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Aid, Policies and Long-Run Growth

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Abstract
This paper analyses the relationship between aid, policies and growth in 54 countries over 45 years. Specifically it hypothesises that if aid affects growth then it does so over a long period of time and that the extent to which this is true depends on an individual country's policy environment. This paper both finds no direct relationship between aid and growth, and that the effectiveness of aid does not depend on the policy environment. This paper therefore adds to the existing evidence showing that Burnside and Dollar's (2000) result of aid effectiveness does not have external validity.

Keywords
Aid, Growth, Policies, Development Economics, GDP, inflation, black market premium, education, budget

Aid, policies and long-run growth

1. Introduction

For the first time in human history the alleviation of global poverty and universal economic development is seen as an achievable and important goal (Millennium Development Goals). Aid (in all its many forms) is often cited as a crucial means to achieve this end (e.g. the UN's long-standing target of 0.7% of rich countries' GNP to be spent on aid). These aid disbursements continue to grow despite considerable academic ambiguity over the effectiveness of such transfers. Recently the logic that aid can have a considerable (and immediate) positive effect in the presence of developmental policies has received new life with the publishing of a paper by Burnside and Dollar (2000). My paper argues that the total effect of aid on growth can only be apparent in the long run, and this has implications for the analysis of the effect of aid in different policy environments.

This paper is going to broadly follow the logic of Burnside and Dollar in the assertion that aid may have a positive effect on growth in the presence of good policies. I will deviate from their paper by critiquing their definitions of aid and policy (but I acknowledge that my choices of variables are more symptomatic of 'overall good governance' than vitally important in their own right). More fundamentally I note that macroeconomic studies of aid effectiveness have historically failed to consider the effect of aid over long periods of time (often due to data limitations), as is necessary to fully identify the aid's impact. Burnside and Dollar argue that analysing the direct impact of a four year average of aid on the contemporaneous four year average of growth correctly identifies the effectiveness of aid. I dispute this and will analyse the data over a long period of time to account for the time taken to both invest the aid and for that investment to become productive.

2. Literature Review

Easterly (2006) estimates that over the last fifty years $2.3 trillion of aid has been disbursed, a considerable percentage of that over the last decade with the expressed intention of development. This has

been recommended by leading economists (e.g. Sachs, 2005) who argue that aid can be crucial in enabling countries to break out from a 'poverty trap'. However critics of aid claim that there is little historical evidence of aid promoting growth, indeed "*the top quarter of aid recipients…received 17% of their GDP in aid over the last 42 years, yet also had near-zero per capita growth*" (Easterly, 2007). These critics argue that those receiving aid have considerable incentives to renege on agreements and appropriate aid for private consumption with little threat of retribution (Bauer, 1976). Aid can even weaken a government's developmental performance through reducing the incentives to adopt good policies and reform inefficient institutions (Heller and Gupta, 2002). Overall "*the debate about aid effectiveness is one where little is settled"* (Rajan, 2005).

Given the critical stakes involved much research has been undertaken into what makes aid more effective. It has long been theorised that '*poor countries with sound economic policies benefit directly from the policies, and in this environment aid accelerates growth"* (Burnside and Dollar, 2000). Burnside and Dollar (henceforth BD, 2000) authored a highly influential paper which aimed to empirically analyse the relationship between foreign aid, economic policies and growth of per capita GDP. They hypothesised that the extent to which aid would be effective depends on the extent to which it is invested. Because investment decisions and subsequent productivity are negatively affected by policy distortions BD claimed that countries with 'better' policies would see more growth as a result of the aid. They robustly found that aid has had a '*positive impact on growth in developing countries with good fiscal, monetary and trade policies but little effect in the presence of poor policies.'*

This paper has been seized upon by those involved in the aid industry as evidence that aid can be effective, indeed the paper has been cited by several development agencies as justification for selectively increasing aid flows (Easterly, 2003). However do the empirical results stand up to further scrutiny? Many economists have critiqued BD's work, including Hansen and Tarp (2001), Dalgaard and Hansen (2001), Guillamont and Chauvet (2001), Collier and Dehn (2001), Lensink and White (2001), Collier and Dollar (2002) and Easterly et al (2004). These papers considered variants on the BD model with

inconclusive results, some of these papers endorsed BD's finding whilst others found contrary evidence, e.g. Easterly et al. (2004) who expanded the dataset to include more years and countries and saw the significance of the relationship disappear. Easterly (2003) makes the important point that '*choosing the appropriate specification often means there are more plausible right-hand side variables than there are data points in the sample."* This has an implication for my work; rather than trying to exhaustively identify every relevant variable I should instead select those variables which are symptomatic of a broader concept (of commitment to development).

Although I re-evaluate the definitions of aid and policy most fundamentally I argue that, if aid impacts growth, it will take time to do so. Aid given to build a road, or to buy textbooks for a school or to equip a new hospital will not predominately have an immediate impact on growth. My model therefore allows for this by looking at the impact of past (and present) aid on present growth. A currently circulating IMF working paper (Minoiu and Reddy, 2009) addresses the impact of aid on growth over the long run, finding that development aid has a robust and strong impact on growth. Their work does briefly consider the interaction of policies over the long run (and finds no evidence that aid raises growth only in 'good' policy environments) but does not consider it in detail.

In conclusion there is much academic ambiguity about the effectiveness of aid. Whilst it is commonly argued that the effectiveness of aid depends on a country's policies there are no empirical specifications that seek to analyse the relationship between aid and policy whilst giving particular attention to the time frame involved, and it is this anomaly that my paper will seek to address.

