

# Aid, Policies, and Growth

*by Craig Burnside & David Dollar*  
*:AER(2000)*

***Presentation by Kuk Mo Jung***



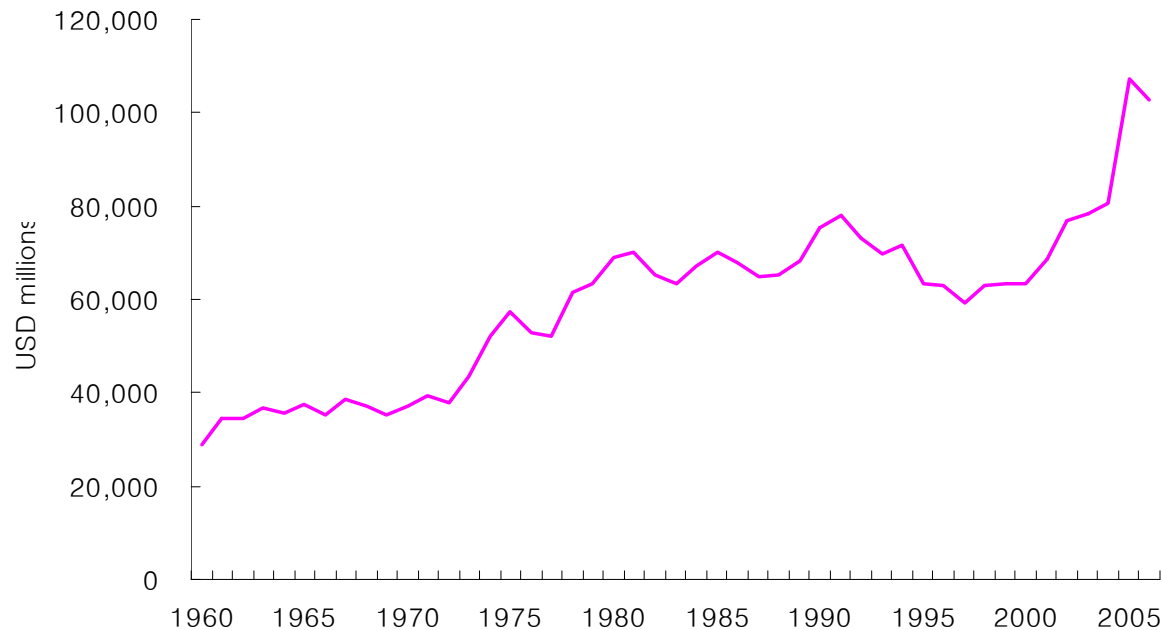
## **Contents**

- 1. Introduction**
- 2. Empirical Model and Data Sources**
- 3. Growth Regression Results**
- 4. Explaining the Allocation of Aid**
- 5. Conclusion**

## 1. Introduction

- After UN member states agreed on Millennium Development Goals (MDG) in 2001, Official Development Assistance (ODA) from rich countries to poor countries has been considerably increasing.

World ODA: 1960~2006



Source: OECD/DAC, International Development Statistics Online database, 2007



## 1. Introduction

- Therefore, the effectiveness of ODA (or foreign aid) is becoming a very important issue.
- However, a lot of studies show foreign aid has not raised growth rates in the typical poor country
- Burnside and Dollar(2000) try to refute these studies arguing aid does affect growth on the condition that recipient countries have sound policies
- By conducting econometric study of growth, aid and policies, they indeed found that aid has a positive impact on growth in developing countries with good fiscal, monetary and trade policies

## 2. Empirical Model and Data Sources

- Two basic questions this empirical study attempts to answer
  1. Is the effect of aid on growth conditional on economic policies?
  2. Do donor governments and agencies allocate more aid to countries with good policies?
- For the investigation of Q.1 & Q.2, they estimate the system of equations as follows

$$(1) \text{ Growth equation } g_{it} = y_{it}\beta_y + a_{it}\beta_a + \mathbf{P}'_{it}\beta_p + a_{it}\mathbf{P}'_{it}\beta_1 + \mathbf{Z}'_{it}\beta_z + g_t + \varepsilon_{it}^g$$

$$(2) \text{ Aid equation } a_{it} = y_{it}\gamma_y + \mathbf{P}'_{it}\gamma_p + \mathbf{Z}'_{it}\gamma_z + a_t + \varepsilon_{it}^a$$



