Centre for Efficiency and Productivity Analysis

Working Paper Series
No. 08/2004

Title
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Date: November 2004

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Centre for Efficiency and Productivity Analysis (CEPA) Working Paper
School of Economics
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November, 2004

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Abstract

The conclusion that foreign aid will promote economic growth only when allocated towards good policy regimes has been the subject of considerable debate. Aid effectiveness researchers have variously sought to falsify this result or to find other individual conditions of aid effectiveness. However, economic theory suggests that any factor which influences the expected returns to investment may influence the effect of aid on growth even when aid is partly diverted to consumption. To investigate this hypothesis, "all" of the hypothesized conditions of aid effectiveness are individually tested in a cross-country growth specification. From these tests the most significant and robust individual interactions are simultaneously modeled, thereby deriving multiple conditions of aid effectiveness. The paper concludes that aid is more effective in economies experiencing economic shocks or recovering from war, and less effective in countries which are geographically disadvantaged or at war. We also find a previously unidentified condition of aid ineffectiveness: the inflow of foreign direct investment. This finding renews a justified interest in the policy-aid-growth nexus, insofar as domestic policy determines the distribution of aid and FDI flows, which appear to act as substitutes in the growth process.

JEL Classification: F350, O111, O400
Keywords: Foreign Aid. Economic Growth. Macroeconomic Policy. Institutional Quality. War. Geography. Macroeconomic Volatility. Foreign Direct Investment.
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Introduction

Towards the end of the 1990s, amidst a climate of aid fatigue on the part of donors and aid weariness on the part of recipients, a seminal work by Burnside and Dollar (1997, 2000) – *Aid, Policies and Growth* - suggested that foreign aid could still promote economic growth provided it was directed towards "good policy" environments (open economies with low inflation and low budget deficits), a result obtained by virtue of a significant and positive aid*policy interaction term in a cross-country growth regression. Though the finding was warmly received by many influential aid agencies[1], the Burnside and Dollar paper immediately sparked a heated debate in development circles, one which continues until this day and essentially constitutes the so called "Third Generation" of macroeconomic aid effectiveness studies (Hansen and Tarp, 2000).

This Third Generation is comprised of two types of studies, summaries of which are provided in Tables A1 and A2 in our appendix. In the first type (hereafter denoted 3G-1), researchers have directly tested the sensitivity of the Burnside and Dollar's key result (the significance of an aid*policy interaction term) to variations in regressors, instruments, selection of outliers, changes in data, and even the pure updating of data (Dayton-Johnson and Hoddinott, 2001; Hansen and Tarp, 2001; Hudson and Mosley, 2001; Dalgaard, Hansen and Tarp, 2002; Easterly, Levine and Roodman, 2003; Roodman, 2003). This literature has amply demonstrated the sensitivity of the Burnside and Dollar result, but has not positively added to our knowledge of the determinants of aid effectiveness.

In contrast, researchers in the second type of Third Generation study (3G-2) have questioned whether good policy is the only condition of aid effectiveness, postulating that economic and political stability (Chauvet and Guillaumont, 2001; Collier and Dehn, 2001; Chauvet and Guillaumont, 2002), geography (Dalgaard *et al*., 2002) and war (Collier and Hoeffler, 2002) might influence the effect of aid on economic growth. Though this literature has been ripe with positive ideas, each author(s) has typically only tested their new condition against, at most, one other condition of aid effectiveness, Burnside and Dollar's aid*policy interaction term. Thus, as it stands, policy-makers have no means of knowing whether this list of conditions is exhaustive, nor whether they operate in tandem or reflect common causes.

Our main objective here is to engage in a comprehensive Third Generation Type-2 study. Specifically, we postulate that economic theory suggests that the returns to aid will be influenced by *any* factor – economic, political, social or geographic – which affects the returns to investment (section I). To test such a hypothesis we have constructed arguably the largest yearly cross-country panel data set heretofore employed in growth empirics of this type (section II), and separately tested for the significance of over 50 aid interaction terms (Section III) in a Burnside and Dollar type growth model:

$$g_{it} = \beta_0 + y_{i,t-1}\beta_y + i_{i,t}\beta_i + \sum_{k=1}^{K-j} x_{it}^k \beta_x^k + a_{it}\beta_a + a_{it} z_{it}^j \beta_{az} + z_{it}^j \beta_z + \varepsilon_{it} \qquad (1)$$

in which growth in GDP per capita (g) is a function of initial income (y), domestic and foreign investment flows (i), foreign aid receipts (a), a vector of growth determinants (x) including macroeconomic, political, institutional and geographical variables, and an interaction between aid and z, the j^{th} hypothesized condition of aid effectiveness taken out of x. However, in response to the 3G-1 studies, we test the sensitivity of our key findings to a number of methodological variations. Finally, we test for the significance of the J significant conditions from equation (1) in a single model:

$$g_{it} = \beta_0 + y_{i,t-1}\beta_y + i_{i,t}\beta_i + \sum_{k=1}^{K-J} x_{it}^k \beta_{gx}^k + a_{it}\beta_a + a_{it} \sum_{j=1}^{J} z_{it}^j \beta_{az} + \sum_{j=1}^{J} z_{it}^j \beta_z + \varepsilon_{it} \qquad (2)$$

In doing so we derive an empirical estimate of "all" the measurable, robust and systematic conditions of effective aid which are justified by economic theory.

Our results strongly suggest that aid effectiveness is largely determined by three previously identified factors - economic instability, geographical factors, the state of conflict (including post-war effects) – and one factor entirely new to the 3G literature – the level of foreign direct investment flows. Our discussion section (Section IV) primarily focuses on this

new and complex result. In particular, we discuss how our findings warrant greater consideration of private as well as public foreign financing for developing countries, especially the under-researched issue of whether aid substitutes or complements private foreign investment. Section V concludes.

1. Theoretical Model

1.1 *Growth Theory*

Aid flows have typically been justified on the grounds that they augment savings and, therefore, investment. For Burnside and Dollar (2000), aid effectiveness is a function of the productivity of this investment. Foreign aid, however, comes in many different forms and is intended to promote growth in a variety of manners. Arguably a more complete means of capturing the overall effects of aid is to let it enter a consumer's budget. However, the Ramsey (1929)-Cass (1965)-Koopmans (1965) model, in which savings is endogenous, typically shows that aid increases consumption one for one but has no effect on long run capital per worker and, by extension, long-run income (Dalgaard and Hansen, 2001). To amend this rather exaggerated result, Dalgaard and Hansen augment the standard model by letting producers operate in a risky environment in which they receive returns to investment with a probability, *p*, which is a function of consumption per capita, as per (Barro and Sala-i-Martin, 1995). Unlike other models of aid and growth in which aid flows may augment investment only, foreign aid may be effective in this model even when it is diverted to consumption, since higher consumption levels lead to greater social stability and, by extension, higher expected returns to investment (Alesina and Perotti, 1996).

For the purposes of this study, the Dalgaard and Hansen augmentation of the Ramsey model is incomplete in that the probability of receiving returns is *only* a function of consumption (*c*) and policy[2]. Instead, we let the probability of receiving returns (*p*) also be a function of *any* exogenous risk factor, **x**, including policy (Burnside and Dollar, 2000), the likelihood of expropriation or other losses to capital due to civil unrest (Collier and Hoeffler 2002), exogenous shocks (Chauvet and Guillaumont, 2001; Collier and Dehn, 2001), geographical factors (Dalgaard, Hansen *et al.,* 2002), and demographic factors. For simplicity of analysis, we let ***x*** denote variables which are positively correlated with *p*[3]. Formally:

$$p = p(c, \mathbf{x}) \tag{3}$$

Defining such a function allows us to more realistically model expected profits (π), and therefore growth, as a function of a wide variety of economic, social, political and geographical conditions. Expected profits are given by:

$$\pi(K,L) = p(c(t),\mathbf{x})F(K(t),L) - (R(t)+\delta)K(t) - w(t)L \tag{4}$$

where $F(\bullet)$ is a standard output function of capital (K) and labor (L) (which reduces to $f(k)$ in intensive form), R is the interest rate, δ is the depreciation rate, and w is the wage rate. Since p is external to the individual firm, the standard optimization procedure implies that producers employ capital and labor until the expected marginal productivity of each factor equals the rental price and the wage rate (w) respectively:

$$R(t) = p(c(t),\mathbf{x})\frac{\partial F(K(t),L)}{\partial K(t)} - \delta \tag{5}$$

$$w(t) = p(c(t),\mathbf{x})\frac{\partial F(K(t),L)}{\partial L} \tag{6}$$

We now let foreign aid (a) augment household consumption as per Dalgaard and Hansen[4]. Households maximize the discounted utility (where ρ and σ represent the subjective discount rate and time preference respectively) from their consumption, *c(t)*:

$$\max_{c(t)_0^\infty} U(0) = \int_0^\infty \frac{c(t)^{1-\sigma}}{1-\sigma} e^{-\rho t} dt \tag{7}$$

subject to:

$$\dot{k}(t) = R(t)k(t) + w(t) + a - c(t) \text{ and } k(0) \text{ given that } k(t) \geq 0 \text{ for all t} \tag{8}$$

That is, the change in capital per worker (k) is the sum of capital income per worker, wages and aid transfers less consumption. The present value Hamiltonian leads to the usual Keynes-Ramsey rule[5]. Using (5) and (6) and the intensive form of the production function we obtain:

$$\frac{\dot{c}(t)}{c} = \frac{1}{\sigma}\left[p(c(t),\mathbf{x})f'(k(t)) - \delta - \rho\right] \tag{9}$$

While substituting (6) into the budget constraint (8) yields:

$$\dot{k}(t) = p(c(t),\mathbf{x})f(k(t)) + a - c(t) - \delta k(t) \tag{10}$$

Figure 1 shows the dynamics of the augmented Ramsey model.

[insert Figure 1]

The first panel, taken from Dalgaard and Hansen (2001), shows that the key difference in this augmented formulation is that the $\dot{c} = 0$ curve slopes upwards and is only asymptotically vertical as p approaches unity. This is due to the positive effect of consumption on the expected return to capital.

In panel 2 an unanticipated permanent increase in aid results in the $dk/dt = 0$ curve shifting upwards. However, this marginal effect is determined by the change in p produced by a change in aid *conditional upon risk factors*, $\mathbf{x}$. Geometrically, these factors have an effect on the aid-growth transmission mechanism insofar as they determine the slope of the $\dot{c} = 0$ curve. Using the chain rule, this slope is given by:

$$\frac{\partial c}{\partial k} = -p(\tau, c(t),\mathbf{x})\frac{\partial p}{\partial c}\frac{f''(k(t))}{f'(k(t))} > 0 \tag{11}$$

Now suppose that a stability-related factor, x, increases. By definition, p increases, but what happens to $\frac{\partial p}{\partial c}$? Suppose $\frac{\partial p^2}{\partial c \partial x} > 0$. That is, the responsiveness of p to aid-induced changes in consumption per capita is increased by x (i.e. aid and x are complements in producing higher returns to investment). Equation (11) would then imply that any condition, x, which increases (decreases) p will steepen the $\dot{c} = 0$ curve and shift it right, such that the marginal effect of aid on growth is reduced (increased). As an example, take the case of a transition from an autocratic to a democratic government. One would hopefully expect that aid would be distributed in a less discriminatory manner in a democratic society. The p function in the democratic society is therefore more responsive to changes in consumption (as shown in panel 2 by the less vertical $dc^D/dt = 0$ curve), relative to the autocratic society (the $dc^A/dt = 0$ curve). An equal increase in foreign aid produces greater capital accumulation in the democratic country (that is, $k_2^D - k_1^D > k_2^A - k_1^A$).

