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Aid and Growth in Fragile States

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Abstract

The literature on aid has come a long way in recent years, and as a result we now know much more about aid effectiveness than possibly ever before. But significant gaps in knowledge remain. One such gap is the effectiveness of aid in the so-called ‘fragile states’, countries with critically low policy and institutional performance ratings. The current paper addresses this void by examining possible links between aid and economic growth in fragile states. It finds that: (i) growth would have been 1.4 percentage points lower in highly fragile states in the absence of aid to them, compared to 2.5 percentage points in other countries; (ii) highly fragile states from a per capita income growth perspective can only efficiently absorb approximately one-third of the amounts of aid that other countries can, and; (iii) while from the same perspective most fragile states are under-aided, to the extent that they could efficiently absorb greater amounts of aid than they currently receive, many of the highly fragile states are substantially over-aided in this sense. The overall conclusion is that donors need to look very closely at their aid to the sub-set of fragile states deemed in this paper as highly fragile.

Keywords: foreign aid, economic growth, fragile states, policies, absorptive capacity

JEL classification: E60, F35, O11, O40, O43

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Acronyms

| | |
|------|--|
| CPIA | World Bank's country policy and institutional assessment |
| GMM | general method of moments |
| IV | instrumental variables |
| MDGs | Millennium Development Goals |
| ODA | official development assistance |

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1 Introduction

For many decades the research literature on the country-level impacts of aid sent mixed messages as to whether aid was effective in promoting economic growth. Some empirical studies found evidence of a positive association between aid and recipient country growth (Papanek 1973; Dowling and Hiemenz 1982; Gupta and Islam 1983; Levy 1987, 1988). Other empirical studies either failed to find any association or if they did, found that it was negative (Rahman 1968; Griffin 1970; Gupta 1970; Weisskopf 1972; Voivodas 1973; Mosley 1980; Mosley et al. 1987; and Boone 1996).¹ The second group of studies had support from non-empirical research, with many influential writers providing damning critiques of aid, from both left and right wing perspectives (Friedman 1970; Hayter 1971; Hensman 1971; Bauer 1981, 1991; and Hancock 1989, among many other writers). The lack of a consensus regarding the country-level impact of aid combined with strong evidence that aid projects were in general effective in attaining their intended outcomes, was described as the ‘micro-macro paradox’ of aid (Mosley 1986). This paradox was widely accepted in the aid policy and research circles.

The late 1990s saw a fundamental change in the literature on aid and growth. Commencing with the publication of the seminal and extremely influential study by Burnside and Dollar (1997), a new stream of empirical studies emerged that provides a reasonably clear, unambiguous message that growth would on average be lower in the absence of aid. This has proved to be an especially robust research finding drawn by the clear majority of an increasingly large number of empirical studies of aid and growth conducted since Burnside and Dollar (1997). The consistency of this finding across studies is evident from a number of aid-growth literature surveys (Hansen and Tarp 2000; Morrissey 2001; Beynon 2002; McGillivray 2003; Clemens, Radelet and Bhavnani 2004; Addison, Mavrotas and McGillivray 2005; McGillivray et al. 2006). The macro-micro paradox of aid would appear to be dead and buried, therefore.

The macro-micro paradox’s demise does not imply that there are no remaining controversies or gaps in knowledge regarding aid effectiveness within research circles that aid works in all countries and at all levels.² A repeated finding of the recent aid-growth literature is that there is an inverted U-shaped relationship between aid and growth. It is not beyond the bounds of imagination to infer that the levels of inflows to some countries are such that aid might have actually reduced growth within them. A disputed finding in the literature, which to date remains unsettled, is that the impact of aid on growth is contingent on the policy regimes of recipient countries. Burnside and Dollar (1997, 2000, 2004); Collier and Dollar (2001, 2002) and Collier and Hoeffler (2004) are among the studies that find that policies do matter, while Hansen and Tarp (2001); Hudson and Mosley (2001); Dalgaard, Hansen and Tarp (2004) and Easterly, Levine and Roodman (2004) are among those that find otherwise.

¹ A number of the studies just cited do not look directly at growth but instead at either investment or savings within a Harrod-Domar framework. Increases in either investment or savings necessarily translate into growth in this framework.

² Nor should it be overlooked that there are those who either flatly reject or question the view that growth would be lower in the absence of aid. See, for example, Brumm (2003); Easterly (2003); Ovaska (2003) and Rajan and Subramanian (2005).

