted considerable attention to aid effectiveness, reviving the heated debates of earlier decades. LW is part of a growing literature that, following Burnside and Dollar's influential finding[3] that aid contributes more to growth in countries with good policies, supports the idea that aid can spur growth and that the aid-growth relationship is nonlinear, albeit not necessarily in the way specified by Burnside and Dollar (2000). The notion of diminishing returns to aid is a variant of the nonlinear aid-growth relationship that LW and many other studies put forth. What distinguishes LW from many studies looking into the notion of diminishing returns to aid is that it is, to our knowledge, the only one including a theoretical model aimed at illustrating the possible existence of what has been labeled an "aid Laffer curve."

The increasing number of references to LW—although not necessarily directed at the theoretical model therein—reflects the attention the paper has attracted. In this comment, the theoretical model put forth in LW is examined to ascertain what it accomplishes. The analysis highlights the model's weaknesses and suggests that the model does not fulfill the purpose of illustrating the possible existence of negative returns to aid.

In light of the array of views on a subject of such great importance for development policy as aid effectiveness,[4] the motivation of the analysis carried out below is threefold: first, to highlight that the notion of negative returns to aid, although plausible, has a shaky foundation that needs to be reinforced;[5] second, to encourage increased scrutiny of models

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[2] The study was first circulated in 1999 by the Centre for Research in Economic Development and International Trade at the University of Nottingham in England.

[3] Burnside and Dollar's result has been the centerpiece of an apparent consensus that has formed gradually in the international development community around the notion that the fight against poverty in low-income countries (LICs) can benefit from aid that is part of a broad framework of economic policies and institutional reforms that can promote economic growth by encouraging private sector development and an upgrade of indicators of social well-being.

[4] See Hansen and Tarp (2000) for a literature review.

[5] Thresholds for negative returns are varied, as are specifications of empirical models they are derived from. The threshold for negative marginal returns to aid is found to be 50 percent of GNP in LW and 25 percent of GDP in Hansen and Tarp (2000) and Hadjimichael and others (1995). The finding of diminishing returns to aid in Hadjimichael and others (1995, p. 42)—rightly considered as a pioneer study on the subject—is also associated with a U-shaped relationship between inflation and growth. In particular, with inflation and its square among the explanatory variables in the growth model, inflation enters with a negative and significant coefficient, in line with the prediction of cash-in-advance models, while its square enters with a positive and significant one. Together, the two coefficients suggest that inflation has a negative impact on growth up to a threshold of 85 percent, beyond which its

(continued)

that support diverse findings put forth in the aid-growth literature;[6] and third, to emphasize the need for well-structured theoretical models that would hopefully integrate key factors accounting for the nonlinearity of the aid-growth nexus, so as to shed light on the different results obtained in empirical analyses and to guide policymaking.

The remainder of the paper is organized as follows: Section II analyzes the Lensink-White model, and Section III concludes.

II. The Lensink-White Model

The key features of a good model are its ability to simplify a complex real-life problem, the consistency of its structure, and its ability to help explain real-life phenomena or make predictions that guide decision making. Along these lines, a model is judged foremost by its usefulness, which is its purpose.

The theoretical model in LW was developed for the purpose of illustrating, in the authors' own words, "that aid may have not merely decreasing returns but that, after a certain level, the returns to further aid flows are negative." Does the model accomplish its purpose in accordance with the key features of models? This question is addressed below after a presentation of the broad lines of the model in the following box.

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marginal impact becomes positive. This counterintuitive finding could be downplayed because the 85 percent threshold for inflation exceeds the average inflation for most countries in the sample used, but so is the 25 percent of GDP threshold for aid that supports the notion of diminishing returns to aid.

[6] The diversity of results in itself indicates that findings are being scrutinized. Nonetheless, there is a need for more work.

Box 1. Presentation of the Lensink-White Model

The economy in the model consists of three sectors:

- infinitely lived households that have perfect foresight and maximize a constant elasticity of substitution utility function;
- firms that combine labor, capital, and government services to produce goods with a Cobb-Douglas production function, with the objective of maximizing profits; and
- the government, which receives foreign aid and buys private goods to provide free public goods and services to private producers.