In addition to the central implications of the model described above, several more general implications still hold form the Dalgaard and Hansen (2001) model. First, foreign aid has a long-run effect on growth provided that it is directed towards risky environments (p<1), which implies, among other things, that aid will tend to be more effective in poorer (low consumption) countries (Gomanee *et al.,* 2003). And second, the upward sloping $\dot{c} = 0$ curve generates generic diminishing marginal returns to aid as p approaches unity (Hadjimichael, 1995; Durbarry *et al.,* 1998; Hansen and Tarp, 2001; Lensink and White, 2001).

The key innovation of this model, however, is that it encompasses *all* previous 3G-2 studies by modeling a generic aid-growth transmission mechanism. This mechanism leads to broad but empirically testable hypotheses about the influences of country-specific conditions.

2.1 *Structural Equations*

We now examine the implications of the Ramsey model for the modeling of economic growth. Based on the representative producer's profit equation (4), we model expected output as a constant returns to scale Cobb-Douglas formulation which now includes the level of technology, A, which was previously excluded for analytical simplification.:

$$Y_t = p_t A_t K_t^{\alpha} L_t^{1-\alpha} \quad (12)$$

The intuition behind this model is that two countries with the same levels of factor inputs and technology could still, in a given year, have different levels of output if they have different levels of country-wide risk.[6] This model therefore explains a well-known stylized fact: the existence of the high-return but low-investment developing economy (Lucas 1990).

In intensive notation this leads to (13)[7]:

$$y_t = p_t A_t k_t^{\alpha}, \text{ where } y_t = {Y_t}/{L_t} \text{ and } k_t = {K_t}/{L_t} \quad (13)$$

Log differentiating (13) provides us with a growth (g) equation of the form:

$$g_t = {\Delta p_t}/{p_t} + {\Delta A_t}/{A_t} + \alpha.{\Delta k_t}/{k_t} \quad (14)$$

Neither p nor A is directly measurable, while data on capital per worker is not available for most developing countries. We therefore proxy for the growth in the capital stock by considering the following identity, where we ignore depreciation rates[8]:

$$\Delta k_t = {K_t}/{L_t} - {K_{t-1}}/{L_{t-1}} = {I_t}/{\Delta L_t} \quad (15)$$

where I represents total domestic and foreign investment flows. However, because we do not any very accurate measures of the labor force at time t, we simply use total gross domestic and foreign direct investment flows in proportion to GDP[9].

Accounting for growth in A and p is more imprecise, particularly as they may be a function of at least some of the same factors[10]. We have previously expressed p as a function of consumption per capita, which is partly financed by aid, and a host of exogenous factors, $\boldsymbol{x}$. Since we do not have direct measures of consumption or income taxes, we employ foreign aid as an important determinant of changes in consumption per capita in conjunction with a host of indirect indicators of risk (e.g. distortionary policies, domestic conflict, external trade and geographical factors), the inclusion of which is guided by informal theory and previous growth research (See section III). These factors also account for growth in technology, A, while a lagged output per capita term (y_{t-1}) captures the distance from the steady state output level, and thus the well documented conditional convergence phenomenon.

Thus far we have implicitly described a linear model. However, the augmented Ramsey model suggests that: aid-augmented consumption will increase p conditional upon the relationship (complementarity or substitutability) between consumption and other factors which affect the returns to investment, $\boldsymbol{x}$; there are diminishing marginal returns to aid; and that aid is more effective in riskier countries. We test these with interaction terms between aid and z, where z may be either: an exogenous factor taken from $\boldsymbol{x}$, foreign aid (such that we model aid-squared to test diminishing marginal returns), or one of two measures of the general risk level of the economy, income per capita and foreign direct investment.[11] A full list of our exogenous variables and their expected relationship to aid effectiveness is presented in Table A4 in our appendix.

Bearing the multitude of potential conditions in mind, our growth model takes the form:

$$g_{it} = \beta_{g0} + y_{i,t-1}\beta_{gy} + i_{i,t}\beta_{gf} + a_{it}\beta_{ga} + a_{it}z'_{it}\beta_{gaz} + x_{it}^{g}\beta_{gx} + \varepsilon_{it}^{g} \quad (16)$$

Where ε_{it}^{g} is an error term capturing both measurement error and unaccounted for shocks, but which satisfy the normal OLS assumptions.

Although we do employ (16), it is important to note that two important variables in this model may suffer from simultaneity bias: gross domestic investment and aid flows[12].

The potential endogeneity of investment flows, and the difficulty in finding suitable instruments (Mankiw *et al.,* 1992), has provided a justification for many aid studies, including Burnside and Dollar's, to exclude investment from the growth equation. A second reason is that the underlying theory of these studies generally suggests that aid is only effective insofar as it augments investment, which we may be a somewhat restrictive assumption[13]. However, in excluding investment or savings, a modeler runs the risk of inducing omitted variables bias. Given that there is no easy way to address the tradeoff between these simultaneity and

omitted variable biases, we run regressions of equation (16) with and without gross domestic investment flows.

The other potentially endogenous variable - foreign aid - cannot be excluded from (16), though the availability of valid instruments for aid flows renders the issue far less problematic. In particular, we let aid be determined by various measures of the benevolence of donors (captured by indicators of underdevelopment) as well as their strategic interests (captured by geopolitical indicators). However, since aid is entered non-linearly into the growth equation, we also employ these instruments in a non-linear fashion as per Burnside and Dollar (2000)[14]. The preponderance of such instruments therefore renders our equations over-identified and therefore more consistent. We also increase consistency by using continental dummy variables to derive our aid projections.

In summary, our structural model takes the form:

$$g_{it} = \beta_{g0} + y_{i,t-1}\beta_{gy} + i_{i,t}\beta_{gf} + a_{it}\beta_{ga} + a_{it}z'_{it}\beta_{gaz} + x^{g}_{it}\beta_{gx} + \varepsilon^{g}_{it} \quad (16)$$

$$a_{it} = \beta_{a0} + y_{i,t-1}\beta_{ay} + g_{it}\beta_{ag} + x^{a}_{it}\beta_{ax} + \varepsilon^{a}_{it} \quad (17)$$

where $x^{g} \neq x^{a}$, such that each equation is identified.

Lastly, multicollinearity between the various exogenous components of $\boldsymbol{x}$ suggests that some of the conclusions drawn from testing rotations of (16) could be spurious. Our final regression procedure therefore involves simultaneously testing the J significant conditions from equation (16) in a single model:

$$g_{it} = \beta_0 + y_{i,t-1}\beta_y + i_{i,t}\beta_i + \sum_{k=1}^{K-J} x^{k}_{it}\beta^{k}_{gx} + a_{it}\beta_a + a_{it}\sum_{j=1}^{J} z^{j}_{it}\beta_{az} + \sum_{j=1}^{J} z^{j}_{it}\beta_z + \varepsilon_{it} \quad (16)'$$

2. Data and Methodology

The data requirements of this study were demanding indeed. Contrary to previous 3G studies, we sought to test *any* potential condition of aid's effect on economic growth. The recent empirical growth literature suggests a vast array of factors may fall into this category. Since our own analysis seeks to use panel data, as per previous 3G studies, we were required to collect what is probably the largest yearly data set ever employed in cross-country growth regressions.

Additional challenges were posed on the methodological front. A unique feature of the Third Generation Type-1 studies is the sharp disagreement over measurement and methodological issues such as the preferred measure of foreign aid, the construction of indices, model specification, and the treatment of outliers.

2.1 *The Data Set*

Since Burnside and Dollar (1997) the majority of Third Generation studies have employed four year averages rather than yearly data. The key exceptions are Chauvet and Guillamont (2001) who effectively test volatility measures in twelve year periods, and Hudson and Mosley, who employ yearly data. We employ four year averages in order to reduce the effects of measurement error, and because we expect that four year averages are sufficiently long to capture most volatility measures, but short enough so as not to completely dampen the medium run variation in our indicators.[15]

Data limitations restrict the dataset's final dimensions to 56 countries and 76 variables for the years 1970 to 2001. There are therefore eight four-year time periods, two more than were available to Burnside and Dollar. A full list of the countries included in our sample can be found in Appendix Table A3 while our variable codes, their definitions, sources and hypothesized relationship to aid effectiveness is provided in Table A4.

Briefly, the variables in this study can be stratified into four categories: (1) macroeconomic policy measures[16]; (2) political and institutional data, (3) indicators of war and the propensity for conflict; and (4) geographic and demographic data. Suffice it to say, the great diversity and sheer quantity of variables reflects both the range of conditional effectiveness arguments put forth in Third Generation Type-2 studies, as well as the rapid advances in growth measurement and theory.

Lastly, we employ Overseas Development Assistance over GDP (ODA) as our preferred foreign aid measure. The Burnside and Dollar study departed from previous studies by choosing to employ Effective Development Assistance (EDA) data constructed by researchers at The World Bank (Chang *et al.,* 1998). There are several controversies in both the original construction of the EDA data and in Burnside and Dollar's use of the measure[17] (Dalgaard and Hansen, 2001; Robrecht and Cassimon, 2001), but we need not resolve these controversies in order to reject the data for the simple reason that the EDA measure is not available beyond 1995 and before 1975.

We also considered an alternative measure of aid which includes only those components of ODA directly intended to promote economic growth, including sectoral aid and program assistance, excluding items such as humanitarian and emergency aid. This sort of measure was constructed and considered by Headey (2003) and more recently by Clemens, Radelet and Bhavani (2003). However, the disaggregates required are only available in the form of commitments, not disbursements. We were unwilling to take the Clemens *et al*. step of filling in pre-1990 data. Furthermore, employing the more standard ODA measure renders our results more comparable to the majority of past research.

2.2 *A Comment on the Construction of Indices*

The construction of indices in growth regressions is often necessitated by the simultaneous objectives of capturing the effects of multiple variables whilst conserving degrees of freedom. Nevertheless, Burnside and Dollar (and following in their footsteps, Chauvet and Guillaumont, 2001) constructed their "good policy index" in a highly controversial two-step procedure. They first included their three good policy indicators – the inflation rate, the budget surplus and the Sachs-Warner openness index - in a growth regression which excludes foreign aid. They then took the beta coefficients of these three variables and used them as weights in a good policy index, after which they re-entered the policy index into a similar growth regression, but one which included aid as well as aid interacted with policy.

Other authors have criticized this procedure on several grounds, particularly Lensink and White (2000)[18]. Potentially the most serious problem has thus far been overlooked, however. By using the coefficients from the first growth regression, the policy index is essentially *pre-fitted* to growth when it is re-entered into the second regression. It is therefore possible that other variables in the second regression, particularly a newly entered variable such as foreign aid, are less likely to explain growth if they are at all correlated with the good policy index. Burnside and Dollar, then, may have artificially reduced the likelihood that aid entered separately will explain growth, but increased the chance that aid interacted with a pre-fitted policy index will be significant. On this basis the conclusion that aid *only* works in a sound policy environment is potentially unsurprising.

The lesson here seems to be that growth empiricists should be extremely wary of employing indices derived in this manner. Furthermore, we suggest that failure to test interactions with the individual components of an index is also unrewarding, particularly if components vary in their causal relevance or statistical reliability[19]. In light of these concerns, we decided to form our own indices with arbitrary equal weights (though we do include both Burnside and Dollar's and Chauvet and Guillaumont's indices) and separately test the individual components of all our indices.

2.3 *Econometric Methodology*

Our econometric methodology consists of four steps. (1) We first construct a base specification with a full list of growth determinants using OLS. We select a number of popular indicators of growth from the literature (including the aid literature), and then reduce the model by removing insignificant variables. (2) In step 2 we add foreign aid and aid interactions to the base model and run both OLS and 2SLS regressions on all our interactions. These regressors are also applied to a low income sample. (3) Our next step is to add five additional sensitivity tests to those interactions which survive step (2), in order to address the methodological concerns raised in the 3G-2 literature.[20] (4) Our final step is to simultaneously include all significant interactions in one regression.

Our five sensitivity tests are as follows.