3. The Model

I can investigate the long-run impact of aid on growth by estimating the following model:

$$g_{it} = g_t + \beta_y y_{it_{-1}} + \beta_a a_{it_{-j}} + \beta_p p'_{it} + \beta_{ap} a_{it_{-j}} p'_{it} + \beta_z z'_{it} + \varepsilon^g_{it} \quad (1)$$

$$a_{it} = a_t + \gamma_y y_{it_{-1}} + \gamma_p p'_{it} + \gamma_x x'_{it} + \varepsilon^a_{it} \quad (2)$$

$$p'_{it} = p_t + \theta_y y_{it_{-1}} + \theta_p p'_{it_{-1}} + \varepsilon^p_{it} \quad (3)$$

where i indexes countries, t indexes time, j indicates a time lag, g_{it} is per capita real GDP growth, y_{it} is the logarithm of real per capita GDP, a_{it} is aid receipts relative to GDP, p_{it} is a P x 1 vector of policies that affect growth, z_{it} is a Z x 1 vector of other exogenous variables that might affect growth, x_{it} is an X x 1 vector of other exogenous variables that might affect aid, g_t, p_t and a_t are fixed time effects and ε^g_{it}, ε^a_{it} and ε^p_{it}, are mean zero scalars. I construct my model by using the existing literature to select variables that belong in the policy and exogenous vectors. Some of the variables that belong in the growth equation do not belong in the policy or aid equations while the same is true for some variables in the aid and policy equations (these zero restrictions allow me to achieve identification of the model). The equations are estimated using data from 1960 to 2004 averaged over nine five-year periods, from 1960-1964 through to 2000-2004.

a) What determines growth?

I use the literature to develop a model of growth which depends on a variety of political and institutional variables, the aim of this is to control for a range of factors in order to identify the true impact of aid on growth. Firstly, lagged real per capita GDP is included in this regression because of convergence growth theory (Solow, 1957).

The exogenous variables include a measure of institutional quality (Knack and Keefer, 1995), ethnolinguistic fractionalisation (Easterly and Levine, 1997), lagged (to eliminate potential endogeneity) M2 as a percentage of GDP (Levine, 1997) and dummy variables for sub-Saharan Africa and East Asia.

These variables have all been suggested by the literature as suitable exogenous variables (assassinations as a measure of political unrest was also considered but data was not available over the full time period).

I now consider which variables should be considered for the policy vector. Carroll and Carroll (1997) examine the successful case of Botswana and emphasise that the incentives were correctly aligned; that is the '*politicians had personal commitment to economic development'*. As I am trying to proxy a government's commitment to development I have been guided by the literature to choose political variables that are symptomatic of this. Whilst BD utilise the highly subjective Sachs-Warner variable to proxy openness I am going to use the black market premium which is an effective way of showing trade distortions (Rodrik and Rodríguez, 2000). Fischer (1993) argues that inflation (GDP deflator) is negatively associated with growth (this can be controlled by monetary policy). Alogoskoufis and Ploeg (1991) show that running persistent budget deficits can lead to reduced savings and lower growth, hence I also include the budget surplus/deficit (% GDP). The degree to which the population is educated is also cited in the literature as being important for growth (e.g. Jamison, Jamison and Hanushek, 2007) and as such the percentage of children in primary education is included (a proxy for the degree of education in the larger population).

In order to consider the long-run impact of aid on growth I include lagged aid in the equation (two lagged variables are included: aid lagged one period and the average of aid lagged two periods and aid lagged three periods) and so that I can see the long-run impact of aid in different policy environments I include lagged aid interacted with current policy (in a similar fashion). BD define aid as 'Effective Development Assistance' which is solely the grant element of aid. An expanded definition is 'Official Development Assistance' (ODA) which includes loans targeted for development. I believe ODA to be a more accurate representation of true aid because the recipients are very often considerably liquidity-constrained (Easterly, 2003) and the loans are highly subsidised.

b) What determines aid?

The determinants of aid is a well researched topic in economics literature. The overarching consensus is that donors give a large amount of aid strategically (Maizels and Nissanke, 1984). In order to account for this I include dummy variables for sub-Saharan Africa (much European aid is directed here), the Franc zone (which receives a disproportionate amount of French aid), Egypt (a strategic American ally) and Central American countries (also a favoured recipient of American aid). It has also been found that aid is given to countries with small populations (Neumayer, 2002) and to countries with low incomes (Frey and Schneider, 1986) so population and lagged GDP per capita are also included in the exogenous vector. It is also conceivable that some aid is allocated to countries with good policies (Burnside and Dollar, 2000) so my policy variables are also included in the model.

c) What determines policies?

I hypothesise that policies are durable; that is the policies in one period depends on policies in the previous period(s). For example the theory of adaptive expectations implies that inflation in one period is highly dependent on inflation in the previous period (Carlson and Parkin, 1975).

d) Constructing a policy index

Earlier I identified four policy variables that impact growth to various extents. My results from Regression One will be difficult to isolate clearly if I am comparing the impact of differing policy variables, for instance what weightings should I attach to the various policies? Because I postulate that the effectiveness of aid on growth depends crucially on the policy environment it makes sense to weight these policies according to their own impact on growth. Furthermore the creation of an index allows me to clearly distinguish between those countries with ‘good’ policies and those with ‘bad’ policies, a feature which will prove useful when I come to interpreting the results. I considered the logic that different regions may differ in their optimal combination of policies to impact growth and introduced interactive variables between regions and policies to test this. However none of the different regions (Sub-Saharan Africa, Middle East and North Africa, and Asia) have significantly different combinations of optimal

policy (relative to the default region, the Americas) at the 5% level (see Appendix 1) so I conclude that there is a global combination of policies that are optimal for growth. I compute this index by estimating the following regression:

$$g_{it} = g_t + \mu_y y_{it-1} + \mu_p p'_{it} + \mu_z z'_{it} + \varepsilon_{it}^{gp} \quad (4)$$

and fixing the values of the coefficients that determine the policy index (i.e. $\mathbf{p}_{it} = b_p p'_{it}$) where b_p is the OLS estimate of β_p in equation two. Then I can estimate the following main regression instead (with a similar alteration to equations 2 and 3):

$$g_{it} = g_t + \delta_y y_{it-1} + \delta_a a_{it-j} + \delta_p \mathbf{p}_{it} + \delta_{ap} a_{it-j} \mathbf{p}_{it} + \beta_z z'_{it} + \varepsilon_{it}^{g}$$

I am conscious that these new equations are restricted versions of the originals and this may lead to misspecification when I remove outliers. For this reason I will re-evaluate the policy index at that point. Furthermore if the policy variables are endogenous in the growth equation I will have bias in these estimates. My specification tests (reported in detail later in the paper) demonstrate that I can assume policies to be exogenous in this instance.