The consumer maximizes $\int_0^\infty e^{\sigma t}\left(\frac{c^{1-\theta}-1}{1-\theta}\right)dt$, (1)

Subject to the budget constraint,

$$\frac{dz_t}{dt} = w_t + r_t z_t - c_t, \tag{2}$$

where c is consumption; σ is the rate of time preference; θ is the inverse of the elasticity of substitution; z is net assets per person (households do not borrow or lend internationally); w is the real wage rate; and r is the rental price of capital.

The optimization leads to the intertemporal Euler condition:

$$\frac{dc}{c} = \frac{r-\sigma}{\theta}. \tag{3}$$

Firms produce with a production function of the form

$$Y = TL^{(1-\alpha)}K^{\alpha}G^{(1-\alpha)}, \tag{4}$$

where $\alpha \prec 1$ is the share of capital in output; Y is output; L is labor force; K is capital stock; G is government purchases; and T is the technology shift parameter, interpreted as a measure of total factor productivity.

Profits of firms, $\prod$, at any point in time equal

$$\prod = TL^{(1-\alpha)}K^{\alpha}G^{(1-\alpha)} - (r+\delta)K - wL. \tag{5}$$

δ is the rate of depreciation of capital. Taking the rental price of capital and the wage rate as given, profit maximization leads to the first-order condition (for capital, considered in the analysis as the only relevant one)

$$\alpha TL^{(1-\alpha)}K^{(\alpha-1)}G^{(1-\alpha)} = r+\delta. \tag{6}$$

All the foreign aid, A, representing a fixed percentage, a, of the recipient country's production is channeled to the economy through the government:

$$G = A = aY. \tag{7}$$

Using the production function, G can be rewritten as

$$G = aTL^{(1-\alpha)}K^{\alpha}G^{(1-\alpha)}$$

$$G = (aT)^{\frac{1}{\alpha}}L^{\frac{1-\alpha}{\alpha}}K.$$

In the model, the growth rate of output, g, is equal to the growth rate of consumption. Therefore, using the intertemporal Euler condition, the first-order condition from the firms' optimization problem and the expression for G yield the following:

$$g = \frac{\alpha TL^{(1-\alpha)}K^{(\alpha-1)}(aT)^{\frac{1-\alpha}{\alpha}}L^{\frac{(1-\alpha)^2}{\alpha}}K^{1-\alpha} - (\delta+\sigma)}{\theta} \tag{8}$$

$$g = \frac{\alpha(aL)^{\frac{1-\alpha}{\alpha}}T^{\frac{1}{\alpha}} - (\delta+\sigma)}{\theta}. \tag{9}$$

The level of technology, T, is specified as

$$T = (1-\beta a)T_0, \tag{10}$$

where β is a coefficient assumed to be smaller than 1 and above 0 and T_0 is the level of technology without aid.
Combining (10) and (9) yields

$$g = \frac{\alpha(aL)^{\frac{1-\alpha}{\alpha}}(1-\beta a)^{\frac{1}{\alpha}}T_0^{\frac{1}{\alpha}} - (\delta+\sigma)}{\theta} \tag{11}$$

$$\frac{dg}{da} = \left(\frac{1-\alpha)}{\alpha} - \frac{\beta}{1-\beta a}\right)\left(\frac{(aL)^{\frac{1-\alpha}{\alpha}}(1-\beta)^{\frac{1}{\alpha}}T_0^{\frac{1}{\alpha}}}{\theta}\right). \tag{12}$$

The sign of $\frac{dg}{da}$ is determined by the first term in brackets on the right-hand side, the second term being positive. Therefore, $\frac{dg}{da} \succ 0$ if $\frac{1-\beta a(2-\alpha)-\alpha}{(1-\beta a)a} \succ 0$. (13)

The denominator of expression (13) being positive, the sign of the numerator determines the sign of the expression and is at the center of the conclusions LW reach.

While the LW model takes an interesting approach for exploring the idea of nonlinearity in the aid-growth relationship, an examination of its structure reveals several weaknesses that affect its quality. This comment criticizes the LW model on three fronts: the specification of technology, the imprecision and very limited usefulness of the model's conclusion, and the failure of the model to mimic the stylized facts of a likely aid-recipient economy in a manner that consistently support the notion of negative returns to aid and its relevance for development policy.