First, in response to the problems associated with outliers and influential points in Third Generation Type-1 studies (see Dalgaard and Hansen, 2001, for example) we employ the well known Least Absolute Error (LAE) regressor[21]. The LAE estimator seeks to find the set of coefficients that minimizes the sum of absolute errors. Of course, not all outliers are necessarily anomalous or bias-inducing. Rather this test suggests that a more detailed analysis is warranted somewhere down the line.

Second, we alter our base model to exclude domestic investment (GDI) on the grounds that it may be endogenous, which renders our specification closer to that of Burnside and Dollar and some other aid researchers.

Third, we add aid-squared to the model, partly because there is a significant body of research which suggests that the existence of diminishing marginal returns to aid is both theoretically and empirically justified.,[22] but also because aid interaction terms and squared aid terms could be collinear or causally related.

Fourth, we employ a simple fixed effects specification to take advantage of the panel data set. Though we prefer to use specific indicators in order to identify some of the exact country-specific causes of growth, we nevertheless add continental dummies to the model as an additional specification test.

Fifth and finally, we employ an entirely novel specification test in which we use a principal components reduction of all the exogenous factors in our general model. This procedure, which is analogous to the rotational robustness tests of Sala-i-Martin (1997) and Levine and David Renelt (1992), applies a robustness test to the non-reduced factors (including the aid and aid-interaction terms), which could be correlated with any one of the variables within the components. The elegance of this method is that the components themselves remain orthogonal to each other such that multicollinearity between the components does not weaken the specification test. Details of the procedure are available upon request.

3. Results

3.1 *Base Regressions*

Our base model contains explanatory variables which are required to be included on strong theoretical grounds, such as investment flows and the convergence term, in addition to time dummies which are use to capture short run world business cycle effects (not reported). As to which variables should capture the technological and risk-related factors, we let the data decide subject to the general constraint that all our variables have been previously tested in the aid or growth literatures. We adopt this method, rather than employ the Burnside and Dollar specification, because four of the twelve explanatory variables in their base regression were regularly insignificant, while it also did not include variables from the more recent aid and growth literatures, such as geographical factors, war variables[23], and the effects of economic shocks. Our general model therefore incorporates not only the usual suspects from the empirical growth literature, but also variables employed by Chauvet and Guillaumont (2001), Dalgaard *et al.,* (2002), and Collier and Hoeffler (2002), as well as aid flows.

In fact, when we move to a more parsimonious model (Table 1, Regression 1), we find that many of the variables from the Burnside and Dollar base regression disappear[24], while several "conditions of aid effectiveness" from the aforementioned studies are generally highly

significant. These are: the proportion of land in the tropics (TROPLAND), the change in war intensity (ΔWAR, a measure similar to Collier and Hoeffler's), and the Chauvet and Guillaumont (2001) economic stability index (STABILITY). Furthermore, two of Burnside and Dollar's policy variables, LCPI and OPEN are significant, as is a good governance measure (GOV) from Knack and Keefer (1995), and our two investment measures, gross domestic and foreign direct investment (GDI and FDI). Similar results hold for our low income sample (Regression 2). Regressions 3 and 4 add aid (ODA) to the full and low income models, even though aid was included in our general specification and dropped in the reduction process. We also test for the endogeneity of aid using a Hausman (1978) test: aid is apparently not endogenous in either sample. Likewise we reject tests for overidentifying restrictions for a 2SLS version of our base model (not reported), which did not yield markedly different results from regressions 1 to 4.

On the basis of these base regressions, it would appear that, unconditionally, foreign aid is ineffective in promoting economic growth. However, we now come to the crux of our analysis, the empirical imposition of conditions of aid effectiveness.

[insert Table 1 - Base Regressions]

3.2 *Rotational Interactions*

We now turn to the crux of our analysis, the systematic testing of "all" potential conditions of aid effectiveness. Tables A5 to A8 in our appendix present the results of running 50 such tests with variations in sample size (full or low income) and regressors (OLS or 2SLS), in which we rotate the conditions of aid's effect on growth, as per equation (1).

$$g_{it} = \beta_0 + y_{i,t-1}\beta_y + \sum_{k=1}^{K-j} x_{it}^k \beta_{gx}^k + a_{it}\beta_a + a_{it} z_{it}^j \beta_{az} + z_{it}^j \beta_z + \varepsilon_{it} \quad (1)$$

In practice, however, we wish to avoid biasing our tests by including in the vector, x, any variable which is likely to be highly correlated with z^j. Thus, when testing other measures of geographical disadvantage, economic instability, governance or conflict, we would remove TROPLAND, STABILITY, GOV and ΔWAR respectively.

Due to space constraints, Tables A5 to A8 present beta-coefficients and heteroskedastic consistent t-values only for three variables from each regression: foreign aid (ODA), an interaction term between aid and the j^{th} hypothesized condition of aid effectiveness ($a.z^j$), and the j^{th} condition itself (z^j)[25]. These tables present results for all our major variations - OLS and 2SLS for the full sample and the low income sample. We also include a column which denotes the expected sign of each term. We do not report R-squared values, largely because these are quite uninformative, increasing slightly when interactions are significant and otherwise remaining at around 0.41. Finally, since we are running an unbalanced panel, readers should be aware that sample sizes for each model are often not equal. Full results are available on request.

Though we leave the reader to peruse Tables A5 to A8 in our appendix at leisure, we offer Table 2 as a summary of these rotational tests.

[insert Table 2 - Summary of Rotational Interactions Tests]

The first two columns of Table 3 shows that of the 50 interactions tested, at least 28 of these were significant in one or more of the four variations. On the one hand, an optimistic aid researcher might be encouraged by this result. For a skeptic, however, this finding would tend to validate Roodman's (2003) conclusion that statistical noise tends to drown out the signals about aid effectiveness, or alternatively, drown *in* spurious signals. We attempt to reduce this noise by applying a survival of the fittest type approach. We first use a simple empirical robustness check: column 3 shows the number of interactions which are significant on more than one occasion. We are left with 17 slightly more robust interactions[26].

This first elimination criterion removes several interesting results, however, including: the positive interaction between aid and a well-known proxy for the level of financial development, M2 money and quasi-money (Levine, 1997); negative interaction terms which include ethno-linguistic fractionalization index (ETHNIC, a measure of the propensity for conflict) and war intensity (WAR); and a positive interaction with the Sub-Saharan Africa dummy variable (SSA).

Secondly, we apply a theoretical robustness check by asking whether the significant interactions are all of the expected sign. This robustness check relies on the soundness of our *a priori* expectations and our decision to ignore those results for which there are sign reversals. Column 4 indicates that there are 5 interactions which pass this criterion. However, a host of interesting though somewhat inexplicable results are excluded by this criterion. First, the Burnside and Dollar variables (though not their index) are rejected as all of them show indications of adversely influencing aid effectiveness, as per Hudson and Mosley (2002) and Chauvet and Guillaumont (2001), while two "bad policy" indicators, the black market premium on the exchange rate (BLACK) and arms expenditure over GDP (ARMS), would appear to increase aid effectiveness despite our hypothesis that these variables might capture the propensity for adverse Dutch Disease effects and fungibility,

respectively[27]. Second, a number of other measures of growth adversity - geographical, demographical and political – also appear to increase aid effectiveness. These include variable such as age dependency ratios, illiteracy rates, the level of democracy and the Knack and Keefer measure of governance (GOV).

Our final list of empirically and theoretically robust results is of particular interest. Table 4 presents the relevant terms from five consistently significant interactions which fulfilled our *a priori* hypotheses.

[Insert Table 3 - Consistently significant interactions with expected signs]

These results confirm *a priori* expectations that:

1. Foreign aid is less effective in high FDI countries, because aid and private foreign investment tend to act as substitutes in the growth process (Table A5, Appendix).
2. Aid is less effective in tropical countries (TROPLAND), as per Dalgaard *et al.,* (2002). This result is perhaps weakened by the lack of supporting evidence from other indicators of geographical adversity, including a similar measure of the proportion of the population living in the tropics (TROPPOP). Furthermore, the precise mechanism by which geography inhibits aid effectiveness (transport costs, lower human capital, lower agricultural productivity) is still not known (see Table A8).
3. Aid is less effective in economies with stable agricultural production (AGRICSTAB) or positive trends in their terms of trade (TOTTREND) as per Chauvet and Guillaumont (2001), though the former appears to be the more robust of the two (Table A7). The converse conclusion would appear to be that aid is more particularly effective when it serves as insurance against production or price shocks.
4. Aid is both less effective in countries where there has been an increase in hostilities ($\Delta WAR>0$) and more effective in countries coming out of war ($\Delta WAR<0$). Though this result is similar to Collier and Hoeffler (2002), their indicators are not significant in our samples. This result only holds for 2SLS regressions (Table A6).
5. Aid appears to be generally less effective in Latin America and the Caribbean (LATAM; Table A8, Appendix), though the generality of this result prevents us drawing more specific conclusions about the mechanism of this ineffectiveness.[28]

These results lend credence to the work of several prominent 3G-2 studies, with the exception of the negative interaction terms for both FDI and the LATAM dummy variable. For the remainder of the analysis, however, we drop the LATAM result on the grounds that it is a highly general condition of aid effectiveness, which, even if true, tells us very little about the causes of aid ineffectiveness in this region. We therefore leave this result aside for future research

3.3 *Sensitivity Analysis*

We have already highlighted the widely expressed concern over the robustness of previous Third Generation results. We now subject our own results to five types of sensitivity analyses as outlined in Section II, all of which are carried out with OLS regressions: a principal components (PC) reduction of our base specification, a Least Absolute Error (LAE) regression of the six models, the removal of GDI, the inclusion of aid-squared, and a fixed effects (FE) (continental dummy variable) specification.

Table 4 presents a summary of our results for the full sample only. Readers should note that the PC test, which is incompatible with a 2SLS regressor, was not applied to the ΔWAR variable as it was only significant in 2SLS regressions.[29]

Our results are generally quite insensitive to the aforementioned variations. In fact, only the ODA*AGRICSTAB and the ODA*ΔWAR interactions lose significance under the LEA and fixed effects specifications, respectively[30]. However, the AGRICSTAB variable is purposely designed to capture the effects of outliers (i.e. shocks), such that the LEA test is not very meaningful for this interaction, while continental variations in ΔWAR no doubt induce

multicollinearity in the continental fixed effects regressions. We also find that aid-squared is significant and negative only in the ΔWAR regression, perhaps suggesting that there are diminishing marginal returns to aid except when they are allocated to post-war countries in which the absorptive capacity of the economy is unusually high.

[Insert Table 4 - Sensitivity Tests of Significant Findings]

3.4 Simultaneous Conditions of Aid Effectiveness

We now turn to the modeling of the four simultaneous conditions of aid effectiveness discussed above (see equation (2)) using both OLS and 2SLS. Regressions 1, 2 and 3 in Table 5 show our OLS results. Regression 1 indicates that ODA*ΔWAR is now highly significant (which was not the case with the individual interaction of ΔWAR), whereas ODA*FDI is now insignificant.

We believe there are two explanations of this result. The first is multicollinearity between these interactions. If a cessation of conflict results in an increase in both FDI and aid flows then the post-war effectiveness of aid flows may not be lessened by the presence of FDI flows because the absorptive capacity of the post-war economy is abnormally and sufficiently high (Collier and Hoeffler, 2002) to accommodate both flows. Mozambique in the 1990s is an example of just such an economy. Secondly, the literature on the causes of civil war (Murdoch and Sandler 2001) suggests that the incidence of civil war is significantly higher in tropical countries, where, *ceteris paribus*, aid is generally less effective. After controlling for aid's *in*effectiveness in tropical countries, it may be unsurprising that the ODA*ΔWAR interaction is strengthened in the OLS regressions.

Regressions 2 and 3 experiment with dropping both ODA*FDI and ODA*ΔWAR, respectively. Without the presence of the other, each interaction is significant. Regression 4, 5 and 6 repeat this experiment with 2SLS. In these regressions ODA*FDI is consistently insignificant. It would appear, then, that the ODA*FDI result is sensitive to both the 2SLS regressor and the presence of the ODA*ΔWAR interaction.