Table One

	(1)	(2)	(3)
Growth	**LHS**		
Aid	RHS	**LHS**	
Policy index	RHS	RHS	**LHS**
Per capita income (Lag_1)	RHS	RHS	RHS
Institutional quality	RHS	RHS	
Ethnic fractionalisation	RHS	RHS	
M2/GDP (Lag_1)	RHS	RHS	
Population (log)		RHS	
Sub-Saharan Africa dummy	RHS	RHS	
East Asia dummy	RHS		
Egypt dummy		RHS	
Franc zone dummy		RHS	
Central America dummy		RHS	
Aid (Lag_1)	RHS		
Aid [½(Lag_2 + Lag_3)]	RHS		
Aid*Policy	RHS		
Aid (Lag_1)*Policy	RHS		
Aid [½(Lag_2+Lag_3)]*Policy	RHS		
Education (Lag_1)			RHS
Black market premium (Lag_1)			RHS
Budget surplus (Lag_1)			RHS
Inflation (Lag_1)			RHS

I now summarise the main equations that I will estimate (with some variations) in Table One. LHS indicates that the variable is

dependent whereas RHS indicates the variable is independent. There are unique variables in each regression which can be used as instruments in (a hypothetical) 2SLS estimation. The assumption that some variables do not belong in all of the equations (which has been justified by the existing literature) allows me to achieve identification of the model. In practice the 2SLS estimator is overidentified.

4. Econometric Estimation

I am initially going to estimate this model using Ordinary Least Squares. I believe this is justified unless I can demonstrate that some of the assumptions underpinning OLS do not hold. Because my dataset is unbalanced it is prudent to use heteroscedasticity-consistent standard errors as suggested by White (1980) throughout. My Breusch-Godfrey tests for serial correlation (see Appendix 2) reveal none in any of the regressions except the aid equation (so for these estimates I use the heteroscedasticity and auto-correlation-consistent standard errors as demonstrated by Newey and West (1987)). Computing Dickey-Fuller tests (see Appendix 3) reveal no evidence of a unit root in any of the key variables. The major potential problem with OLS in this instance is endogeneity caused by simultaneity bias.

a) Endogeneity

Endogeneity could occur in this instance due to growth and policy or growth and aid being codetermined. I first consider potential endogeneity (see Appendix 4a for full details of tests) between policies and growth, that is whether the error terms ε^{gp} and ε^{p} are correlated. I now need to decide whether estimation of these equations by OLS would result in bias (i.e. whether the use of instruments is necessary). Computing a Durbin-Wu-Hausman test reveals that the policy index can be assumed to be orthogonal at the 5% level to the error term in the growth equation and I will therefore consider policy as exogenous in the growth equation.

The other potential source of endogeneity in my model is that between aid and growth, i.e. whether the error terms ε^{g} and ε^{a} are correlated (see Appendix 4b for full details of tests). Computing the Durbin-Wu-Hausman test reveals that I can also consider aid as exogenous in the growth equation. This may be a

surprising result but it is not unique to my data (e.g. Hansen and Tarp, 2001) and inspection of the estimates generated by 2SLS reveals that they indeed do not deviate substantially from OLS.

b) Different specifications

Assuming that I have correctly specified my model my OLS results (adjusted for heteroscedasticity and serial correlation where appropriate) should be consistent. I will initially consider a long-run relationship between growth and aid. Following this I will then consider whether aid is more effective in different policy environments (over the long-run) by including aid*policy variables. Finally I will investigate the removal of outliers and this will highlight a possible need to change my definition of policy.

5. Data (see Appendix 5 for full details of sources)

Many previous analyses of the impact of aid on growth have been characterised by a lack of data over long periods of time and have therefore been unable to analyse long run effects. I have attempted to get information for all countries which have received aid since 1960. I have been able to use a World Bank dataset to provide the majority of my data with information from 1960-2004 on GDP (both levels and growth rates), official development assistance, M2/GDP, budget surplus/deficit (which was supplemented by IMF data), primary education rates, population and inflation. I have utilised data from Levine on the black market premium and ethnic fractionalisation whilst institutional quality is measured in PRS Group's IRIS III dataset as described in Knack and Keefer (1995). The dataset is unbalanced and countries have been removed for which truly insufficient data (classified as data being available for fewer than three time periods) is available; in total there are 54 countries (see Appendix 6 for a list). The policy index can only be computed from 1970 onwards, which is satisfactory because the need to lag other variables means that policy variables before 1970 would not be included in the regression.

Furthermore the countries I am missing data for are not selected at random; it is almost certain that the reasons why I am missing this data are correlated with variables in my model. Finally I do not include countries such as Japan and Korea (due to a lack of data pre-1960) which have 'graduated' from aid and

this is likely to negatively bias my effect of aid on growth. From a pragmatic perspective there is little I can do about these issues except acknowledge that my results cannot be assumed to have external validity.

Logarithms were taken of population, inflation, black market premium and GDP levels both in order to reduce the impact of outliers and because the theory suggests that a log-linear relationship is most appropriate in these cases (diminishing returns). Certain variables were assumed not to change over time, for example ethnic fractionalisation and quality of institutions (information on these variables is not widely available over time so I justified these assumptions on the logic that institutions and ethnic fractionalisation change slowly over time). Averages over five year periods (1960-1964, 1965-1969, etc.) were taken to remove business cycle fluctuations from the analysis (i.e. only medium-to-long term impacts should be observed).

Summary statistics for my dataset are available in Table Two. It is important to note that aid is a net value (negative values are possible when the aid is being repaid) and the education variable is calculated by looking at the number of students in primary education and dividing it by the number of children of primary education 'age' (i.e. figures of over 100% are possible). Inflation, black market premium and GDP per capita all have considerable outliers and this is one of the reasons why logarithms were taken.