## 2. Empirical Model and Data Sources

- Some econometric issues with regard to the system of equations
  1. Endogeneity: The error terms in Eq(1) and Eq(2) are likely to be correlated. So this study adopts both OLS and 2SLS
  2. Identification of the system: We need some exogenous variables that don't appear in both Eq(1) and Eq(2). So this study builds the specification of the system of equations such that excluded exogenous variables exist.
  3. Coefficients  $\beta_1$  on interactions terms in Eq(1): Hard to obtain precise estimates even with OLS. So this study constructed a policy index, one representative measure for economic policy

## 2. Empirical Model and Data Sources

- Modified version of system of equations
  1. First, a Policy Index needs to be constructed. The key feature of policy index is that it weights the policy variables according to their correlation with growth
  2. Do an OLS regression of the growth equation(Eq(1)) with no aid terms to get the policy index,  $p_{it} = P'_{it} b_p$  where  $b_p = \hat{\beta}_p^{OLS}$
  3. Then, we get the modified system of equations for estimation as follows

$$(3) \quad g_{it} = y_{it} \beta_y + a_{it} \beta_a + p_{it} \theta_p + a_{it} p_{it} \theta_1 + Z'_{it} \beta_Z + g_t + \varepsilon_{it}^g$$

$$(4) \quad a_{it} = y_{it} \gamma_y + p_{it} \phi_p + Z'_{it} \gamma_Z + a_t + \varepsilon_{it}^a$$

## 2. Empirical Model and Data Sources

### ■ Summary of estimation and Identification

TABLE 1—SUMMARY OF REGRESSION SPECIFICATIONS AND IDENTIFICATION

Variable	Equation			
	Variants of (4), growth			(5), aid
<b>Endogenous variables</b>				
Real growth rate	LHS	LHS	LHS	
Aid/GDP	RHS	RHS	RHS	LHS
(Aid/GDP) × policy		RHS	RHS	
(Aid/GDP) <sup>2</sup> × policy			RHS	
<b>Exogenous variables</b>				
Logarithm of initial income	Included	Included	Included	Included
Policy index	Included	Included	Included	Included
Institutional quality	Included	Included	Included	
Ethnic fractionalization	Included	Included	Included	
Assassinations	Included	Included	Included	
Ethnic fractionalization × assassinations	Included	Included	Included	
M2/GDP, lagged	Included	Included	Included	
Logarithm of population				Included
Arms imports/imports, lagged				Included
Sub-Saharan Africa dummy	Included	Included	Included	Included
East Asia dummy	Included	Included	Included	
Egypt dummy				Included
Franc zone dummy				Included
Central America dummy				Included
Logarithm of initial income × policy				
Logarithm of population × policy				
Arms imports/imports, lagged × policy				
(Logarithm of initial income) <sup>2</sup> × policy				
(Logarithm of population) <sup>2</sup> × policy				

*Notes:* LHS indicates that a variable is included as the left-hand-side variable. RHS indicates that a variable is included as a right-hand-side variable. All exogenous variables are used as instruments in 2SLS estimation.

### 3. Growth Regression Results

TABLE 4—GROWTH REGRESSIONS: USING ALL COUNTRIES AND THE POLICY INDEX

Estimation method	(3)		(4)		(5)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Initial GDP	-0.61 (0.56)	-0.79 (0.59)	-0.56 (0.56)	-0.71 (0.60)	-0.60 (0.57)	-0.90 (0.65)
Ethnic fractionalization	-0.54 (0.72)	-0.70 (0.75)	-0.42 (0.73)	-0.47 (0.83)	-0.42 (0.72)	-0.73 (0.81)
Assassinations	-0.44* (0.26)	-0.43 (0.27)	-0.45* (0.26)	-0.44* (0.26)	-0.45* (0.26)	-0.41 (0.27)
Ethnic fractionalization × assassinations	0.82* (0.44)	0.78* (0.44)	0.80* (0.44)	0.75* (0.45)	0.79* (0.44)	0.71 (0.45)
Institutional quality	0.64** (0.17)	0.63** (0.17)	0.67** (0.17)	0.68** (0.19)	0.69** (0.17)	0.66** (0.18)
M2/GDP (lagged)	0.014 (0.013)	0.019 (0.015)	0.016 (0.014)	0.025 (0.017)	0.012 (0.014)	0.017 (0.016)
Sub-Saharan Africa	-1.60** (0.73)	-1.31* (0.72)	-1.84** (0.74)	-1.71** (0.82)	-1.87** (0.75)	-1.29 (0.84)
East Asia	0.91* (0.54)	0.81 (0.53)	1.20** (0.58)	1.27** (0.63)	1.31** (0.58)	1.15** (0.56)
Policy index	1.00** (0.14)	1.01** (0.14)	0.78** (0.20)	0.65** (0.30)	0.71** (0.19)	0.74** (0.20)
Aid/GDP	0.034 (0.12)	-0.12 (0.18)	0.49 (0.12)	-0.10 (0.21)	-0.021 (0.16)	-0.32 (0.36)
(Aid/GDP) × policy	—	—	0.20** (0.09)	0.37 (0.33)	0.19** (0.07)	0.18* (0.10)
(Aid/GDP) <sup>2</sup> × policy	—	—	-0.019** (0.0084)	-0.038 (0.038)	—	—
Partial R <sup>2</sup> of first-stage regressions						
Aid/GDP	—	0.44	—	0.42	—	0.29
(Aid/GDP) × policy	—	—	—	0.16	—	0.60
(Aid/GDP) <sup>2</sup> × policy	—	—	—	0.11	—	—
Test for exogeneity of the aid variables						
χ <sup>2</sup> (j)	—	1.10 [0.29]	—	0.85 [0.84]	—	1.51 [0.47]
Other statistics						
Observations	275	275	275	275	270	270
R <sup>2</sup>	0.36	0.35	0.36	0.34	0.36	0.35