[insert Table 5: Simultaneous Conditions of Aid Effectiveness]

3.5 *Marginal Effects of Aid on Growth*

Finally, we use the results from Table 5 to analyze the conditional marginal effects of aid on growth, though we first provide something of a disclaimer: we firmly believe that cross-country regressions are an insufficient basis by which to make accurate quantitative inferences regarding aid effectiveness[31]. Furthermore, as the next section makes clear, assumptions regarding the causal relationships between aid and conditions of aid effectiveness are numerous, controversial, and for the moment at least, largely untested. Nevertheless, if one is willing to make a sufficiently large leap of faith, the findings above support a relatively pessimistic view of aid effectiveness, except in extenuating circumstances.

Let us consider the derivative of growth with respect to aid from regressions 2 and 3 from Table 5, which exclude ΔWAR and FDI interactions respectively:

$$\partial g / \partial a = 0.10 - 0.16 * TROPLAND - 0.005 * AGRICSTAB - 0.05 * \Delta WAR \quad (18)$$

$$\partial g / \partial a = 0.11 - 0.12 * TROPLAND - 0.004 * AGRICSTAB - 0.01 * FDI \quad (19)$$

Table 6 considers alternative evaluations of the marginal effects of aid on growth based on alternative assumptions and employing either (18) or (19), with the variation that we have standardized our agricultural stability measure.

[Insert Table 6 - The marginal effects of aid on growth under various assumptions.]

In the first scenario we evaluate an "average country" - all conditions are set to their means (Scenario 1, Table 6). Foreign aid is, in this "average country", completely ineffective, with perhaps even mildly adverse effects on growth. Scenario 2 considers a hypothetical African model: a country which receives no FDI, is fully tropical and has an above average volatility. Again, the marginal effect on growth is virtually zero.

Next, we exclude FDI from the model to analyze the effects of conflict. Scenario 4 looks at the African model above under the onset of war (Scenario 3, Table 6). Our results suggest that aid will tend to reduce growth in these countries. In the post-war environment, however, an increase in aid of 1 percent will tend to increase growth by 0.139 percentage points (Scenario 4, Table 6). Finally, we consider a non-tropical country in a post-war environment (Scenario 5, Table 6). This is an almost ideal case in which aid is supra-effective, such that a 1 percent increase in aid over GDP will increase growth by 0.292 percentage points. This latter value falls roughly in the middle of Burnside and Dollar's highest (0.47) and lowest estimates (0.11) of the impact of aid.

4. Discussion

4.1 *Inferences*

Despite running close to 900 regressions, our study is less than fully comprehensive. In particular, we have *not* tested variations in alternative aid measures; a wider range of non-linear terms (such as additional quadratic terms for aid and interacted variables); an overtly dynamic model; and donor-specific factors[32]. With those general considerations in mind, it is pertinent to discuss what sort of reasonable inferences can be made regarding our determination of the significant conditions of aid effectiveness.

Aid in the Tropics

TROPLAND appears to be one of the more robust conditions of aid effectiveness, confirming the findings of Dalgaard *et al.,* (2004) and Roodman (2004). Dalgaard *et al.,* argue that this result undermines Collier and Dollar's (2002) justification for a selective approach to aid allocation based on policy performance: if aid ineffectiveness is due to geographical factors rather than poor policy, then donors can hardly punish countries with climate related hindrances to their development. There are two problems with drawing this conclusion, however.

First, our study, unlike those of Dalgaard et al and Roodman, does in fact question the robustness of the tropics-aid-growth relationship. This is because the key variable of interest, TROPLAND, was only one of eight comparable measures of geographical disadvantage, none of which produced even remotely significant results. Of course, it may be that TROPLAND acts the most preferred natural index of aid ineffectiveness - one which captures the effects of higher health costs, lower labor productivity, lower soil productivity and higher transport costs (Dalgaard et al, 2002, Gallup et al., 1999). But a second possibility is that the TROPLAND variable is not capturing the productivity of aid, but only its intention. Numerous authors, for example, have noted that a large proportion of foreign aid (humanitarian aid, emergency aid, and aid for long run development in health and education, for example) is not intended to increase growth. Unsurprisingly, this sort of aid is heavily directed towards the tropical countries – countries with high incidences of disease, low levels of education, volatile climates and lower income per capita (Gallup et al, 1998). Clemens et al (2004), for example, use an aid measure which removes these non-growth related forms of aid and find that aid effects growth unconditional on the tropical effect. This certainly questions the validity of any policy conclusions that can drawn with respect to an aid-tropics-growth relationship.

Aid and War

Turning to our second finding, that war decreases aid effectiveness while its cessation increases aid's effect on growth, it is worth noting that our only consistently significant measure of conflict (ΔWAR) differs significantly from the war and post-war dummy variables used by Collier and Hoeffler (2002) which we also tested in modified form (see tables A4 and

A6). Our variable has the advantage that it simultaneously captures the adverse effects of the onset of war ($\Delta WAR>0$), and the beneficial effects of war's cessation ($\Delta WAR<0$). Ideally, however, we would prefer more precise measures of total battle deaths (which could be scaled according to the population size) as well as the geographical coverage of the war[33]. These measures would hopefully more accurately gauge the "physical" effect of war on economic activity. Furthermore, our analysis was unable to establish differences between civil and external wars (see table A4).

Aid and Economic Instability

Roodman (2004) discusses some of the strengths and weaknesses of the various measures of economic volatility employed by Collier and Dehn (2001) and Chauvet and Guillaumont (2001). Our own study, however, has uncovered that agricultural volatility appears to be driving the Chauvet and Guillaumont result, though we have also found evidence that aid has been effective in counterbalancing the effects of unfavorable long-run terms of trade movements[34]. More generally, the observed relationship between aid and the agricultural sector appears to justify closer inspection.

Aid and FDI Flows

The literature on the relationship between public and private financial flows to developing countries is small indeed. A handful of analyses have looked at whether aid flows can or should act as a catalyst for foreign investment (Bauer 1976; Clemens 2002; Dapice 2002), while the converse FDI-effectiveness literature has, to our knowledge, not yet considered the role of aid flows to FDI recipients. If aid flows do affect FDI flows or vice-versa, or if FDI flows are endogenous to growth (a likely possibility), then at the very least our structural equations for growth (16) and aid flows (17) need to be augmented by an FDI equation.

Setting aside these possibilities for the moment, one can identify three types of relationships between aid, FDI and growth which are consistent with the negative ODA*FDI interaction term: our *a priori* position, that FDI might reduce aid effectiveness; a converse conclusion, that aid reduces FDI effectiveness (analogous to White's (2001) critique of the Burnside and Dollar aid-policy interaction); or, nesting these two, aid and FDI flows are broadly symmetric substitutes in that the presence of one systematically reduces the effectiveness of the other.

Post priori, which interpretation is the most appealing? The common characteristic of aid and FDI flows, and therefore their superficial degree of substitutability, is that they both may augment the capital stock. They differ significantly, however, in their response to market failures. Neoclassical growth theory, which typically abstracts from market failures, suggests that FDI should flow from rich countries to poor countries because of the higher rate of return in the latter. The paradox famously raised by Lucas (1990) is 'Why is this not the case?' Lucas considers several possibilities - human capital differentials and political risk – and one could add a third, limited information. In many ways, though, these are interconnected explanations, all of which probably play some role in the high return-low investment paradox. Let us include them all under the general heading, risk.

To analyze the relationship between aid, FDI and risk, imagine two developing countries, both with savings constraints, and both with high pre-risk returns to investment. Let us assume that foreign investment and aid are perfect substitutes in terms of the provision of capital, and let one country be low risk (that is, a high probability of receiving returns country), and the second high risk.

In the first economy there are no significant market or government failures which affect investment risk, so private investors allocate funds to the highest expected return investments. Thus, unless aid crowds out private investment, which presumably affects the level of FDI more so than its average rate of return, aid can only be allocated to relatively low return projects or consumption (Bauer, 1974)[35]; aid is therefore ineffective in this low risk-high FDI country.

In the high risk country, foreign private investment is low because expected returns are low. Expected returns to foreign aid are also low *unless* aid donors face a different level of

risk than private foreign investors do. In this sense, aid donors may in fact have a comparative advantage in high risk countries due to greater access to information (e.g. previous research and data collection), higher levels of human capital (e.g. technical assistance), their ability to target funds towards governance strengthening and conflict resolution, and their somewhat more debatable capacity to affect recipient government policies (i.e. conditionalities). Furthermore, donors can direct funds towards projects in which part of the risk faced by private investors concerns their ability to extract all the returns (that is, projects with large positive externalities). An important auxiliary conclusion is that if donors can reduce risks in the short run, they may also be able to affect long run risk and thereby catalyze private investment flows, which in fact is one of the original rationales for foreign aid (Clemens, 2002). We leave this important issue to further research.

4.2 *Aid Allocation*

Previous aid effectiveness research has been used to justify a selectivity approach which argues that aid should be reallocated towards countries in which the conditions of aid effectiveness are in place (World Bank, 1998; Collier and Dollar, 2002). One significant criticism of this approach – indeed, the very rationale of 3G-2 research - was that all the conditions of aid effectiveness were not identified by Burnside and Dollar and Collier and Dollar. On the basis of previous 3G-2 work, this study has uncovered three previously identified conditions of aid effectiveness, and augmented this list with an important new condition, the level of FDI flows. It could therefore be argued that our results are seemingly amenable to the formation of an improved selectivity decision rule. Nonetheless, we do not believe this is the case, for reasons outlined below.

Perhaps the greatest difficulty in implementing a four-pronged selectivity rule is that, unlike 'good policy', our four conditions of aid effectiveness cannot neatly be categorized as endogenous in the sense that they are within the recipient governments' control. Our conditions range from being almost strictly exogenous (geography), to semi-endogenous (volatility of agricultural production), to something closer to being directly in the control of recipient government policy (war, FDI). Therefore the moral justification of allocating aid on an efficiency basis alone - that is, that recipient governments are solely responsible for aid *in*efficiencies - is largely removed.

However, our very ability to accurately gauge aid efficiency with macroeconomic regression analysis also has to be questioned. First, econometric tests can rarely settle issues of causality to the theoretician's satisfaction, such that the exact causal relationships between aid, growth and our four conditions of aid effectiveness may always be largely unknown. But beyond statistical tests of historical data, the selectivity approach relies on a presumption that donor behavior, as well as aid flows themselves, cannot directly or indirectly influence the efficiency of aid flows, a proposition which has been called into question by various aid experts (Mosley and Hudson, 2002; Roland-Holst and Tarp, 2002). Thus the selectivity approach envisages a static and narrow conception of the role of aid agencies, one which ironically renders the most legitimate rationale for aid - its potential to overcome the types of failures which cause low levels of investment - largely obsolete. One hopes, then, that our empirical findings will be used for some more creative thought as to how donors can successfully influence the obstacles to aid's ineffectiveness, rather as a basis for redirecting flows to countries which are relatively unencumbered by serious impediments to their development.

5. Conclusion

This study has carried out an extensive investigation of the conditions of aid effectiveness, though it has certainly opened as many doors as it has closed. Empirical results broadly confirm several prominent findings from previous Third Generation studies and also suggest that aid effectiveness is adversely affected by the level of foreign direct investment. Though no evidence was found that good policies directly promote aid effectiveness, this study indirectly imposes the need to reconsider the role of policies in the aid-growth relationship, in that investor-favorable policies almost certainly play a vital role in

determining the size of FDI flows and, therefore, the degree to which aid will be necessary and effective. Future research should not only consider the extent to which aid can catalyze or complement private foreign investment flows, but also the potential for donors to successfully influence the other obstacles to effective foreign aid.

Tables and Figures

Figure 1: The effects of aid on growth via consumption.