The donor community seems to side with the first group of above-mentioned studies, to the extent that it expresses grave concerns regarding the extent to which aid can promote growth, and in turn reduce income poverty, in countries it classifies as ‘fragile states’. These states are diverse in many respects. Some are engaged in, on the verge of, or have recently emerged from a civil war. Others have histories of military coups or are governed by corrupt, inept or oppressive regimes. Others are small states with limited resource endowments, or those that suffer from droughts and other natural hazards. In addition they tend to be especially income poor, with most belonging to the low-income country group. But, compared with other aid-receiving countries, all are thought to use aid poorly and to have lower capacities to absorb aid efficiently due to having especially bad policies and especially poorly performing institutions or both, as measured by the well-known World Bank country policy and institutional assessment (CPIA) measure.³ Donors insist that unless aid can be made to work better in these countries, worldwide achievement of the much espoused Millennium Development Goals (MDGs) will not be possible in the foreseeable future, let alone by the agreed target of 2015.⁴

The analytics of the donor view can be interpreted in various ways. But a consistent interpretation is that while the quality of policies and institutional performance are in general important for aid effectiveness, they are additionally important in countries with critically low CPIA scores. Alternative interpretations are that the quality of policies and institutional performance matter only at critically low CPIA scores, or that it is only fragility per se that matters. Each of these views is consistent with the hypothesis that aid effectiveness behavioural relationships are different in fragile states: a given amount of aid to or interaction between aid and policies in a fragile state yields less growth (and, by implication, poverty reduction) than in a non-fragile one. Yet this view has not been examined in the now rather large aid-growth and related literatures.⁵ This is not to imply that it is wrong or without foundation, just that it is yet to be put to formal, systematic country-wide empirical scrutiny.

Such is the primary focus of this paper. It consists of four more sections. Section 2 outlines an aid-growth econometric model, which is essentially an augmentation of that originally used by Burnside and Dollar (1997, 2000). Fragility is factored in to this model and donor views regarding aid effectiveness in fragile states are presented formally. Section 3 discusses econometric and data issues. Results are provided in

³ It is evident from this discussion that the term ‘fragile state’, as used in the donor community, might be misleading, to the extent that it is not used to delineate states only in terms of their likelihood of breaking-up or vulnerability to downside shocks.

⁴ According to one of the two classification criteria currently used by the donor community, 46 countries were classified as fragile states in 2004. Roughly one-third of the world’s population that live in extreme income poverty, some 340 million people, reside in these states. Of the estimated 10.8 million children in 2002 who died before their fifth birthday, just over 40 per cent lived in these 46 states (Branchflower et al. 2004).

⁵ Burnside and Dollar (1997, 2000, 2004) conclude that aid does not work in countries with bad policies. To the extent that these countries are at the bottom end of the Burnside and Dollar policy index will include some fragile states, one might be able to infer from their results that aid works less well or not at all in these states. But Burnside and Dollar, Collier and Dollar (2001, 2002) and the other studies that look at the importance of policy for aid effectiveness do not look directly at fragile states nor look for changes in the above-mentioned behavioural relationships. Collier and Hoeffler (2004) look at aid and growth in post-conflict countries, but not all post-conflict countries are classified as fragile and vice versa.

Section 4 and conclusions outlined in section 5. Among the main results emerging from this paper is that although aid is associated with growth in fragile states, it is associated with much higher growth in non-fragile ones. The former also have much smaller aid absorptive capacities than their non-fragile counterparts. These results, however, are based on a sub-set of the states classified as fragile by the donor community. That sub-set consists of countries that might be termed as highly fragile, as they have been selected using a lower threshold than currently adopted by the donor community.

2 Aid-growth empirics

The empirical literature on links between aid and growth and related variables has in recent years been dominated by the analysis of panel data using what might be termed as a Burnside and Dollar (1997, 2000) type economic model. A defining feature of this model is that it contains one or more multiplicative terms. These terms are constructed by interacting aid with key variables, on which the impact of aid is thought to be contingent. Such an approach is clearly no panacea.⁶ It is however of considerable appeal to the analysis of aid and growth in fragile states due to the realities of developing country empirical data.⁷ The starting point to the current analysis is, therefore, what can be termed as a Burnside and Dollar type aid-growth model, augmented with fragility variables. Two versions of the model are posited, based on the interpretations of the donor view of aid effectiveness in fragile states outlined above. These versions can be written as follows:

$$g_i = \beta_0 + \beta_1 a_i + \beta_2 a_i^2 + \beta_3 (a_i \cdot p_i) + \beta_4 (a_i \cdot p_i \cdot f_i) + \beta_5 \Phi_i + \beta_6 \Pi_i + \mu_i \quad \text{and} \quad (1)$$