Table Two

Metrics	Mean	Median	S.D.	Min	Max
GDP p.c .(1960) (PPP - 2005US$)	2032	1704	2233	237	11,175
GDP Growth (%)	1.56	1.58	3.40	-11.84	32.01
Net Aid (% of GDP)	5.85	2.85	6.96	-0.02	35.99
Budget surplus (% of GDP)	-3.08	-2.27	3.79	-22.20	8.00
Black market premium (%)	55.08	11.27	215.12	-2.68	2792.36
Inflation (%)	15.10	8.01	29.17	-92.74	321.37
Education (% in primary education)	86.64	95.26	28.87	2.66	167.58

6. Results

a) Constructing a policy index

Table Three

	(A)
	Estimation Method: OLS Number of Observations: 173 R^2: 0.45
	Dependent Variable: **GDP p.c. growth**
Initial GDP	-0.41 (0.35)
Ethnic fractionalisation	-1.03 (0.99)
Institutional Quality	0.24 (0.15)
M2/GDP (lagged)	-0.001 (0.002)
Sub-Saharan Africa	-1.15 (0.80)
East Asia	0.83 (1.01)
Budget Surplus	**0.09*** **(0.05)**
Inflation	**-4.13**** **(1.27)**
Black Market Premium	**-0.28**** **(0.14)**
Education	**0.02*** **(0.01)**
* Significant at 10% level ** Significant at 5% level	

In Table Three I show the results of regression (4) in order to compute a policy index. All of the exogenous variables have the expected sign and moderate explanatory power. All of these variables will be retained throughout the analysis (irrelevant of significance in individual regressions), in order to have a directly comparable base specification. Turning to the policy variables I can see that, as anticipated, an increase in the budget surplus, a fall in inflation, a reduction in the black market premium and an increase in education all, ceteris paribus, lead to increased growth. The most significant determinants of growth are the black market premium and inflation. Although the budget surplus and education variables are not significant at the 5% level in this model I have reason to believe that there is considerable multicollinearity between these variables and the others in the regression (indeed when I remove inflation from the regression these variables becomes significant). As the theoretical literature suggests these variables belong in this regression and the four variables are jointly significant at the 5% significant level I will include all four variables in my policy index.

The policy index is computed using the regression coefficients:

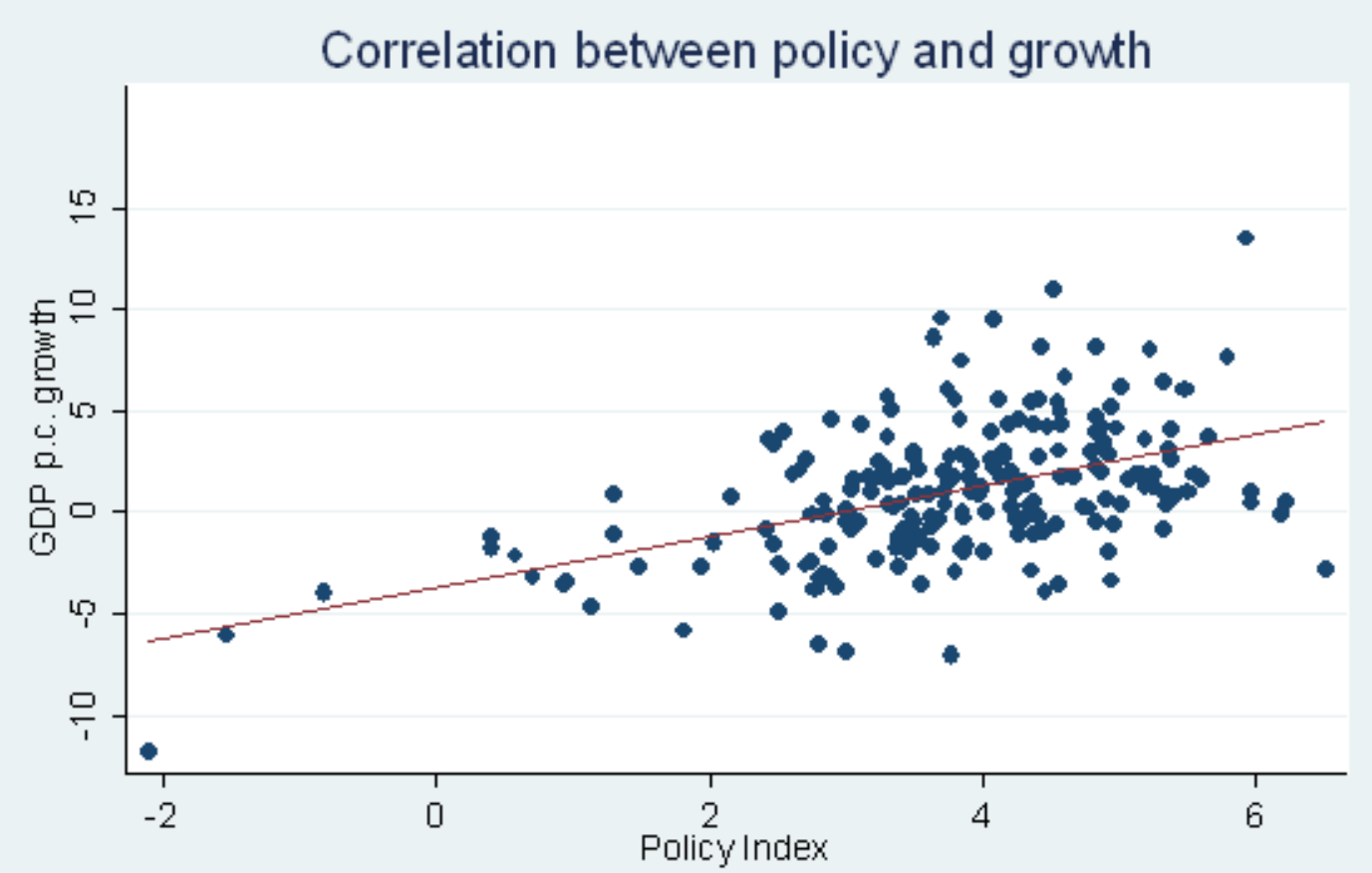
$$Policy = 3.65 - 0.28 * Log\ of\ black\ market\ premium - 4.13 * Log\ inflation$$

$$+ 0.09 * Budget\ Surplus + 0.02 * Education\ Rate$$

The constant 3.65 was found by predicting the growth rate using the mean value of all the other variables in the regression. In this way the policy index can be thought of as the predicted growth rates of the country for that time period (assuming mean values of all other variables).