With respect to the first criticism—the specification of technology—the assumption relating aid to the level of technology rushes into the results one would expect to be derived from the model. While this criticism could probably be applied to several models whose conclusions may be built into the assumptions, it is definitely relevant in the case of the LW model on two grounds:

- First, the assumption is extreme. Its formalization in equation (10) indicates unambiguously that the model rules out the possibility that aid contributes to an improvement in productivity, improvement that can come, for instance, from an upgrade in infrastructure and human capital.[7] It suggests, on the contrary, considering that a is aid as a share of GDP according to equation (7), that for any β in the range specified in the model— $\beta \subset (0,1)$— when a country moves from no aid to even 0.01 percent of GDP of aid inflow, a decline in productivity is triggered.

- Second, the assumption appears to go beyond what the authors intend to suggest. In particular, while the authors claim that their model "shows that an aid Laffer curve may exist when (high) aid inflows negatively affect a country's productivity" (p. 49), equation (10) simply suggests that zero is the optimal level of aid as far as productivity is concerned.

The second criticism is that the model's conclusion is imprecise and not very useful. Specifically, LW find that the sign of the impact of an increase in aid on the growth rate is determined by the sign of equation (12)—referred to as the "multiplier"— whose sign is in turn determined by that of equation (13). As the denominator of equation (13) is always positive,[8] the sign of the numerator will determine that of the multiplier. LW conclude that the multiplier is negative for small values of α and positive for high values of α. Considering that $\alpha \prec 1$, as indicated in the model, this conclusion is not valid without further assumptions on both the parameter β and its product with the level of aid a. In their 1999 paper, the authors conclude that the multiplier is positive for "low" values of a and negative otherwise. The conclusion

[7] Mansfield (1992) considers that not all models are good or useful, and that a model may be so oversimplified and distorted that it is utterly useless (p. 19). He also indicates that, while the model builder freely chooses the simplifying assumptions that he/she thinks will set the ground for solving the problem defined, the choice is not random. The assumptions should capture the essential structure of the problem under examination.

[8] $|\beta a| \prec 1$ is implied.

referring to small values of either a or α in a study aimed at shedding light on the threshold for negative returns to aid is not very helpful because the attribute "small" is indefinite.

The final criticism of the LW model is that, when it is calibrated to explore its usefulness for developing countries, results counter the model's conclusion, make its structure internally inconsistent, or clearly indicate that the model weakens the relevance of the very notion of negative returns to aid it intends to illustrate. In the calibration exercise, the parameters are selected using the restrictions imposed by the model and considering estimates of α from the relevant literature. Under the conditions, the calculated multipliers—shown in Appendix Table A1—provide no support for the linkage between α and the threshold for negative returns that LW establish:

- In contrast with LW's conclusion that the multiplier is negative for small values of α, not only is the multiplier positive for values of α close to its infimum—even with levels of aid exceeding 50 percent of GDP—but also, it can be negative for values of α close to its supremum.[9]
- In relation with the previous point, for given values of α and aid levels, a, the smaller α, the larger the multiplier, casting further doubts on the validity of LW's conclusion.

Second, as shown in Appendix Table A2, in the absence of a clear indication of what β is and what determines its size, its relationship with the threshold for negative returns is random. Moreover, this relationship is ineffective with regard to the purpose of illustrating the possible existence of negative returns to aid in the setting of the production structure likely to characterize the economic environment of many developing countries:

- For combinations of values of α, up to a magnitude of 0.3 to 0.4—pertinent for many developing countries—and aid-to-GDP ratios within a range of 5 percent to 35 percent,[10] negative returns are triggered only with values of β outside the range (0,1) specified in the model, suggesting that for such values of α and aid levels, the model rules out the possibility of negative returns to aid. While this seems to corroborate the finding in the empirical part of LW, which places the turning point for negative returns to aid at 50 percent of GDP, it has limitations. On the one hand, when aid reaches 50 percent of GDP, negative returns are triggered only with β in excess of almost 75 percent. On the other hand, when β exceeds 75 percent but lies close to its supremum, threshold levels of aid beyond which marginal returns are negative fall within 50 percent of GDP, as shown in the lower right

[9] The infimum is the greatest lower bound while the supremum is the least upper bound.

[10] Values of α in the range [0.3, 0.4] are pertinent for developing countries in light of findings in the growth literature like for instance in Bosworth, Collins, and Chen (1995) and Sacerdoti, Brunschwig, and Tang (1998). Aid-to-GDP ratios in the 5–35 percent range are pertinent to include in the calibration exercise as they reflect broadly what developing countries received in the 1990s, on an annual average basis.

end of Table A2. These limitations proceed, to a great extent, from the specification of technology. They underscore the need for clarification regarding what determines β.