$$g_i = \delta_0 + \delta_1 a_i + \delta_2 a_i^2 + \delta_3 (a_i \cdot f_i) + \delta_4 (a_i \cdot f_i)^2 + \delta_5 \Phi_i + \delta_6 \Pi_i + \varepsilon_i \quad (2)$$

where g_i is per capita GDP growth in recipient country i , a_i is aid to that country, p_i is an assessment of i 's policies and institutional performance, f_i is an indicator of whether or not i is classified by the donor as a fragile state, Φ_i is a vector of additional aid interaction terms, Π_i is vector of control variables relating to growth in i , μ_i and ε_i are residuals, β_0 and δ_0 are constants, β_1 through to β_5 and δ_1 through to δ_5 are slope coefficients and $i = 1, \dots, n$. All variables are for period t . The elements of Φ_i are the products of aid and other variables. They are constructed in the same way as the interactions attached to β_3 , β_4 , δ_3 and δ_4 in (1) and (2). As already mentioned, a common finding in the literature is that an inverted U-shaped relationship exists between aid and growth, due primarily to recipient country absorptive capacity constraints. Given the considerable empirical support for this view it is expected that $\beta_1 > 0$, $\delta_1 > 0$, $\beta_2 < 0$ and

⁶ It has also had its critics and is subject to some widely accepted limitations such as treating aid from different donors as analytically equivalent and not being able to take into account changes in the composition of aid over time. There are of course the ever-present concerns over the reliability of the data used. Roodman (2004) provides an incisive methodological critique of a number of recent studies, and warns of the limits of panel data analyses of aid and growth.

⁷ Other approaches might include the analysis of fragile state-specific timeseries data or a panel only containing data for fragile states. Data availability rules out these approaches. Analysis of timeseries data is in particular ruled out given the extreme difficulty of obtaining long-run relationships.

$\delta_2 < 0$. Aid is assumed to be less effective in fragile states, following the views of the donor community. It is therefore expected that $\beta_4 < 0$, $\delta_3 < 0$ and $\delta_4 < 0$.

The fragile state variable is a binary dummy constructed as follows:

$$\begin{aligned} f_i &= 1 & \text{if } p_i \leq p^* \text{ and } y_i \leq y^* \\ &= 0 & \text{otherwise} \end{aligned} \quad (3)$$

where p^* and y^* are CPIA and per capita income thresholds, respectively, used by the donor community to classify a country as a fragile state in any given period t .

Given equations (3), it follows that (1) and (2) can be written, respectively, as follows

$$g_i = \beta_0 + \beta_1 a_i + \beta_2 a_i^2 + (\beta_3 + \beta_4)(a_i \bullet p_i) + \beta_5' \Phi_i + \beta_6' \Pi_i + \mu_i \quad \text{and} \quad (1a)$$

$$g_i = \delta_0 + (\delta_1 + \delta_3) a_i + (\delta_2 + \delta_4) a_i^2 + \delta_5' \Phi_i + \delta_6' \Pi_i + \varepsilon_i \quad (2a)$$

for the $i = 1, \dots, k$ countries for which $f_i = 1$ and reduce to

$$g_i = \beta_0 + \beta_1 a_i + \beta_2 a_i^2 + \beta_3 (a_i \bullet p_i) + \beta_5' \Phi_i + \beta_6' \Pi_i + \mu_i \quad \text{and} \quad (1b)$$

$$g_i = \delta_0 + \delta_1 a_i + \delta_2 a_i^2 + \delta_5' \Phi_i + \delta_6' \Pi_i + \varepsilon_i \quad (2b)$$

for the $i = k+1, \dots, n$ countries for which $f_i = 0$.

The incremental rates of growth in fragile and non-fragile states due to aid, according (1a) and (1b), are:

$$g_i^{af} = \frac{\partial g_i}{\partial a_i} = \beta_1 + 2\beta_2 a_i + (\beta_3 + \beta_4) p_i \quad \text{and} \quad (3a)$$

$$g_i^{anf} = \frac{\partial g_i}{\partial a_i} = \beta_1 + 2\beta_2 a_i + \beta_3 p_i \quad (3b)$$

respectively. From (2a) and (2b) the equivalent incremental rates of growth are:

$$i g_i^{af} = \frac{\partial g_i}{\partial a_i} = \delta_1 + \delta_3 + 2(\delta_2 + \delta_4) a_i \quad \text{and} \quad (4a)$$

$$i g_i^{anf} = \frac{\partial g_i}{\partial a_i} = \delta_1 + 2\delta_2 a_i \quad (4b)$$

respectively.