Diagram One demonstrates the high degree of correlation between the policy index and the p.c. GDP growth rate. As I have already identified no endogeneity in this relationship I can say with confidence that those countries with 'better' policies grow at a faster rate [see also regression (B)].

Diagram One



b) Main Regression

The next stage is to look at the direct impact of aid on growth [regression (1)]. Because lagged values of aid will display multicollinearity it is important to do a joint test of significance, and the aid variables are significant at the 5% level.

Table Four

	(B)	(C)
	Estimation Method: OLS Number of Observations: 148 R^2: 0.46	Estimation Method: OLS Number of Observations: 148 R^2: 0.48
	Dependent Variable: **GDP p.c. growth**	Dependent Variable: **GDP p.c. growth**
Initial GDP	-0.89** (0.30)	-0.89** (0.30)
Ethnic Fractionalisation	-0.98 (1.00)	-1.23 (1.01)
Institutions	0.35** (0.15)	0.37** (0.16)
Sub-Saharan Africa	-1.59** (0.71)	-1.11 (0.72)
East Asia	0.33 (1.23)	0.88 (1.28)
Money (lagged)	0.007 (0.01)	-0.001 (0.01)
Policy	0.98** (0.23)	0.78** (0.25)
Aid	**-0.08** **(0.07)**	**0.08** **(0.10)**
Aid (lagged one period)	**0.14*** **(0.08)**	**-0.36** **(0.32)**
Aid (lagged two/three periods)	**-0.17**** **(0.07)**	**0.02** **(0.39)**
Aid*Policy	-	**-0.05** **(0.03)**
Aid (lagged one period)*Policy	-	**0.12*** **(0.07)**
Aid (lagged two/three periods)*Policy	-	**-0.03** **(0.09)**
Prob > F (on results in bold)	0.05	0.01
* Significant at 10% level ** Significant at 5% level		

From these results (B) I can analyse the overall impact on growth of a permanent increase in aid. This will be δ_{a1} in the first period, $\delta_{a1} + \delta_{a2}$ in the second period and $\delta_{a1} + \delta_{a2} + \delta_{a3}$ from the fourth period onwards.

Taking partial derivatives of GDP growth with respect to aid over the long-run reveals:

$$\frac{\partial g^*}{\partial a^*} = \delta_{a1} + \delta_{a2} + \delta_{a3} = -0.11$$

So a sustained one percentage point increase in aid/GDP will, ceteris paribus, lead to a sustained fall in the growth rate of 0.11%. As discussed in the literature review there are several reasons why aid may have a negative effect on growth, primarily due to reducing the accountability of the government to the electorate. However this result is not significantly different from zero at the 5% significance level.

The focus of this paper is on the impact of aid on growth in the presence of different policy environments and the second result (C) shows me what happens when I have a permanent increase in aid in different policy environments. Because of multicollinearity between all the aid variables it is necessary to do a significance check and I can see that I am justified in including these variables at the 5% level.

$$\frac{\partial g^*}{\partial a^*} = \delta_{a1} + \delta_{a2} + \delta_{a3} + \delta_{ap1} p_{it} + \delta_{ap2} p_{it} + \delta_{ap3} p_{it} = -0.27 + 0.04 * policy$$

Intuitively this result makes sense; aid has a sharply negative impact on growth in a policy environment of zero (a relatively bad policy environment), whilst it can be seen that for countries with a particularly good policy environment the impact of aid on growth can be positive. However neither the impact of aid on growth nor the impact of aid*policy on growth is statistically different from zero at the 5% significance level.

c) Different specifications

I am now going to investigate whether my results change when I remove outliers from my dataset and re-estimate the relationship. I use the Hadi test to identify and remove outliers (see Appendix 7 for full details). I feel comfortable removing outliers as, although these outliers are genuine results, they will not

be representative of a 'typical' relationship between aid, policies and growth. I can justify this by observing that these outliers are all caused by unique cases, for instance Bolivia, DRC and Nicaragua all experienced hyperinflation, whilst Rwanda's increase in aid followed genocide and Oman's extraordinary growth was caused by a short-run exploitation of oil reserves. Removing these outliers results in an interesting change to the significance of the policy variables, it transpires that the significance of the inflation variable (which was highly significant) and the education variable depends entirely on the outliers. As a robustness check I will therefore look at two scenarios; one where I consider all the policy variables (plausibly justified given the degree of multicollinearity between the variables) and one where I drop the inflation and education variables from the policy index (see Appendix 8 for information about the construction of these policy indices and the growth regressions).