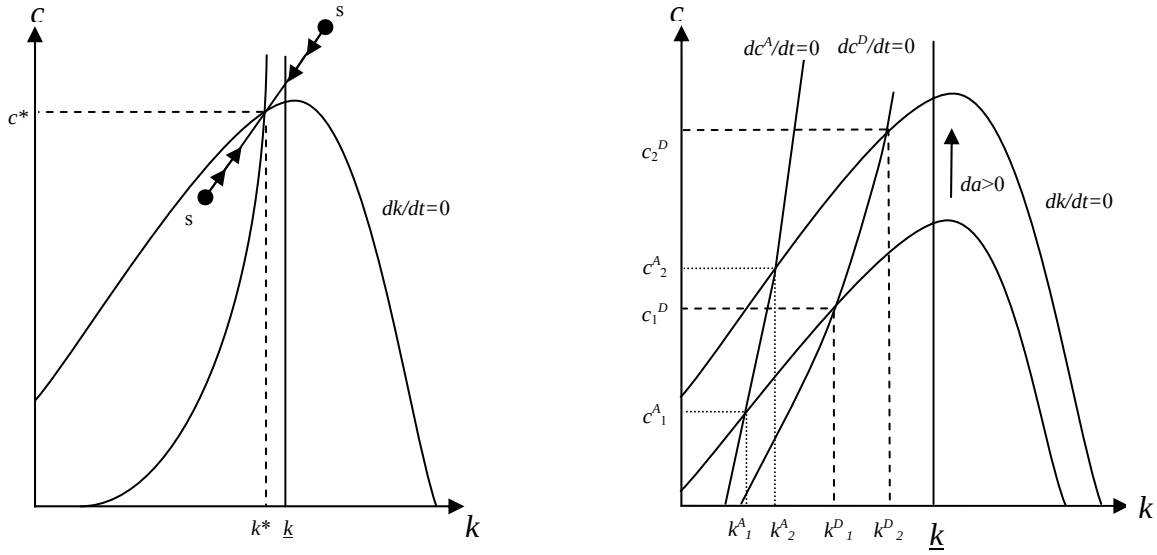

Table 1 - Base Regressions

Reg. No.	1	2	3	4
Sample	Full	Low Income	Full	Low Income
Regressor	OLS	OLS	OLS	OLS
N	419	294	419	294
LGDP	-0.55**	-0.60**	-0.67**	-0.57**
	(2.69)	(2.24)	(2.01)	(2.16)
GDI	0.13**	0.14**	0.14**	0.13**
	(4.08)	(3.75)	(3.77)	(4.08)
FDI	0.39**	0.36**	0.37**	0.39**
	(4.69)	(3.50)	(3.54)	(4.67)
LCPI	-1.45**	-1.47**	-1.45**	-1.44**
	(3.91)	(3.59)	(3.43)	(3.82)
OPEN	1.89**	1.97**	1.97**	1.89**
	(4.89)	(4.24)	(4.25)	(4.87)
STABILITY	7.45**	7.47**	7.12**	7.35**
	(3.09)	(2.84)	(2.54)	(2.88)
TROPLAND	-1.80**	-1.77**	-1.79**	-1.80**
	(4.58)	(3.15)	(3.18)	(4.61)
ΔWAR	-0.35	-0.59**	-0.61**	-0.35
	(1.58)	(2.11)	(2.10)	(1.56)
GOV	0.29**	0.26**	0.27**	0.29**
	(2.99)	(2.54)	(2.55)	(2.98)
ODA	--	--	-0.009	-0.003
			(0.36)	(0.13)
CONSTANT	4.07**	4.56**	5.07**	4.23**
	(2.62)	(2.31)	(2.08)	(2.15)
R^2	0.40	0.43	0.40	0.43
R_a^2	0.39	0.41	0.39	0.41
Hausman test for exogeneity of foreign aid				
$t(e_{oda})$	--	--	0.058	-0.18
Test for overidentifying restrictions				
χ_q^2			0.08	0.14

Notes: White heteroskedastic-consistent t-values are in parentheses.
* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

Table 2 - Summary of Rotational Interactions Tests

	1	2	3	4
Criterion	None	Significant at 10% level at least once	Significant at 10% level at least twice	As 2. but with expected sign.
Number of variables	50	28	17	5

Table 3 - Consistently significant interactions with expected signs

Variables	Exp. Sign	OLS, Full Sample		OLS, Low Income		2SLS#, Full Sample		2SLS#, Low Income	
		β	t	β	t	β	t	β	t
ODA		0.027	0.97	0.021	0.68	-0.022	0.83	-0.040	1.42
Interaction	-	-0.016	2.61**	-0.015	2.20**	-0.020	1.73*	-0.021	1.58
FDI	+	0.495	5.36**	0.501	4.19**	0.577	5.06**	0.592	4.01**
ODA		0.117	1.68*	0.088	1.09	-0.004	0.13	-0.019	0.63
Interaction	-	-0.140	1.90*	-0.113	1.32	-0.123	2.59**	-0.140	2.40**
TROPLAND	-	-1.309	3.06**	-1.304	2.05**	-1.828	4.73**	-2.092	3.82**
ODA		0.021	0.85	0.018	0.67	-0.032	1.20	-0.055	1.84*
Interaction	?	-0.104	2.87**	-0.124	3.17**	-0.090	1.85*	-0.133	2.48**
LATAM	?	1.339	3.04**	2.063	3.80**	0.930	2.15*	1.586	2.89**
ODA		-0.015	0.65	-0.014	0.57	-0.048	1.96**	-0.059	2.28**
Interaction	-	-0.004	2.69**	-0.004	1.68*	-0.004	2.70**	-0.004	2.80**
AGRICSTAB	+	0.037	2.85**	0.039	1.55	0.027	3.05**	0.023	2.08**
ODA		-0.016	0.58	-0.013	0.41	-0.041	1.48	-0.058	1.93
Interaction	-	-0.026	1.50	-0.020	1.02	-0.069	2.12**	-0.074	2.20**
ΔWAR	-	-0.176	0.70	-0.513	1.57	-0.008	0.33	-0.237	0.76

Notes: White heteroskedastic-consistent t-values are in parentheses.

* Significant at 10% level

** Significant at 5% level

*** Significant at 1% level

#Instruments include DEMOC, SCHOOL, TROPLAND, RURAL, AGEDEP, FRENCH, SCHOOL2, MORTALITY, ARMS, POSTWAR, MILITARY, POP2, MORT2, POP*MORTALITY.

Table 4 - Sensitivity Tests of Significant Findings

Tests:	PC	LAE	No GDI	ODA^2	FE
ODA	0.045*	0.016	0.038	0.024	0.048*
	1.85	0.56	1.32	0.41	1.65
ODA*FDI	-0.020**	-0.015*	-0.012**	-0.016**	-0.019**
	3.19	1.83	2.01	2.63	2.84
FDI	0.42**	0.37**	0.55**	0.50**	0.15**
	4.54	3.39	5.45	5.36	4.68
ODA^2				0.000	
				0.08	
ODA	0.208**	0.186**	0.176**	0.100	0.190**
	2.73	2.98	2.66	1.25	3.03
ODA*TROPLAND	-0.215**	-0.214**	-0.189**	-0.147**	-0.207**
	2.72	3.13	2.67	2.01	3.13
TROPLAND	-1.33**	-0.92**	-1.21**	-1.30**	-2.36**
	2.92	2.07	2.86	3.04	4.14
ODA^2				0.001	
				0.60	
ODA	0.032	-0.043*	-0.001	-0.040	0.002
	1.24	1.86	0.06	0.80	0.10
ODA*AGRICSTAB	-0.005**	-0.003	-0.003**	-0.003**	-0.003**
	3.09	1.17	2.13	2.59	2.00
AGRICSTAB	0.046**	0.030	0.038**	0.040**	0.029**
	3.39	1.55	2.62	3.26	2.22
ODA^2				0.001	
				1.02	
$ODA^{\#}$	--	-0.150**	-0.077	-0.061	-0.037
		3.60	1.64	1.31	0.79
ODA*ΔWAR	--	-0.116**	-0.068**	-0.076**	-0.060
		2.91	2.01	2.30	1.58
ΔWAR	--	-0.17	0.01	-0.01	-0.05
		0.63	0.06	0.06	0.22
ODA^2	--			-0.001*	
				1.94	

Notes: White heteroskedastic-consistent t-values are in parentheses.
* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

Table 5: Simultaneous Conditions of Aid Effectiveness

Regression	1	2	3	4	5	6
N	420	420	420	374	374	374
LGDP	-0.90**	-0.79**	-0.89**	-1.26**	-1.23**	-1.26**
	(3.52)	(3.14)	(3.50)	(4.17)	(4.02)	(4.16)
GDI	0.13**	0.13**	0.13**	0.11**	0.11**	0.11**
	(4.22)	(4.21)	(4.18)	(4.79)	(4.65)	(4.80)
FDI	0.43**	0.43**	0.38**	0.57**	0.46**	0.55**
	(4.56)	(4.53)	(4.77)	(5.04)	(5.23)	(4.90)
LCPI	-1.39**	-1.23**	-1.43**	-0.81**	-0.87**	-0.72**
	(3.46)	(3.02)	(3.58)	(2.49)	(2.91)	(2.09)
OPEN	1.70**	1.69**	1.68*	2.06**	2.06**	2.09**
	(4.44)	(4.39)	(4.39)	(5.57)	(5.58)	(5.62)
TROPLAND	-1.55**	-1.61**	-1.47**	-1.63**	-1.58**	-1.63**
	(3.75)	(3.86)	(3.57)	(3.95)	(3.81)	(3.89)
AGRICSTAB	0.04**	0.04**	0.04**	0.03**	0.03**	0.03**
	(3.17)	(2.81)	(3.28)	(3.29)	(3.48)	(3.42)
ΔWAR	-0.02	-0.32	-0.02**	0.08	0.04	-0.17
	(0.08)	(1.38)	(0.08)	(0.35)	(0.17)	(0.74)
ICRG	0.29**	0.29**	0.30**	0.23**	0.24**	0.23**
	(2.86)	(2.83)	(2.97)	(2.44)	(2.50)	(2.37)
ODA	0.11	0.11	0.10**	0.09	0.08	0.10
	(1.51)	(1.61)	(1.45)	(1.26)	(1.04)	(1.27)
ODA*FDI	-0.01	-0.01*	--	-0.02	--	-0.01
	(1.33)	(1.74)		(1.31)		(1.22)
ODA*TROPLAND	-0.14*	-0.12*	-0.16**	-0.19**	-0.20**	-0.19**
	(1.93)	(1.67)	(2.18)	(2.79)	(2.92)	(2.77)
ODA*AGRICSTAB	-0.005**	-0.004**	-0.005**	-0.004**	-0.004**	-0.004**
	(3.50)	(2.75)	(3.64)	(3.14)	(3.22)	(3.01)
ODA*ΔWAR	-0.05**	--	-0.05**	-0.07**	-0.06**	--
	(3.11)		(3.52)	(2.05)	(2.03)	
CONSTANT	6.43**	5.70**	6.45**	10.01**	9.92**	10.02**
	(3.35)	(3.00)	(3.36)	(4.20)	(4.11)	(4.20)
R-SQUARE	0.42	0.41	0.41	0.43	0.43	0.43
	0.39	0.39	0.38	0.40	0.40	0.40

Notes: White heteroskedastic-consistent t-values are in parentheses.

* Significant at 10% level

** Significant at 5% level

*** Significant at 1% level

Table 6 - The marginal effects of aid on growth under various assumptions.