- For combinations of the same values of α, pertinent for developing countries and values of β close to its infimum, the multiplier remains positive even at aid levels exceeding 400 percent of GDP. Should the threshold for negative returns be some unrealistically high aid levels, there would be very little interest in the notion of negative returns to aid.

III. Concluding Remarks

While the LW model takes an interesting approach for exploring the idea of nonlinearity in the aid-growth relationship, in the context of the possible existence of negative returns to aid after a certain threshold, its structure has several weaknesses with regard to the key features of models. In particular, the specification of the relationship between technology and the level of aid, which is at the center of the model's structure, seems to assume the conclusion in an extreme manner that rules out the possibility of a positive relationship between aid and the level of technology in an aid-recipient economy. Moreover, the connection between the model's assumptions and its conclusion precludes the generation of realistic predictions that can enable the model to fulfill its purpose. Also, a calibration of the results of the model casts doubt on the validity of the model's conclusion and highlights irregularities that weaken the relevance of the very notion of negative returns to aid that the model intends to illustrate.

In light of the proliferation of specifications in empirical studies and the ensuing array of results, most of them likely to contain partial truths, the model would be useful if it could meaningfully formalize the link between one or more factors accounting for the diminishing returns to aid and the threshold beyond which returns become negative. Under the assumption that there are negative returns, the absence of clear guidance on how to determine the threshold should be perceived as a challenge to be met through the design of better theoretical models.

There is a need for well-structured models that would integrate key factors explaining the nonlinearity of the aid-growth nexus so as to possibly shed light on the different results obtained in empirical analyses and guide policymaking. In fairness to Lensink and White, they stress that their model serves only to illustrate one economic mechanism that underlies the so-called aid Laffer curve, rather than being a definitive statement of the impact of aid on the economy. Moreover, weaknesses in their theoretical model are inconsequential to the contribution of their empirical analysis to the literature on negative returns to aid. Nevertheless, the juxtaposition of their theoretical model with empirical analyses that tend to support the model's implications conveys a sense of the appropriateness of the model—an appropriateness that this paper challenges, as demonstrated above. The paper reemphasizes the need for more research, a call made by Lensink and White and many other researchers.

Table A1. Calibration of the Sign of the Impact of Aid on Growth in the LW Model

α	a	β	Multiplier 1/	α	a	β	Multiplier 1/
Solving for the multiplier for aid levels below 10 percent of GDP							
0.01	0.05	0.50	0.940	0.01	0.075	0.05	0.983
0.20	0.05	0.50	0.755	0.20	0.075	0.05	0.793
0.35	0.05	0.50	0.609	0.35	0.075	0.05	0.644
0.40	0.05	0.50	0.560	0.40	0.075	0.05	0.594
0.60	0.05	0.50	0.365	0.60	0.10	0.05	0.393
0.90	0.05	0.50	0.073	0.90	0.10	0.05	0.095
0.01	0.05	0.75	0.915	0.01	0.075	0.75	0.878
0.20	0.05	0.75	0.733	0.20	0.075	0.75	0.699
0.35	0.05	0.75	0.588	0.35	0.075	0.75	0.557
0.40	0.05	0.75	0.540	0.40	0.075	0.75	0.510
0.60	0.05	0.75	0.348	0.60	0.075	0.75	0.321
0.75	0.05	0.75	0.203	0.75	0.075	0.75	0.180
0.01	0.05	0.99	0.891	0.01	0.10	0.99	0.793
0.20	0.05	0.99	0.711	0.20	0.10	0.99	0.622
0.35	0.05	0.99	0.568	0.35	0.10	0.99	0.487
0.40	0.05	0.99	0.521	0.40	0.10	0.99	0.442
0.60	0.05	0.99	0.331	0.60	0.10	0.99	0.261
0.90	0.05	0.99	0.046	0.90	0.10	0.99	-0.009
Solving for the multiplier with aid levels between 10 percent and 100 percent of GDP							
0.01	0.10	0.45	0.900	0.01	0.10	0.80	0.831
0.01	0.20	0.45	0.811	0.01	0.20	0.80	0.672
0.01	0.40	0.45	0.632	0.01	0.40	0.80	0.353
0.01	1.00	0.45	0.095	0.01	0.70	0.80	-0.124
0.25	0.10	0.70	0.628	0.30	0.10	0.20	0.666
0.25	0.20	0.70	0.505	0.30	0.20	0.20	0.632
0.25	0.40	0.70	0.260	0.30	0.40	0.20	0.564
0.25	0.60	0.70	0.015	0.30	0.40	0.20	0.564
0.30	0.10	0.70	0.581	0.35	0.10	0.30	0.601
0.30	0.20	0.70	0.462	0.35	0.20	0.30	0.551
0.30	0.50	0.70	0.105	0.35	0.50	0.30	0.403
0.30	0.55	0.70	0.046	0.35	0.55	0.30	0.378
0.40	0.10	0.75	0.480	0.60	0.10	0.40	0.344
0.40	0.20	0.75	0.360	0.60	0.20	0.40	0.288
0.40	0.50	0.75	0.000	0.60	0.50	0.40	0.120
0.40	0.51	0.75	-0.012	0.60	0.55	0.40	0.092
0.30	0.10	0.40	0.632	0.60	0.10	0.50	0.330
0.30	0.20	0.40	0.564	0.60	0.20	0.50	0.260
0.30	0.40	0.40	0.428	0.60	0.40	0.50	0.120
0.30	0.50	0.40	0.360	0.60	0.50	0.50	0.050
0.30	1.00	0.40	0.020	0.60	0.80	0.50	-0.160