The levels of aid that maximize per capita GDP growth according to (1) and (2) occur when $\partial g/\partial a_i = 0$. From (1a) and (1b) it follows that these levels, the growth efficient aid levels, are:

$$a_i^{*f} = \frac{-\beta_1}{2\beta_2} - \frac{(\beta_3 + \beta_4)P_i}{2\beta_2} \quad \text{and} \quad (5a)$$

$$a_i^{*nf} = \frac{-\beta_1}{2\beta_2} - \frac{\beta_3 P_i}{2\beta_2} \quad (5b)$$

respectively. From (2a) and (2b) the equivalent aid levels are:

$$a_i^{f*} = \frac{-(\delta_1 + \delta_2)}{2(\delta_2 + \delta_4)} \quad \text{and} \quad (6a)$$

$$a_i^{nf*} = \frac{-\delta_1}{2\delta_2} \quad (6b)$$

respectively. These levels are interpreted as an indicator of the capacity to efficiently absorb aid.

If $\beta_1 > 0$, $\beta_2 < 0$, $\beta_4 < 0$, $\delta_1 > 0$, $\delta_2 < 0$, $\delta_3 < 0$ and $\delta_4 < 0$, it follows that $ig_i^{af} < ig_i^a$ and $a_i^{f*} < a_i^*$. These are the donor views, formally depicted, regarding the effectiveness of aid and absorptive capacity constraints in fragile states relative to their aid-receiving non-fragile counterparts. An empirical evaluation of these views is conducted later in this paper by estimating equations (1) and (2) and conducting standard hypothesis tests. Also conducted is an evaluation of the appropriateness of the donor community's chosen policy threshold, p^* .

3 Data, preliminary tests and econometric method

The parameters of equation (1) were estimated using 1977 to 2001 aggregate aid receipts to a diverse sample of 113 countries. This period was chosen purely on the basis of data availability. The measure of aid used is net disbursements of official development assistance (ODA), expressed as a ratio of recipient country GDP.⁸ The measure of policy and institutional performance employed is the CPIA. There appears to be a high degree of uniformity in the post Burnside and Dollar (1997) literature regarding the likely determinants of growth other than aid. Recent studies are followed in selecting elements of the control variable vector, Π_i . The following variables were selected, all for recipient i : (i) policy stance; (ii) initial GDP per capita; (iii) initial population; (iv) ethno-linguistic fractionalization; (v) assassinations; (vi) money supply;

⁸ Given some of the estimates reported below it is instructive to note that: (i) aid relative to GDP to the countries in the above sample has remained reasonably stable over time (averaging 8, 9 and 10 per cent over the 1970s, 1980s and 1990s, respectively); and (ii) that it is not uncommon in this sample for countries to receive aid that is more than 40 per cent of GDP.

(vii) the interaction of ethno-linguistic fractionalization and assassinations; (viii) institutional quality; (ix) fraction of land area that is tropical, (x) a binary variable taking the value of one for all Sub-Saharan African countries and zero for all others, and (xi) a binary variable taking the value of one for all East Asian countries and zero for all others. The time-variant data are expressed as four year averages, as has become the convention in the aid-growth literature. Such a treatment reduces the likelihood of outliers. Further details of the aid variable and all other variables finally used in the econometric analysis are given in Appendix Table A1.

The international donor community currently uses two fragile state classifications. The first deems a country fragile if it belongs to bottom two quintiles of CPIA scores or has not been rated in the current CPIA exercise. The income threshold (y^*) for this classification is implicit and non-operative, being at a level to deem a country eligible to receive aid per se. The second deems a country fragile if it is a low-income country that has a CPIA score of 3.0 or less (Branchflower et al. 2004).⁹ Values of p^* and y^* consistent with these classifications were used to construct two fragile state variables using the procedure outlined in equation (3) above. Thirty-four of the countries in the overall sample of 113 countries were fragile according to these definitions. The above threshold values were initially used in the regression analysis, although alternative fragile state classifications, based on different values of p^* , were also used. Further details are given in Appendix Table A1.