Scenario No.	1	2	3	4	5
Conditions of Aid Effectiveness	FDI AGRICSTAB TROPLAND	FDI AGRICSTAB TROPLAND	AGRICSTAB TROPLAND ΔWAR	AGRICSTAB TROPLAND ΔWAR	AGRICSTAB TROPLAND ΔWAR
Country Assumptions	Means	No FDI tropical country with some agricultural instability	Tropical country at war with some agricultural instability	Tropical country, post-war with some agricultural instability	Non-tropical country, post-war with some agricultural instability
$\partial g / \partial a$	-0.012	0.018	-0.167	0.135	0.292

Appendix 1

Table A1 - Aid-Policy Interactions & Sensitivity Results from Third Generation Type-1 Studies

Authors	**Conclusion**
Burnside & Dollar (1997, 2000)	Aid is effective in sound macroeconomic policy environments.
Dayton-Johnson & Hoddinott (2003)	aid raises growth only in the presence of a good policy environment in sub-Saharan Africa (SSA). Outside SSA aid raises growth independent of policy;
Hansen and Tarp (2000a, 2000b)	Burnside and Dollar result not robust to: alternative specifications, including aid-squared; and alternative estimators (GMM). Authors use their own data.
Dalgaard and Hansen (2001)	Burnside and Dollar result not robust to alternative selection of outliers, even with Burnside and Dollar data. Aid-squared is preferred non-linear term. Results are highly instrument-dependent.
Easterly, Levine and Roodman (2003)	An updating of the Burnside and Dollar data and application of Burnside and Dollar methodology cannot replicate original Burnside and Dollar results.
Roodman (2003)	Burnside and Dollar result is sensitive to alternative aid and policy measures, lengths of time periods, specifications and regressors.

Table A2: Alternative Conditions of Aid Effectiveness from Third Generation Studies Type-2 Studies

Authors	**Conclusion**
Hadjimichael (1995); Durbarry *et al.,* (1998) Lensink and White (2001); Hansen *et al.,* (2000, 2001)	Aid effectiveness decreases with the level of aid such that there are diminishing marginal returns to aid.
Gomanee (2003)	Aid tends to increase pro-poor expenditure (PPE) in low income countries
Guillaumont & Chauvet (2001, 2002)	Aid is more effective in countries experiencing trade and production shocks (economic instability), but less effect in political unstable environments.
Collier & Dehn (2001)	Aid is more effective in countries experiencing export shocks (economic instability).
Collier & Hoeffler (2002)	Aid is more effective in post-conflict societies.
Dalgaard *et al.,* (2002)	Aid is more effective in non-tropical countries.

Table A3 – List of Countries

Sub-Saharan Africa		Latin America & Caribbean		Asia	Middle East & North Africa
		Low Income			
Botswana	Mali	Bolivia	Haiti	East Asia	Algeria
Burkina Faso	Mozambique	Dominican Rep.	Honduras	Indonesia	Egypt
Cote d'Ivoire	Niger	Ecuador	Nicaragua	PNG	Jordan
Congo, Rep.	Nigeria	El Salvador	Paraguay	Philippines	Morocco
Cameroon	Senegal	Argentina*	Mexico *	Thailand	Tunisia
Congo, DR.	Sierra Leone	Brazil *	Panama *	Malaysia *	Syria*
Ethiopia	Tanzania	Chile *	Peru *		Turkey *
Gambia	Togo	Costa Rica*	Trinidad & Tobago*		
Ghana	Uganda	Colombia *	Uruguay*	South Asia	
Kenya	Zambia	Guatemala *	Venezuela*	Bangladesh	
Madagascar	Zimbabwe	Jamaica *		Sri Lanka	
Malawi				Pakistan	
Gabon*				India	

Table A4 – Variable codes, definitions and hypothesized relationship to aid effectiveness

Code	Definition	Source	Influence on Aid Effectiveness
ΔODA	Change in ODA		n.a.
ARMS	Arms imports over total imports.	US Department of State, Various Years.	-ve (poor governance)
BLACK	Black Market Premium (%; 0 means zero)	Global Development Finance & WDI	-ve (poor policy conditions)
FDI	Foreign Direct Investment over GDP	WDI	-ve (aid and FDI are growth substitutes)
GDI	Gross domestic investment over GDP	WDI	n.a.
GROWTH	GDP per capita growth (annual %)	WDI	n.a.
LCPI	The natural log of the Consumer price index (1995 = 100) plus one	WDI	-ve (poor policy environment)
LGDP	Log of GDP per capita in first year of period.	Harvard University CID	-ve (aid is more effective in poor countries)
M2	Money and quasi money (M2) as % of GDP, lagged one period.	WDI	+ve (good policy conditions)
ODA	Aid percentage of Gross National Product	OECD DAC Creditor Reporting System	n.a.
OPEN	Open economy=1, closed =0.	Sachs and Warner (1995); Roodman (2003); Wacziarg and Welch (2002).	+ve (good policy environment)
POLICY	Burnside and Dollar good policy index = 1.28 + 6.85*SURP – 1.40*INFL + 2.16*OPEN	Burnside & Dollar (2000)	+ve (good policy conditions)
SURP	Budget surplus/deficit over GDP	International Financial Statistics, WDI.	+ve (good policy environment)
TRADE	Total trade (imports+exports) over GDP	WDI	+ve (good policy environment)
ΔWAR	Change in war intensity (WAR)		-ve & +ve (poor governance in war high returns post-war)
ARMY	Size of military/population	Arthur S. Banks	-ve (poor governance)
ASSAS	Number of assassinations: Any politically motivated murder or attempted murder of a high government official or politician.	Arthur S. Banks	-ve (poor governance)
BUREAUC	Bureaucratic quality (0 to 6)	PRS Group's IRIS III (Knack & Keefer, 1995)	-ve (poor governance)
COUPS	Coups d'etat dummy variable	Arthur S. Banks Cross National Time-Series Data Archive	-ve (poor governance)
DEMOC	Democracy score 1-10	POLITY IV	+ve (good governance)
CIVWAR	A dummy variable for incidence of civil war, large populations (>50m)	Collier and Hoeffler (2002), with	-ve (poor governance)

	excluded.	extensions.	
DURABLE	Years since conception of independent autonomous state.	POLITY IV	+ve (good governance)
ETHNIC	Probability that two individuals will belong to different ethnic groups.	Easterly 1992	-ve (poor governance)
ETHTENSE	Ethnic tensions (1 to 10)	PRS Group's IRIS III (Knack & Keefer 1995)	+ve (good governance)
EXPROP	Expropriation risk (1 to 10)	PRS Group's IRIS III (Knack & Keefer 1995)	+ve (good governance)
GOV3	Equally weighted average of HONEST, LAW & BUREAUC		+ve (good governance)
HONEST	Corruption in government (0 to 6)	PRS Group's IRIS III (Knack & Keefer 1995)	+ve (good governance)
LAW	Rule of law (law and order tradition)	PRS Group's IRIS III data set (see Knack and Keefer 1995)	+ve (good governance)
PCWAR	Post civil war dummy variable. Effectively the period of peace onset.	Collier and Hoeffler (2002) with extensions.	+ve (high returns to aid)
PCONF	Simple average of assassinations and coups per year lagged one period.	Roodman (2003); underlying data from Arthur S. Banks.	-ve (poor governance)
REPUD	Repudiation of government contracts	PRS Group's IRIS III data set (see Knack and Keefer 1995)	+ve (good governance)
REV	Revolutions	Arthur S. Banks	-ve (poor governance)
WAR	War Intensity	PRIO (2003)	-ve (poor governance)
PSHOCK	-ve % price index changes, threshold country-specific as shares of GDP. Reconstructed based on underlying index data for 1957–97.	From Collier and Dehn (2002) with updates from Roodman (2003)	+ve (aid buffers shocks)
AGRICSTAB	Stability in agricultural value added = reciprocal of deviations from time trend.	Chauvet and Guillaumont (2001).	-ve (aid buffers shocks)
EXPORTSTAB	stability in exports =reciprocal of deviations from time trend.	Chauvet and Guillaumont (2001).	-ve (aid buffers shocks)
NSHOCK	-ve % price index changes, threshold country-specific as shares of GDP. Reconstructed based on underlying index data for 1957–97.	From Collier and Dehn (2001) with updates from Roodman (2003)	+ve (aid buffers shocks)
STABILITY	Chauvet and Guillaumont stability index	Chauvet and Guillaumont (1998)	-ve (aid buffers shocks)
TOTTREND	Perms of trade trend (regression against time).	Chauvet and Guillaumont (1999, 2001).	-ve (aid buffers shocks)
AGEDEP	Age dependency: ratio of less than 15yrs and over 65 yrs to working age.	WDI	-ve (cost of aid)
CENTAM	dummy variable for Central America		n.a.
CIFFOB	The C.I.F./F.O.B. ratio of transport from capital city to Baltimore in	IMF	-ve (cost of aid)

	1995		
EASIA	East Asia dummy	WDI	No expectations
EGYPT	Dummy variable for Egypt		n.a.
FRZ	Dummy variable for Franc Zone	Burnside and Dollar (2000)	n.a.
GEOIND	Equally weighted index of RURAL, TROPLAND and INLAND		-ve (cost of aid)
ILLIT	Illiteracy rate, adult total (% of people ages 15 and above)	WDI	-ve (cost of aid)
INLAND	Proportion of land not within 100km within coast	Harvard University CID	-ve (cost of aid)
ISOLATED	Distance from economic core (Europe, Japan, USA)	Harvard University CID	-ve (cost of aid)
LATAM	Latin America dummy	WDI	No expectations
LIFE	Life expectancy at birth, total (years)	WDI	-ve (cost of aid)
LPOP	Log of the population.	WDI	
MAL66	% of 1995 population living in areas with malaria, 1966	Harvard University CID	-ve (cost of aid)
MORT	Mortality rate, infant (per 1,000 live births)	WDI	-ve (cost of aid)
RURAL	Rural population (% of total population)	WDI	-ve (cost of aid)
SASIA	south asia dummy variable	WDI	No expectations
SCHOOL	School enrollment, primary (% gross)	WDI	-ve (cost of aid)
SSA	Sub-Saharan Africa dummy	WDI	No expectations
TROPLAND	Percentage of land in the tropics.	Harvard University CID	-ve (cost of aid)
TROPPOP	Percentage of population which is in tropics	Harvard University CID	-ve (cost of aid)