Notes: The variables are described in more detail in the text. The dependent variable is real per capita GDP growth. The excluded exogenous variables for 2SLS estimation are listed in Table 1. White heteroskedasticity consistent standard errors are in parentheses. *p*-values for the tests of exogeneity appear in brackets. The degrees of freedom parameter *j* is 1 in column (3), 3 in column (4), and 2 in column (5).

\* Significant at the 10-percent level.

\*\* Significant at the 5-percent level.



### 3. Growth Regression Results

- Some important results to notice
  - No significant relationship between aid and growth regardless of OLS and 2SLS
  - However, aid interacted with policy has a significant positive coefficient while the quadratic term has a significantly negative coefficient. This implies the impact of aid on growth is a positive function of the level of policy and a negative function of the level of aid.
  - The cross derivative of growth with respect to aid and policy is significantly positive
  - The 2SLS regression loses significance of the coefficients on the aid variables. This is due to weak instruments used for 3 RHS variables

### 3. Growth Regression Results

- Robustness Check

- When five big outliers are omitted in the sample, the coefficient on aid\*policy is highly significant in both the OLS and the 2SLS regression

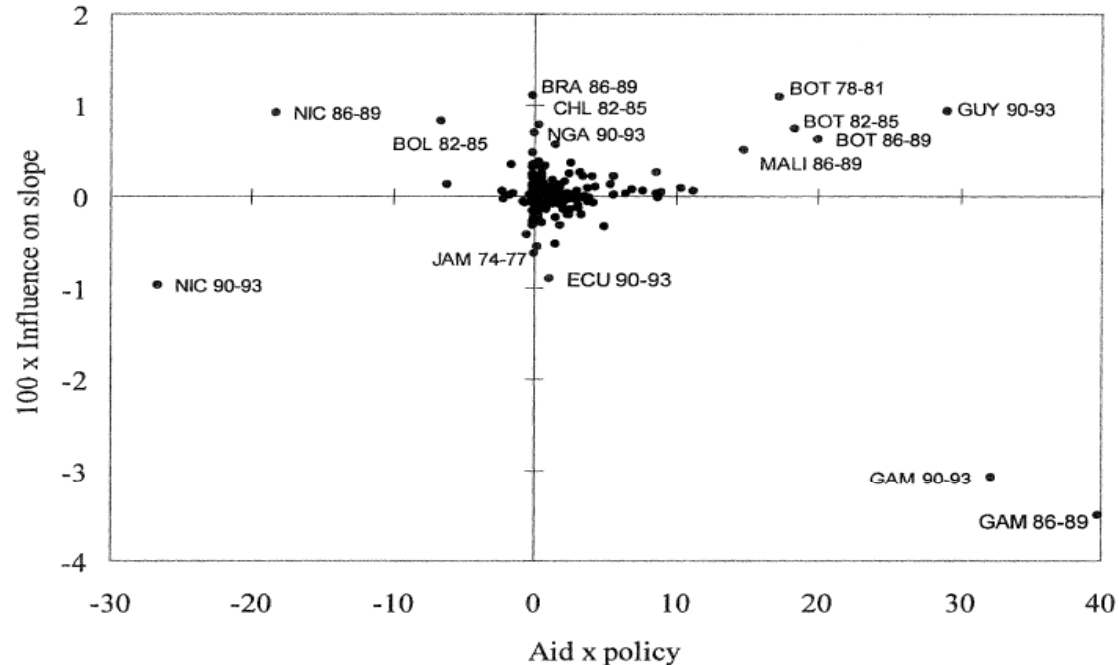


FIGURE 1. OUTLIERS IN THE AID  $\times$  POLICY DIMENSION

Notes: The y-axis illustrates the influence of each observation on the slope coefficient on the interaction term, aid  $\times$  policy, when the quadratic interaction term is omitted from the regression. Influence is defined as the difference in the slope coefficient when each observation is omitted. The x-axis is the value of aid  $\times$  policy for each observation. Country mnemonics (used in World Bank publications) are given along with time periods for some important points.