d) Summary of results

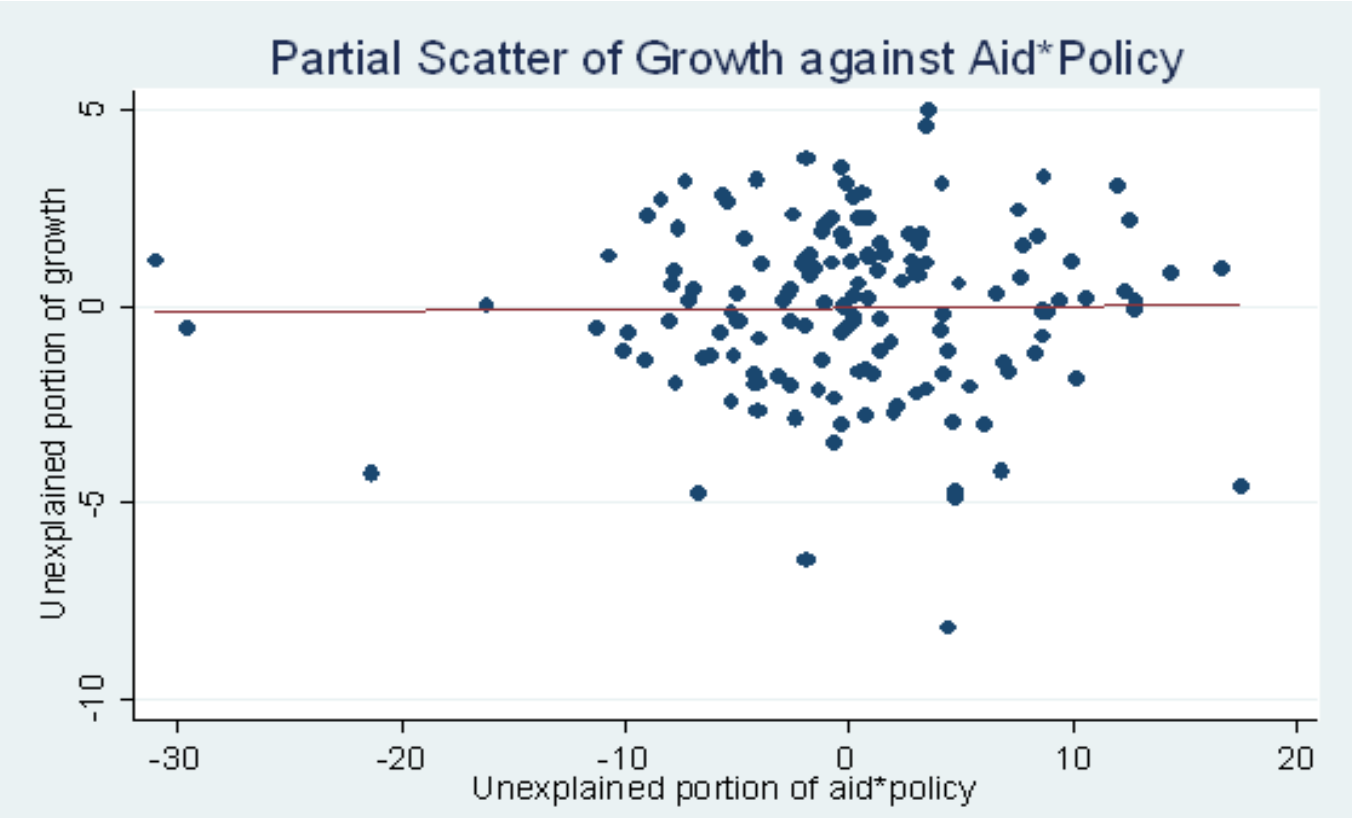
I can summarise these results by looking at the long-run impact of aid (and aid*policy) in the six econometric specifications that I have outlined.

Table Five

$\frac{\partial g^*}{\partial a^*}$	**Full dataset (original policy)**		**Outliers removed (original policy)**		**Outliers removed (different policy)**	
	(B) Table Four	**(C) Table Four**	**(D) Table Twelve**	**(E) Table Twelve**	**(F) Table Twelve**	**(G) Table Twelve**
Aid (F-value)	-0.11* (3.62)	-0.27 (1.14)	-0.16** (6.42)	-0.13* (3.12)	-0.18** (9.24)	-0.13 (0.24)
Aid*Policy (F-value)	-	0.04 (0.39)	-	0.01 (0.98)	-	-0.02 (0.05)
* Significant at 10% level ** Significant at 5% level						

The most interesting result here is that the impact of aid on growth is not dependent on the level of policy. The partial scatter graph, Diagram Two [from regression (C)], plots the unexplained portion of aid*policy (unexplained by other right-hand side variables) against the unexplained portion of growth. A data point where growth controlling for other factors is high and aid*policy (also controlling for other factors) is high implies that aid is more effective in a good policy environment. However there is no clear relationship between these residuals and therefore I cannot conclude that the impact of aid on growth is a function of the level of policy.

Diagram Two



Looking at the pure aid-growth relationship, initially (regressions D and F) aid appears to have a negative effect on growth but this loses most of its significance once the additional aid-policy variables are added (regressions E and G). As a result I cannot robustly conclude anything about the nature of the aid-growth relationship, which is in line with much of the empirical literature.

7. Extensions

Extensions to this paper would certainly touch on the impact of differing types of aid, for instance looking at the differences between bilateral and multilateral aid, the latter more often intended for developmental purposes. Minoiu and Reddy (2009) find that multilateral aid positively affects growth over the long run; it would be pertinent to fully explore the impact of different policy environments in this context. Secondly I would recommend developing a dataset with a sufficient quantity of data to allow lagging of the policy variable as it would be interesting to look at the impact of aid conditional on the policies in which the aid was given (as opposed to the current policy environment which was a necessary limitation of my dataset). Finally further work would also focus on looking in more detail at cross-country

differences (e.g. what exactly is it about Botswana that enables aid to be effective in this instance?) in order to further understand and apply the lessons from aid disbursement over the last 45 years to ensure that aid is more successful at promoting growth over the next 45 years.

8. Conclusion

In this paper I have considered two aspects of the aid debate; whether aid affects growth over the long run and whether aid is more effective in the presence of good policies. This paper adds to the growing literature that finds that Burnside and Dollar's 2000 result is not robust to a change in specification as I can find no evidence that aid is more effective in the presence of good policies. Overall I cannot conclude whether aid's effect on growth is positive or negative (or indeed whether there is an effect at all). This does not mean that I recommend an immediate cessation of aid but rather emphasise its current ineffectiveness in the majority of cases.

9. Bibliography

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10. Appendix

(1) Optimal Policy Tests

Table Six

	Sub-Saharan Africa	Middle East and North Africa	Asia
F-test of joint significance	1.61	2.37*	0.47
* Significant at 10% level ** Significant at 5% level			

(2) Serial Correlation Tests (Breusch-Godfrey)

I test for serial correlation in the growth, aid and policy equations. I calculate this by predicting the residuals from the equations and regressing it on the lag of the residual as well as all other variables. An F-test on the lagged-residual will be significant if there is serial correlation.