Table A5 - Aid interactions with Policy Indicators

Variables	Exp. Sign	OLS, Full Sample		OLS, Low Income		2SLS, Full Sample		2SLS, Low Income	
		β	t	β	t	β	t	β	t
ODA	+	-0.003	0.13	-0.009	0.36	-0.056	1.20	-0.056	1.20
ODA	+	-0.002	0.04	-0.054	0.84	-0.016	0.50	-0.032	0.97
ODA^2	-	0.000	0.02	0.001	0.95	-0.002	1.14	-0.002	1.03
ODA	?	-0.001	0.05	-0.023	0.68	-0.013	0.43	-0.031	0.97
Interaction	+	-0.012	1.25	-0.014	1.31	-0.020	1.51	-0.022	1.38
POLICY	+	0.954	5.70**	0.991	5.20**	1.030	6.53**	1.073	5.43**
ODA	?	0.016	0.60	0.019	0.61	-0.024	0.91	-0.037	1.30
Interaction	+	-0.044	1.31	-0.058	1.60	-0.063	1.67*	-0.083	1.80*
OPEN	+	2.148	4.90**	2.341	4.40**	2.553	5.84**	2.902	5.21**
ODA	?	0.001	0.03	-0.005	0.19	-0.030	1.08	-0.044	1.52
Interaction	+	-0.011	0.55	-0.011	0.51	-0.037	1.10	-0.048	1.36
LCPI	+	-1.368	3.17	-1.375	2.75**	-0.900	2.36	-0.810	1.80
ODA	?	-0.069	1.84	-0.098	2.22**	-0.021	0.65	-0.041	1.24
Interaction	+	-1.031	2.00**	-1.131	1.50	-0.260	0.48	-0.256	0.39
SURP	+	14.64	2.80**	13.623	2.09**	12.411	2.20**	12.81	1.83*
ODA	?	-0.01	0.50	-0.022	0.75	-0.04	1.51	-0.06	2.02
Interaction	-	0.02	3.25**	0.02	3.19**	0.04	2.38**	0.04	2.03**
BLACK	-	-0.28	3.25**	-0.29	3.15**	-0.60	2.48**	-0.58	2.13**
ODA	?	0.052	1.00	0.039	0.69	-0.023	0.77	-0.040	1.21
Interaction	+	-0.001	0.91	0.000	0.63	0.000	0.80	0.000	0.12
TRADE	+	-0.015	2.31**	-0.014	1.93*	-0.009	1.49**	-0.007	0.97
ODA		-0.074	1.44	-0.113	1.99**	-0.028	1.02	-0.046	1.58
Interaction	+	0.003	1.55	0.004	1.94*	-0.001	0.57	0.000	0.09
M2	+	-0.052	3.88**	-0.068	4.25**	-0.029	2.49**	-0.041	2.58**
ODA		0.080	0.31	0.373	1.18	-0.022	0.81	-0.036	1.20
Interaction	?	-0.012	0.31	-0.055	1.18	-0.007	1.20	-0.011	1.46
LGDP	-	-0.531	1.91*	-0.459	1.21	-0.946	2.58**	-1.235	2.63**
ODA		0.027	0.97	0.021	0.68	-0.022	0.83	-0.040	1.42
Interaction	-	-0.016	2.61**	-0.015	2.20**	-0.020	1.73*	-0.021	1.58
FDI	+	0.495	5.36**	0.501	4.19**	0.577	5.06**	0.592	4.01**
ODA		-0.009	0.38	-0.048	1.70*	-0.039	1.58	-0.048	1.70*
Interaction	-	0.040	1.06	0.02	0.33	0.003	0.55	0.022	0.33
ARMY	-	-0.373	0.80	-0.39	0.61	0.539	1.22	-0.387	0.61
ODA		-0.039	1.39	-0.054	1.66*	-0.051	1.83*	-0.061	1.90*
Interaction	-	0.163	1.22	0.285	1.78*	0.202	0.69	0.431	1.04
ARMS	-	-0.795	0.28	-6.400	1.35	0.404	0.99	-4.474	0.76

Notes: White heteroskedastic-consistent t-values are in parentheses.
* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

Table A6 - Aid interactions with Governance & Conflict Indicators

Variables	Exp. Sign	OLS, Full Sample		OLS, Low Income		2SLS, Full Sample		2SLS, Low Income	
		β	t	β	t	β	t	β	t
ODA		-0.011	0.42	0.000	0.37	-0.026	0.93	-0.044	1.47
Interaction	-	0.023	1.20	0.008	0.40	0.001	0.04	-0.069	1.71*
WAR	-	0.281	1.80	0.389	2.13**	0.225	1.33	0.420	1.94
ODA		-0.016	0.58	-0.013	0.41	-0.041	1.48	-0.058	1.93
Interaction	-	-0.026	1.50	-0.020	1.02	-0.069	2.12**	-0.074	2.20**
ΔWAR	-	-0.176	0.70	-0.513	1.57	-0.008	0.33	-0.237	0.76
ODA		-0.012	0.46	-0.007	0.26	-0.030	1.10	-0.045	1.50
Interaction	-	0.058	1.16	0.048	1.00	0.019	0.26	-0.049	0.53
CIVWAR	-	0.288	0.75	0.398	0.84	0.074	0.20	0.084	0.16
ODA		-0.012	0.48	-0.004	0.14	-0.040	1.46	-0.049	1.60
Interaction	+	0.063	1.39	0.063	1.24	0.144	2.16**	0.157	2.09**
PCWAR	+	0.397	0.30	-0.208	0.11	0.124	0.13	-1.030	0.79
ODA		0.282	3.80	0.261	3.27**	-0.005	0.19	-0.021	0.70
Interaction	+	-0.061	3.87**	-0.055	3.30**	-0.025	2.74**	-0.033	3.01**
GOV3	+	0.575	4.76**	0.530	3.92**	0.309	3.08**	0.337	2.90**
ODA		0.094	1.44	0.121	1.81*	-0.009	0.31	-0.018	0.60
Interaction	+	-0.029	1.78*	-0.035	2.13**	-0.031	2.24**	-0.042	2.51**
HONEST	+	0.443	2.85**	0.455	2.41**	0.315	2.04**	0.353	1.87*
ODA		0.050	0.87	0.054	0.86	-0.018	0.69	-0.033	1.15
Interaction	+	-0.020	0.92	-0.020	0.84	-0.034	2.18**	-0.050	2.65**
BUREAUC	+	0.318	1.64	0.391	1.78*	0.311	1.92*	0.395	2.09**
ODA		0.132	2.76**	0.137	2.53**	-0.017	0.61	-0.028	0.95
Interaction	+	-0.051	3.44**	-0.052	3.01**	-0.028	2.17**	-0.038	2.43**
LAW	+	0.562	3.61**	0.717	4.06**	0.333	2.15**	0.528	2.95**
ODA		-0.017	0.65	-0.010	0.34	-0.054	1.92*	-0.069	2.09**
Interaction	-	0.003	0.11	-0.009	0.29	0.011	0.80	0.015	0.97
ASSAS	-	-0.044	0.34	-0.019	0.13	-0.034	0.34	-0.024	0.22
ODA		-0.025	0.50	-0.049	0.85	-0.035	1.15	-0.069	1.97
Interaction	-	0.013	0.18	0.063	0.74	-0.110	1.78**	-0.055	0.73
ETHNIC	-	-0.769	1.08	-1.334	1.68*	-0.052	0.73	-0.720	0.87
ODA		0.016	0.36	0.040	0.72	-0.024	0.55	-0.027	0.57
Interaction	-	0.160	0.54	-0.117	0.35	0.213	1.30	0.098	0.60
COUPS	-	-2.128	1.65	-1.267	0.69	-2.986	3.01**	-2.960	2.46**
ODA		-0.008	0.22	0.016	0.35	-0.014	0.42	-0.021	0.57
Interaction	-	0.075	1.34	0.043	0.71	0.039	0.55	0.022	0.33
REV	-	-0.397	0.84	-0.833	1.41	-0.539	1.12	-1.319	2.02**
ODA		-0.004	0.16	0.007	0.26	-0.032	1.19	-0.038	1.33
Interaction	-	0.084	0.72	0.070	0.56	0.048	0.79	0.074	1.12
PCONF	-	-1.149	1.69*	-1.674	2.07**	-0.985	1.77*	-1.589	2.44**
ODA		0.045	1.40	0.052	1.43	-0.034	1.22	-0.048	1.53
Interaction	+	-0.011	2.23**	-0.011	2.13**	0.000	0.06	-0.002	0.32
DEMOC	+	0.099	1.87*	0.142	2.21**	0.027	0.49	0.051	0.76

Notes: White heteroskedastic-consistent t-values are in parentheses.

* Significant at 10% level

** Significant at 5% level

*** Significant at 1% level

Table A7 - Aid interactions with Economic Stability Indicators

Variables	Exp. Sign	OLS, Full Sample		OLS, Low Income		2SLS, Full Sample		2SLS, Low Income	
		β	t	β	t	β	t	β	t
ODA		-0.019	0.76	-0.042	1.63	-0.047	1.90*	-0.070	2.67**
Interaction	-	-0.010	0.89	0.018	2.08**	-0.014	0.73	0.011	0.38
EXP_STAB	+	0.023	0.58	-0.123	3.58**	0.079	0.64	-0.128	0.72
ODA		-0.015	0.65	-0.014	0.57	-0.048	1.96**	-0.059	2.28**
Interaction	-	-0.004	2.69**	-0.004	1.68*	-0.004	2.70**	-0.004	2.80**
AGRICSTAB	+	0.037	2.85**	0.039	1.55	0.027	3.05**	0.023	2.08**
ODA		-0.158	1.51	-0.179	1.43	-0.026	0.98	-0.039	1.34
Interaction	-	0.001	1.32	0.001	1.30	-0.001	1.93*	-0.001	1.63
TOT-TREND	+	-0.008	1.12	-0.007	0.85	-0.002	0.30	-0.003	0.39
ODA		0.006	0.24	0.005	0.20	-0.039	1.40	-0.060	1.96**
Interaction	-	0.446	1.21	0.339	0.89	-0.347	0.86	-0.500	1.18
STABILITY	+	5.549	1.91*	5.857	1.82	5.756	1.98**	4.601	1.43
ODA		-0.023	1.14	-0.008	0.35	-0.037	1.73	-0.031	1.27
Interaction	+	1.190	0.92	0.116	0.11	1.484	1.00	-0.023	0.01
PSHOCK	+	1.838	0.30	1.153	0.17	-1.614	0.39	-2.860	0.66
ODA		-0.012	0.63	-0.005	0.23	-0.035	1.62	-0.028	1.14
Interaction	+	-0.642	1.38	-0.896	1.36	-0.900	0.77	-1.295	0.99
NSHOCK	-	-11.33	1.92*	-6.574	1.25	-6.892	0.88	0.309	0.04
ΔODA		0.028	0.72	0.031	0.77	0.028	0.72	0.031	0.77
Interaction	+	-1.819	0.69	-4.334	2.14**	-1.819	0.69	-4.334	2.14**
PSHOCK	+	1.711	0.30	-4.617	0.89	1.711	0.30	-4.617	0.89
ΔODA		0.010	0.24	0.018	0.42	0.010	0.24	0.018	0.42
Interaction	+	0.286	0.26	-0.942	0.79	0.286	0.26	-0.942	0.79
NSHOCK	-	-14.15	2.78**	-8.251	1.58	-14.15	2.78**	-8.251	1.58

Table A8: Aid interactions with Geographical and Social Indicators

Variables	Exp. Sign	OLS, Full Sample		OLS, Low Income		2SLS, Full Sample		2SLS, Low Income	
		β	t	β	t	β	t	β	t
ODA		0.117	1.68*	0.088	1.09	-0.004	0.13	-0.019	0.63
Interaction	-	-0.140	1.90*	-0.113	1.32	-0.123	2.59**	-0.140	2.40**
TROPLAND	-	-1.309	3.06**	-1.304	2.05**	-1.828	4.73**	-2.092	3.82**
ODA		-0.014	0.36	-0.028	0.65	-0.028	0.90	-0.037	1.07
Interaction	-	0.027	0.47	0.054	0.73	0.022	0.34	0.022	0.26
TROPPOP	-	-2.266	4.13**	-2.365	3.36**	-2.161	3.78**	-2.034	2.65**
ODA		-0.119	1.38	-0.188	1.90*	-0.016	0.49	-0.037	1.02
Interaction	-	0.002	1.52	0.003	2.04**	0.000	0.49	0.000	0.27
RURAL	-	-0.019	1.37	-0.046	2.46**	-0.016	1.13	-0.053	2.40**
ODA		-0.035	1.04	-0.059	1.74*	-0.019	0.64	-0.027	0.86
Interaction	-	0.074	1.39	0.121	1.96**	-0.016	0.27	-0.025	0.31
INLAND	-	-0.452	0.81	-0.492	0.72	0.353	0.63	0.807	1.11
ODA		-0.119	1.36	-0.189	1.89*	-0.016	0.49	-0.037	1.03
Interaction	-	0.005	1.49	0.008	2.02**	-0.001	0.52	-0.001	0.30
GEOIND	-	-0.061	1.47	-0.144	2.51**	-0.053	1.26	-0.168	2.49**
ODA		-0.012	0.22	-0.040	0.64	-0.035	1.10	-0.046	1.35
Interaction	-	0.016	0.26	0.053	0.80	0.018	0.37	0.073	1.29
MALARIA	-	-0.938	1.74*	-0.915	1.35	-0.977	1.80*	-1.040	1.41