### 3. Growth Regression Results

- Robustness Check
  - When the sample is restricted to low-income countries, most estimation results are very similar to all country case

TABLE 5—GROWTH REGRESSIONS: USING LOWER-INCOME COUNTRIES AND THE POLICY INDEX

Estimation method	(6)		(7)		(8)	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Initial GDP	-0.74 (0.80)	-0.74 (0.78)	-0.60 (0.79)	-0.58 (0.78)	-0.72 (0.81)	-0.83 (0.77)
Ethnic fractionalization	-0.78 (0.81)	-0.78 (0.83)	-0.56 (0.80)	-0.45 (0.95)	-0.58 (0.80)	-0.67 (0.84)
Assassinations	-0.75* (0.46)	-0.75* (0.45)	-0.84* (0.43)	-0.90** (0.45)	-0.79* (0.44)	-0.76* (0.44)
Ethnic fractionalization × assassinations	0.95 (0.89)	0.95 (0.89)	0.88 (0.90)	0.85 (0.90)	0.69 (0.91)	0.63 (0.90)
Institutional quality	0.77** (0.19)	0.77** (0.19)	0.80** (0.20)	0.81** (0.21)	0.84** (0.20)	0.84** (0.19)
M2/GDP (lagged)	0.028* (0.016)	0.028* (0.016)	0.031* (0.017)	0.035* (0.019)	0.024 (0.017)	0.025 (0.017)
Sub-Saharan Africa	-1.86** (0.65)	-1.85** (0.67)	-2.20** (0.67)	-2.35** (0.91)	-2.24** (0.67)	-2.11** (0.73)
East Asia	0.70 (0.56)	0.69 (0.56)	1.33* (0.71)	1.63 (1.21)	1.54** (0.67)	1.46** (0.71)
Policy index	1.14** (0.19)	1.14** (0.19)	0.74** (0.35)	0.55 (0.76)	0.56* (0.31)	0.59 (0.38)
Aid/GDP	-0.033 (0.13)	-0.034 (0.16)	-0.013 (0.13)	-0.010 (0.17)	-0.18 (0.17)	-0.24 (0.26)
(Aid/GDP) × policy	—	—	0.27** (0.12)	0.43 (0.49)	0.26** (0.08)	0.25** (0.12)
(Aid/GDP) <sup>2</sup> × policy	—	—	-0.024** (0.0093)	-0.041 (0.047)	—	—
Partial R <sup>2</sup> of first-stage regressions						
Aid/GDP	—	0.57	—	0.56	—	0.39
(Aid/GDP) × policy	—	—	—	0.11	—	0.58
(Aid/GDP) <sup>2</sup> × policy	—	—	—	0.09	—	—
Test for exogeneity of the aid variables						
χ <sup>2</sup> (j)	—	0.00 [0.99]	—	0.04 [1.00]	—	0.24 [0.89]
Other statistics						
Observations	189	189	189	189	184	184
R <sup>2</sup>	0.42	0.42	0.42	0.42	0.42	0.42

Notes: The variables are described in more detail in the text. The dependent variable is real per capita GDP growth. The excluded exogenous variables for 2SLS estimation are listed in Table 1. White heteroskedasticity-consistent standard errors are in parentheses. *p*-values for the tests of exogeneity appear in brackets. The degrees of freedom parameter *j* is 1 in column (6), 3 in column (7), and 2 in column (8).

\* Significant at the 10-percent level.

\*\* Significant at the 5-percent level.

### 3. Growth Regression Results

- Robustness Check
  - Yet, policy seems to be more important for aid effectiveness in lower-income countries.