Table Seven

	Growth (aid excluded)	Growth (aid included)	Growth (aid and aid*policy included)	**Aid**	Policy
F-test (approx.)	1.1	0.1	0.2	**43.7**	0.5

These results clearly indicate that I should accept the null hypothesis of no serial correlation in all equations apart from the aid equation.

(3) Unit Root Tests (Dickey-Fuller)

I test for a unit root in the aid, policy and growth variables. This involves regressing the change in the variable on the variable's previous value (a constant is also included to capture time trends, i.e. this is a Model B test). One lag of change in the variable is also included to allow for serial correlation.

Table Eight

	Growth	**Aid**	**Policy**
Significance Value	-12.98	-2.96	-4.21

The special critical value in this instance (at the 5%) level is -2.86 so in all three instances I cannot accept the null hypothesis of a unit root.

(4) Endogeneity Tests (Durbin-Wu-Hausman)

(a) Policies-Growth

I first test for endogeneity between growth and policies. I use lagged policy variables as instruments, i.e. lagged black market premium and lagged inflation. The logic behind this is that lagged policy is relevant to current policy but not to current growth. Lagged education and lagged budget surplus are removed because they cannot be assumed to be exogenous to current growth. My first stage is to calculate the

policy regression and compute an F-test on the joint significance of the lagged policy variables (instruments) which reveals they are relevant instruments (F-value = 28.5). I then predict the residuals from the regression of policy on all exogenous variables and regress GDP per capita growth on all its relevant variables (including policy) and the policy residuals. If growth and policy are endogenous then I will find that the policy residuals are significant in this regression. My results indicate that this is not the case (t = 0.32) so the policy index can be assumed to be orthogonal at the 5% level to the error term in the growth equation (i.e. exogenous). I will therefore treat policy as exogenously determined in the growth equation. The final step is to check that the instruments are exogenous from the growth equation and to do this I use the Sargan test. This involves calculating the IV residuals and regressing these residuals on the exogenous variables and the instruments. I then take the R^2 (0.0127) and multiply it by the number of observations (164) before comparing it (2.08) to a chi-squared distribution where m is the number of endogenous variables (2) and k is the number of instruments (1):

$$nR^2 \sim \chi^2_{m-k}$$

I can use statistical tables to see that (at the 5% level) $\chi^2 =$ 3.84. As 2.08 < 3.84 I cannot reject the null hypothesis of instrument exogeneity. So the instruments used are relevant and exogenous so my Durbin-Wu-Hausman test is legitimate and I can confirm that I can treat policies as an exogenous variable in the growth equation.

(b) Aid-Growth

I now use exactly the same procedure to test for endogeneity between aid and growth. This time I use population, a dummy variable for the Franc zone, a dummy variable for Central America and a dummy variable for Egypt as instruments (I hypothesise that these variables only belong in the aid equation). When considering the growth equation without aid*policy interactive variables I find that these instruments are relevant to aid (F=17.8). Computing the Durbin-Wu-Hausman test (t = 0.90) reveals that aid can be assumed to be orthogonal at the 5% level to the error term in the growth equation (i.e. exogenous). I will therefore treat aid as exogenously determined in this growth equation (without the

interactive aid*policy variable). Furthermore a Sargan test reveals an R^2 of 0.003 using 148 observations therefore $nR^2 = 0.47$.

$$nR^2 \sim \chi^2_{m-k}$$

In this case k=1 and m=4 and I can use statistical tables to see that (at the 5% level) $\chi^2 = 7.81$. As $0.47 < 7.81$ I cannot reject the null hypothesis of instrument exogeneity. So my instruments are suitably exogenous and relevant in this equation.

When considering the growth equation with aid*policy interactive variables I find that these instruments (including population*policy) are relevant to aid (F=15.1) and to aid*policy (F=16.5) and furthermore a Sargan test reveals an R^2 of 0.0172 using 148 observations therefore $nR^2 = 2.55$.

$$nR^2 \sim \chi^2_{m-k}$$

In this case k=2 and m=5 and I can use statistical tables to see that (at the 5% level) $\chi^2 = 7.81$. As $2.55 < 7.81$ I cannot reject the null hypothesis of instrument exogeneity. So my instruments are suitably exogenous and relevant. Computing the Durbin-Wu-Hausman test (F=0.62) reveals that aid and aid*policy can be assumed to be orthogonal at the 5% level to the error term in this growth equation (i.e. exogenous). I will therefore treat aid as exogenously determined in all growth equations.

(5) Data Sources

Table Nine

Variable	Source	Manipulation
GDP (per capita, absolute and growth)	World Bank	Ln (absolute GDP)
Official Development Assistance (% of GDP)	World Bank	Divided by GDP (current $)
Budget surplus/deficit (% of GDP)	World Bank (supplemented by IMF)	Budget surplus (in local currency) divided by GDP (local currency)
Inflation (log)	World Bank	$Ln(1+\pi)$
Black Market Premium (log)	Levine (1997)	Ln (premium)
Education (number of students in primary education as a percentage of number of primary age children)	World Bank	
M2 (% of GDP)	World Bank	
Ethnic fractionalisation (probability that two randomly chosen individuals belong to different ethnic groups)	Levine (1997)	
Institutional quality (score)	Knack and Keefer (1995)	
Population (log)	World Bank	Ln (population)

(6) List of countries

Table Ten

Sub-Saharan Africa	Americas	Middle East/North Africa	Asia
Benin	Argentina	Algeria	China
Burkina Faso	Bolivia	Egypt	India
Chad	Chile	Iran	Indonesia
Burundi	Colombia	Israel	Malaysia
Cote d'Ivoire	Costa Rica	Jordan	Nepal
DRC	Dominica	Mauritania	Papua New Guinea
Ethiopia	Ecuador	Oman	Philippines
Gabon	El Salvador	Tunisia	Thailand
Ghana	Guatemala		
Kenya	Guyana		
Lesotho	Haiti		
Malawi	Honduras		
Mali	Jamaica		
Rwanda	Mexico		
Senegal	Nicaragua		
Sierra Leone	Paraguay		
Tanzania	Peru		
Togo	Uruguay		
Zambia	Venezuela		

(7) Outlier removal

Outliers were removed as a robustness check. The country/time periods removed include, for policy outliers, Bolivia (1980-1984), DRC (1990-1994) and Nicaragua (1990-1994), for growth outliers, Dominican Republic (1965-1969), Gabon (1970-1974) and Oman (1965-1969) and for aid outliers, Nicaragua (1985-1989), Sierra Leone (2000-2004) and Rwanda (1990-1994).