ODA		-0.040	1.05	-0.066	1.63	-0.045	1.50	-0.065	2.05**
Interaction	?	0.061	1.53	0.090	2.13**	0.065	1.09	0.080	1.26
SSA	-	-1.065	1.88*	-1.162	1.89*	-1.258	1.77*	-1.218	1.57
ODA		0.021	0.85	0.018	0.67	-0.032	1.20	-0.055	1.84*
Interaction	?	-0.104	2.87**	-0.124	3.17**	-0.090	1.85*	-0.133	2.48**
LATAM	?	1.339	3.04**	2.063	3.80**	0.930	2.15*	1.586	2.89**
ODA		-0.001	0.06	-0.004	0.16	-0.031	1.14	-0.044	1.49
Interaction	?	0.145	1.21	0.007	0.03	-0.215	1.24	-0.249	1.28
SASIA	?	0.770	1.05	1.244	1.26	2.090	2.42**	2.074	1.83*
ODA		-0.002	0.06	-0.009	0.34	-0.033	1.25	-0.050	1.72*
Interaction	?	0.470	1.35	0.682	1.97	-0.162	1.89*	-0.369	2.45**
EASIA	+	-0.031	0.05	-0.142	0.19	0.574	1.25	0.994	1.66*
ODA		0.047	0.78	0.079	1.27	-0.021	0.79	-0.039	1.34
Interaction	+	-0.001	0.90	-0.001	1.51	-0.001	1.22	-0.001	1.42
SCHOOL	+	0.008	0.84	0.016	1.27	0.007	0.99	0.012	1.25
ODA		-0.530	3.23**	-0.716	3.90**	-0.015	0.50	-0.027	0.85
Interaction	-	0.578	3.30***	0.775	3.96**	-0.058	0.98	-0.096	1.35
AGEDEP	-	-5.628	3.29**	-7.645	3.52**	-1.411	0.98	-2.517	1.38
ODA		-0.057	1.11	-0.106	1.91*	-0.025	0.86	-0.044	1.42
Interaction	-	0.001	1.53	0.001	2.36**	0.000	0.83	0.000	0.22
INFMORT	-	-0.014	1.74	-0.019	1.96**	-0.011	1.23	-0.014	1.16
ODA		-0.101	2.01**	-0.154	2.64**	-0.028	0.95	-0.051	1.65
Interaction	-	0.002	2.53**	0.003	3.04**	0.001	0.66	0.001	0.74
ILLIT	-	-0.045	4.16**	-0.064	4.65**	-0.034	2.92**	-0.051	3.45**

Notes: White heteroskedastic-consistent t-values are in parentheses.
* Significant at 10% level
** Significant at 5% level
*** Significant at 1% level

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*The authors would like to acknowledge the highly valued contributions of numerous colleagues. Particular mention should go to Craig Burnside for his very helpful correspondence on numerous occasions, but also David Roodman, Mark McGillivray, Finn Tarp, Henrik Hansen, Howard White, Bruce Headey, Alicia Rambaldi and Tim Coelli. All these contributions greatly aided the completion of this paper. The usual disclaimer applies. All queries, including data requests, should be directed to Derek Headey (dheadey@yahoo.com).

[1] Including the U.S., British, Dutch and Canadian aid agencies.

[2] Of course, Dalgaard and Hansen (2001) are chiefly interested in constructing a critique of Burnside and Dollar rather than pursuing interactions with other exogenous factors.

[3] For example, the probability of receiving returns to investment may be a function of the quality of governance and social capital (Knack and Keefer, 1995), ethnic heterogeneity (Easterly and Levine, 1997), the state of conflict (Collier and Hoeffler, 2002), political stability (Perotti, 1996), climate and foreign demand (Masters and McMillan, 2000), government expenditure (Dalgaard and Hansen, 2001) and openness to trade and investment (Sachs and Warner, 1995; Gallup, Sachs and Mellinger, 1999).

[4] For simplicity we let aid augment consumption one for one. The prevalence of government corruption implies that this is unlikely to be the case. Dalgaard *et al.,* (2002) let a proportion of recipient governments' aid receipts, π, be diverted away from consumer's pockets. Since we would expect π to be a function of many of the same factors included in $\mathbf{x}$, there is little reason to expect that modeling government leakages would change the broad implications of our model. If x_i, for example, increases π, we would generally expect it to increase p but also to complement aid in the "production" of a more favorable investment environment. One would therefore x_i to have two effects on the aid-growth relationship, though these effects are expected to operate in the same direction.

[5] The existence of a saddle point stable steady state is guaranteed by assuming: $\frac{d\dot{k}}{dc}_{|k=\bar{k}} < 0$

[6] In essence, p constitutes a short run factor that is abstracted away within the long run neoclassical model. However, the output model here should be seen as an expected output model in the *ex ante* sense, as in equation (4). This output function is measured *ex post* and thus includes the *ex ante* influences of risk/uncertainty as well as the *ex post* actual rather than predicted risk/uncertainty factors.

[7] In practice, we have measures of GDP per capita rather than per worker, such that we approximate this relationship by assuming that the proportion of working age people is roughly constant over time.

[8] Abstracting from depreciation rates can be motivated be either assuming rates are equal across countries, or that the variation in rates is captured by other factors in the growth equation, as described in the next section. In particular, one would reasonably hypothesize that depreciation rates would vary positively with measures of geographical disadvantage, particularly the proportion of land in the tropics.

[9] Using GDP in the denominator can also indirectly capture the growth in the labor force (that is, growth in the economically productive population), rather than mere general population growth.

[10] Furthermore, a more sophisticated model might need to allow for A to be a function of p. Also, despite the inability to delineate variables as determining either growth in p or growth in A, we believe that this is a highly intuitive and more transparent means of conceptualizing TFP that the standard risk-free neoclassical model. For example, our model suggests that even two countries with the same inputs and levels of technology need not grow at the same rate if the probability of receiving returns to investment varies significantly (see Mankiw, Romer and Weil, 1992, for a similar discussion of expropriation risk).

[11] Though FDI levels may influence aid flows, it seems safe, for the moment at least, to assume that private foreign investors are not directly influenced by the level of foreign aid in which a country receives. They are, however, high influenced by the risk within a country.

[12] A third could foreign direct investment flows. Though this turns out to be an important variable in lieu of our final results, allowing for the endogeneity of FDI is beyond the scope of the present study.

[13] Burnside and Dollar (2000), for example, conclude that where aid has been diverted to *government* consumption it has been ineffective. These sorts of conclusion require qualification, however. First, not all government consumption need be thought of as unproductive, especially insofar as governments finance current education and health expenditure. Second, in relation to point one, growth regressions of this type do not typically control for the dynamic relationship between aid and growth. Morrissey (2001), for example, has estimated that perhaps only a third of foreign aid is directed towards increasing growth in the medium term.

[14] Strictly speaking, a non-linear simultaneous equations regressor should be employed.

[15] In an earlier version of this paper we employed yearly data as one of several other robustness checks which are described below. Most of the results were insignificant with a greater frequency, with the

exception of the war variables, suggesting that averaging these variables is in fact disadvantageous as they vary intertemporally a great deal.

[16] We have used the term policy measures in an admittedly ambiguous sense. Many authors (see Lensink and White (2001) for example) have drawn attention to the fact that at least one of Burnside and Dollar's three policy indicators - the inflation rate - is actually a measure of policy outcomes/targets, rather than the underlying policy instrument itself.

[17] There are several controversies in the EDA construction. Most troublingly, the title *Effective Development Assistance* is perhaps quite misleading. As Dalgaard *et al.,* (2002) point out, there are not necessarily strong *a priori* grounds to think that a 10 million dollar loan is less growth-effective than a 10 million dollar grant. The relative productivity of loans surely depends on a multitude of factors, not least political factors.

[18] It has generally been argued that this method of index construction is possibly highly sensitive to model specification issues and dependent on the assumption that policies matter for growth in the same way that they do for aid effectiveness (see Lensink and White, 2000, and White, 2001)[18]. There has been less emphasis, however, on the dubious procedure of combining a binary variable (OPEN) with two continuous variables.

[19] The budget deficit component of the good policy index, for example, suffers from both greater paucity and possible self selection issues if non-reporting countries run, on average, higher budget deficits.

[20] In fact, we ran a multitude of variations (e.g. low income 2SLS). Space constraints inhibit our ability to report these, though they are available on request.

[21] Also known as the minimum absolute deviations (MAD), least absolute values (LAV) or the L1 estimator. We employed the Bofinger-Siddiqui method for computing the differential used when selecting ordered residuals.

[22] Despite this, we are skeptical of any claims that the empirical regularity of this result is much proof of its validity when researchers almost inevitably employ very similar data sets. Indeed, we feel that there have been relatively few efforts to derive alternative measures of aid. In that regard, the efforts by Cheng *et al.,* (1998) were welcome indeed.

[23] Burnside and Dollar could argue that their use of the assassinations and ethno-linguistic fractionalization index capture the propensity for conflict, however the latter variable is time-invariant and very indirect, while the assassinations variable can, on occasion completely fail to capture the incidence of conflict. Despite 20 years of often intense civil war in Mozambique, for example, the assassinations variable scores zero for the entire period of our analysis, with the exception of the last period in which the country grew at average rate of 6.6%, one of the highest in Africa.

[24] These variables are assassinations, ETHNIC, M2/GDP, and BLACK.

[25] All results are available on request.

[26] We are reluctant to increase the stringency of this decision rule on the grounds that a particular condition may fail to hold, for example, in the low income sample, particularly if the variation in the condition is a function of income. Likewise, there is very little means of ascertaining whether OLS or 2SLS is the preferred regressor.

[27] Hudson and Mosley (2002) also used the arms expenditure measure in their regressions, but appear not to have interacted aid with arms imports, choosing instead to employ this as a control variable only.

[28] Likewise, interactions with the SSA dummy variable are marginally insignificant and positive in several variations. This result may also account for several of the questionable results eliminated in Table 2, since variations in geographic and demographic factors tend to be highly explained by continental variations.

[29] A 2SLS regressor cannot easily be applied to a principal components specification because the fitted values of aid will inevitably be highly correlated with the variables contained in the principal components. Thus an artificially induced multicollinearity between aid and the principal components leads to low t-values for aid and aid-interaction terms.

[30] The insignificance of ΔWAR on growth is also a troubling result, even though this variable was marginally insignificant in our base regression for the full sample of countries. It suggests that war only has a detrimental effect on growth when accompanied by foreign aid, or, conversely, that there are no supra-returns to peace without foreign aid (also found by Collier and Hoeffler, 2002). The latter result is tolerable, the former not so.

[31] The implications on optimal aid allocation of the Burnside and Dollar (1997, 2000) and Collier and Dollar (2002) findings were controversial precisely because they relied on a whole host of questionable assumptions about the nebulous causal relationships between aid, policy and growth. The causal dimensions of our own findings are understandably far more complex. See section IV.

[32] For example, we did not employ additional quadratic terms, such as aid-squared, in conjunction with interaction terms because this quadratic term was insignificant when entered individually (see Table 2). Regarding alternative aid measures we refer the reader to Section III. Relevant to this is our ability to test donor-side considerations as per Lensink and Morrisey (1999) due to the paucity of data in this regard: for example, data on the tying of aid for specific recipients is not widely available.

[33] Researchers at PRIO have generated rather crude measures of the geographical coverage of wars, such as the war radius as defined by discrete blocks of 50 square kilometers. We tested these measures also by scaling the war radius according to arable land size, but this measure did not generate significant results in terms of determining either growth or aid effectiveness. More refinement of these measures would certainly be desirable.

[34] It is theoretically questionable whether long-run terms of trade movements are of the greatest interest, however, when short-run volatility in price movements, as emphasised by Collier and Dehn (2001), are probably of greater relevance when considering whether aid acts as insurance.

[35] We are grateful to Howard White for this particular reference. Bauer (1974) also considered the dynamic interaction between aid and FDI, in fact arguing that the only economic justification for foreign aid was its ability to stabilize the investment environment and thereby promote private sector development. Bauer, rather anecdotally, concluded that the only case in which aid had been effectively used in this capacity was in Taiwan. More empirically, this is an issue ably addressed by Clemens (2002) with respect to foreign aid from the World Bank.