TABLE 6—THE IMPACT OF AID AND POLICY ON GROWTH

Regression	Method	Derivative of growth with respect to			
		Aid/GDP		Policy	
A. In regressions without interaction terms					
All countries (3)	OLS	0.03 (0.12)		1.00 (0.14)	
	2SLS	-0.12 (0.18)		1.01 (0.14)	
Lower-income countries (6)	OLS	-0.03 (0.13)		1.14 (0.19)	
	2SLS	-0.03 (0.16)		1.14 (0.19)	
B. In regressions with simple and quadratic interaction terms					
		At policy = 1.2	At policy = 2.4	Difference	At aid = 1.6
All countries (4)	OLS	0.21 (0.19)	0.39 (0.26)	0.18* (0.10)	1.06 (0.17)
	2SLS	0.20 (0.39)	0.51 (0.63)	0.32 (0.26)	1.15 (0.23)
Lower-income countries (7)	OLS	0.21 (0.18)	0.44* (0.27)	0.24** (0.12)	1.10 (0.24)
	2SLS	0.34 (0.47)	0.71 (0.88)	0.37 (0.43)	1.13 (0.23)
C. In regressions with simple interaction terms					
		At policy = 1.2	At policy = 2.4	Difference	At aid = 1.6
All countries (5)	OLS	0.20 (0.15)	0.43** (0.18)	0.23** (0.09)	1.01 (0.14)
	2SLS	-0.12 (0.31)	0.11 (0.31)	0.22* (0.13)	1.02 (0.15)
Lower-income countries (8)	OLS	0.13 (0.15)	0.47** (0.20)	0.33** (0.11)	0.99 (0.22)
	2SLS	0.05 (0.22)	0.37 (0.27)	0.32** (0.15)	1.00 (0.24)

\* Significantly greater than 0 at the 10-percent level.  
 \*\* Significantly greater than 0 at the 5-percent level.

### 3. Growth Regression Results

- Economic meaning of the estimates of the impact of aid on growth

- Given the aggregate production function of the form

$$Y = A K^\theta$$

- 1<sup>st</sup> order approximation to the effect of aid on growth equals

$$d Y = \theta A K^{\theta-1} \frac{\partial K}{\partial F} d F$$

- Since  $\theta A K^{\theta-1} = MPK = r + \delta$  the derivative of growth wrt aid can be interpreted as a following

$$(r + \delta) \left( \frac{\partial K}{\partial F} \right)$$

- This implies that when return to capital and a marginal propensity to save are high, impact of aid on growth can be bigger. Good policies are correlated with both terms so good polices matter for the impact of growth

## 4. Explaining aid allocation

TABLE 8—ALLOCATION OF AID: LOWER-INCOME COUNTRIES

	Total	Bilateral	Multilateral	World Bank
Initial GDP	-2.43** (0.44)	-1.11** (0.27)	-1.32** (0.27)	-0.47** (0.080)
Population	-0.84** (0.14)	-0.45** (0.082)	-0.39** (0.084)	-0.079** (0.018)
Policy	0.20 (0.16)	0.061 (0.12)	0.14** (0.062)	0.040** (0.020)
Sub-Saharan Africa	0.082 (0.38)	0.43 (0.26)	-0.34 (0.25)	-0.12* (0.068)
Egypt	1.81** (0.56)	1.60** (0.45)	0.21 (0.19)	0.10 (0.071)
Franc zone	0.54 (0.50)	0.34 (0.36)	0.19 (0.18)	0.040 (0.098)
Central America	0.28 (0.40)	0.52 (0.34)	-0.23 (0.21)	-0.060 (0.072)
Arms imports (lagged)	0.012 (0.018)	0.011 (0.014)	0.0006 (0.0044)	-0.0028* (0.0015)
Observations	195	195	195	195
Mean of aid/GDP	2.07	1.38	0.69	0.17
$\bar{R}^2$	0.61	0.53	0.55	0.50

*Notes:* The estimates were obtained by OLS. The variables are described in the text. The dependent variable is the indicated type of aid as a percentage of GDP. Standard errors are in parentheses. They were computed to be robust to heteroskedasticity and first-order serial correlation.

\* Significant at the 10-percent level.

\*\* Significant at the 5-percent level.



## 4. Explaining aid allocation

- Some important results to notice
  - Policy has a significant positive coefficient only for multilateral aid and World Bank aid
  - For bilateral aid, there is an insignificant coefficient on policy
  - The donor interest variables are more important for bilateral than for multilateral aid as shown by coefficients on regional dummy variables
  - From additional regression (GV consumption on various variables), it is shown that bilateral aid associated with donor interests increases GV consumption. But GV consumption has no significant effect on growth. This probably explains why aid has not been effective



## 5. Conclusion

- More positive impact on growth in good policy environment
- No significant tendency for aid to favor good policy
- Making aid more systematically conditional on the quality of policies would likely increase its impact on developing country
- Further research on relation between aid effectiveness and government policies through the lens of corruption is needed.