(8) Robustness checks

i) Outliers excluded (same policy index)

Taking a very similar approach to the initial investigation I first consider the impact of the individual policy variables on growth (see Table Eleven for results).

Table Eleven

	All variables included	**Inflation and education removed**
	Estimation Method: OLS Number of Observations: 164 R^2: 0.38	Estimation Method: OLS Number of Observations: 177 R^2: 0.35
	Dependent Variable: **GDP p.c. growth**	Dependent Variable: **GDP p.c. growth**
Initial GDP	-0.73** (0.32)	-0.45 (0.28)
Ethnic fractionalisation	-0.68 (0.96)	-0.51 (0.92)
Institutional Quality	0.24 (0.16)	0.19 (0.15)
M2/GDP (lagged)	0.001 (0.002)	0.003 (0.003)
Sub-Saharan Africa	-1.69** (0.66)	-1.68** (0.67)
East Asia	0.96 (1.02)	1.18 (0.96)
Budget Surplus	**0.11** **(0.06)**	**0.11*** **(0.06)**
Inflation	**-1.44** **(1.06)**	**-**
Black Market Premium	**-0.26**** **(0.12)**	**-0.33**** **(0.12)**
Education	**0.01** **(0.01)**	**-**
* Significant at 10% level ** Significant at 5% level		

I can therefore compute the following policy index:

$$Policy = 3.00 - 0.26 * Log\ of\ black\ market\ premium - 1.44 * Log\ inflation$$
$$+ 0.11 * Budget\ Surplus + 0.01 * Education\ Rate$$

Using this new policy index I repeat my analysis and look at the impact of aid on growth. From regression (D – Table Twelve) I can see that aid has a considerable (and, in this instance, significant at the 5% level) negative effect on growth:

$$\frac{\partial g^*}{\partial a^*} = -0.16$$

There are many reasons why aid may have a negative effect on growth, some of which were considered in the literature review. However when I consider the effect of aid in differing policy environments (E – Table Twelve);

$$\frac{\partial g^*}{\partial a^*} = -0.13 + 0.01 * policy$$

Neither of these coefficients can be considered to be statistically different from zero at the 5% level (although the estimate of the pure aid-growth relationship is significant at the 10% level).

ii) Outliers excluded (different policy index)

Removing black market premium and budget surplus from consideration results in the following policy index (see Table Eleven for results):

$$Policy = 3.45 - 0.33 * Log\ of\ black\ market\ premium + 0.11 * Budget\ Surplus$$

Using this new policy index I repeat my analysis and look at the impact of aid on growth. From regression (F - Table Twelve) I can see that aid again has a considerable (and significant at the 5% level) negative effect on growth:

$$\frac{\partial g^*}{\partial a^*} = -0.18$$

However when I consider the effect of aid in differing policy environments (G – Table Twelve);

$$\frac{\partial g^*}{\partial a^*} = -0.13 - 0.02 * policy$$

Once again I find that neither of these coefficients can be considered to be statistically different from zero.

Table Twelve

	(D)	(E)	(F)	(G)
	Estimation Method: OLS Number of Observations: 135 R^2: 0.39	Estimation Method: OLS Number of Observations: 135 R^2: 0.41	Estimation Method: OLS Number of Observations: 140 R^2: 0.39	Estimation Method: OLS Number of Observations: 140 R^2: 0.39
	Dependent Variable: **GDP p.c. growth**	Dependent Variable: **GDP p.c. growth**	Dependent Variable: **GDP p.c. growth**	Dependent Variable: **GDP p.c. growth**
Initial GDP	-1.03** (0.36)	-1.20** (0.36)	-1.18** (0.37)	-1.19** (0.38)
Ethnic Fractionalisation	-1.19 (1.09)	-1.38 (1.09)	-0.72 (1.08)	-0.68 (1.05)
Institutions	0.42** (0.16)	0.42** (0.16)	0.27* (0.16)	0.26 (0.17)
Sub-Saharan Africa	-1.10 (0.88)	-1.31 (0.89)	-1.37 (0.85)	-1.37 (0.85)
East Asia	1.07 (1.29)	0.94 (1.34)	0.31 (1.30)	0.19 (1.33)
Money (lagged)	0.01 (0.01)	0.01 (0.01)	0.02 (0.01)	0.02 (0.02)
Policy	0.01** (0.004)	0.002 (0.01)	0.91** (0.33)	0.98** (0.45)
Aid	**-0.27** (0.09)**	**-0.13 (0.12)**	**-0.21** (0.09)**	**-0.25 (0.29)**
Aid (lagged one period)	**0.28** (0.10)**	**0.12 (0.13)**	**0.19* (0.10)**	**0.25 (0.53)**
Aid (lagged two/three periods)	**-0.17** (0.09)**	**-0.12 (0.10)**	**-0.16** (0.08)**	**-0.12 (0.44)**
Aid*Policy	-	**0.01* (0.004)**	-	**0.02 (0.11)**
Aid (lagged one period)*Policy	-	**-0.01* (0.01)**	-	**-0.03 (0.18)**
Aid (lagged two/three periods)*Policy	-	**0.01 (0.01)**	-	**-0.02 (0.16)**
Prob > F (on results in bold)	0.002	0.004	0.002	0.01
* Significant at 10% level ** Significant at 5% level				