Source: Author's calculations.

1/ The column shows the numerator of expression (13) in Box 1, which determines the sign of the impact of aid on growth—the multiplier. α, a, and β are defined in Box 1.

Table A2. Calibration of Aid Levels and Values of the Parameter β Compatible with a Maximum Multiplier

α	a	β	Multiplier 1/	α	a	β	Multiplier 1/
Solving for β compatible with a maximum multiplier, given α and aid levels, *a*.							
0.30	0.15	2.745	0.000	0.35	0.15	2.626	0.000
0.30	0.20	2.059	0.000	0.35	0.20	1.970	0.000
0.30	0.25	1.647	0.000	0.35	0.25	1.576	0.000
0.30	0.30	1.373	0.000	0.35	0.30	1.313	0.000
0.30	0.35	1.176	0.000	0.35	0.35	1.126	0.000
0.30	0.40	1.029	0.000	0.35	0.40	0.985	0.000
0.30	0.45	0.915	0.000	0.35	0.45	0.875	0.000
0.30	0.50	0.824	0.000	0.35	0.50	0.788	0.000
0.30	0.55	0.749	0.000	0.35	0.55	0.716	0.000
0.30	0.60	0.686	0.000	0.35	0.60	0.833	0.000
0.40	0.35	1.071	0.000	0.35	0.25	1.576	0.000
0.40	0.40	0.938	0.000	0.35	0.30	1.313	0.000
0.40	0.45	0.833	0.000	0.40	0.25	1.500	0.000
0.40	0.50	0.750	0.000	0.40	0.30	1.250	0.000
0.40	0.55	0.682	0.000	0.45	0.50	0.710	0.000
Solving for optimal aid levels given α and β.							
0.30	4.118	0.10	0.000	0.30	2.745	0.150	0.000
0.32	4.048	0.10	0.000	0.32	2.698	0.150	0.000
0.35	3.939	0.10	0.000	0.35	2.626	0.150	0.000
0.40	3.750	0.10	0.000	0.40	2.500	0.150	0.000
0.30	1.647	0.250	0.000	0.30	1.176	0.350	0.000
0.32	1.619	0.250	0.000	0.32	1.156	0.350	0.000
0.35	1.576	0.250	0.000	0.35	1.126	0.350	0.000
0.40	1.500	0.250	0.000	0.40	1.071	0.350	0.000
0.30	0.749	0.550	0.000	0.30	0.549	0.750	0.000
0.32	0.736	0.550	0.000	0.32	0.540	0.750	0.000
0.35	0.716	0.550	0.000	0.35	0.525	0.750	0.000
0.40	0.682	0.550	0.000	0.40	0.500	0.750	0.000
0.30	0.515	0.800	0.000	0.30	0.414	0.995	0.000
0.32	0.506	0.800	0.000	0.32	0.407	0.995	0.000
0.35	0.492	0.800	0.000	0.35	0.396	0.995	0.000
0.40	0.469	0.800	0.000	0.40	0.377	0.995	0.000

Source: Author's calculations.

1/ The column shows the numerator of expression (13) in Box 1, which determines the sign of the impact of aid on growth—the multiplier. α and β are defined in Box 1.

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