A number of aid interaction terms like those in equations (1) and (2) have been popular in the aid-growth literature, subsequent to Burnside and Dollar (1997, 2000). That study interacted aid and a measure of recipient country policy. Subsequent studies have, for example, interacted aid with trade shocks (Collier and Dehn 2001), economic vulnerability and political instability (Guillaumont and Chauvet 2001; Chauvet and Guillaumont 2002), post-conflict and post-conflict and policy (Collier and Hoeffler 2004), tropical area (Dalgaard, Hansen and Tarp 2004) and institutional quality and initial income per capita (Clemens, Radelet and Bhavnani 2004). Most studies have interacted aid with one or two variables only. Clemens, Radelet and Bhavnani (2004) is an exception to this general rule, interacting aid not only with institutional quality and initial income per capita but a range of other variables. The approach adopted by Clemens, Radelet and Bhavnani (2004) was to examine the relevance of each interaction one at a time, in separate regressions. The interactions do not appear, therefore, simultaneously in a single regression equation. There appears to be a good case for adopting that approach, based on this paper's preliminary testing. The above interactions are highly inter-correlated and highly correlated with aid and aid-squared, to such an extent that it is problematic econometrically to include more one interaction in a single regression. The upshot of this preliminary testing was that in subsequent estimation, for which results are reported below, the elements of β_5 are restricted to zero.¹⁰ Subsequent estimation cautiously persists, however, with the aid-policy, aid-fragility and aid-policy-fragility interactions since they are a prime interest of the paper.

⁹ These are also the criteria that the World Bank uses to allocate a country to the low-income country under stress (LICUS) group.

¹⁰ Estimation was also conducted along the lines of that reported in Clemens, Radelet and Bhavnani (2004). This involved using 'short impact' aid variable instead of an aggregate aid variable such as total ODA. The former variable is obtained by summing those aid inflows that are thought to have the

Recent aid-growth studies use either or both of the general method of moments (GMM) and instrumental variables (IV) to estimate the parameters of their econometric models. IV had been the preferred approach of many previous aid-growth studies, owing to the likely endogeneity of the aid variable. GMM is the preferred approach of the current study on the grounds provided by Hansen and Tarp (2001). They accept that aid is likely to be endogenous, but also argue that any policy variables in period t are likely to be correlated with shocks in earlier periods, violating the assumption that all variables other than aid are exogenous and not therefore correlated with the error term. Such a correlation implies that an IV approach will yield inconsistent parameter estimates. GMM is not subject to this criticism as it provides estimates that are consistent in the presence of one or more endogenous regressors. This specific variant of GMM used in the current paper is a two-step system GMM proposed by Blundell and Bond (1998) and extended by Roodman (2005), which is thought to be more efficient than a single-step approach. In that system, equations are first differenced to eliminate unobserved country effects. The Windmeijer (2005) finite sample correction to the two-step covariance matrix is applied. A cost of using this approach is that all time invariant variables cannot be used in econometric model. The choice of variables used to instrument foreign aid in the IV estimation largely follows Burnside and Dollar (2000); Hansen and Tarp (2001) and Clemens, Radelet and Bhavnani (2004).¹¹

4 Results

GMM estimates of variants of equations (1) and (2) are shown in Table 1. The results reported in columns 1 to 4 are for various specifications of equation (1). These results are based on the first above-mentioned fragile states definition, which sees a country being classified as fragile if it is in the bottom two CPIA score quintiles or if it is not rated). Poor results were obtained when both the aid-policy and aid-policy-fragility interactions are included in the equation (see column 1). One cannot reject the null hypothesis that the parameters attached to these interactions (β_3 and β_4 , respectively) are significantly different from zero. The same applies to the parameters attached to aid and aid-squared (β_1 and β_2 , respectively). Dropping the latter interaction made little difference, with β_1 , β_2 and β_3 remaining statistically insignificant (see column 2). Dropping the former interaction also made little difference (see column 3). Dropping both the aid-policy and aid-policy-fragility interactions did make a difference, in that it did permit the replication of the result most commonly reported in the literature, with both β_1 and β_2 being significantly different from zero and being positive and negative, respectively. These results are shown in column 4. Broadly similar results were obtained

potential to stimulate growth within a four year period. This approach proved to be unfruitful. Full details of this and all other preliminary testing are available from the authors.

¹¹ These variables include a country dummy for Egypt, a region dummy for Central America, a Franc zone dummy, arms imports to total imports lagged once, the interaction of the CPIA and arms imports, the interaction of initial GDP and the CPIA, the interaction of initial population and the CPIA and aid, aid squared and the aid fragility interaction term all lagged once. All IV estimations pass the Hansen J-test for over-identifying restrictions and the Anderson canonical correlations likelihood-ratio test for instrument relevance.

Table 1
GMM estimates of aid-growth-fragility relationships

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|--|-------------------------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Constant | (β_0 or δ_0) | -20.848* | -23.665* | -20.163* | -25.059* | -21.275* | -20.163* | -16.718* | -21.814* | -25.743* | -24.742* | -27.318* | -24.829* | -28.553* |
| | | (3.02) | (3.03) | (2.71) | (3.26) | (2.52) | (2.71) | (1.85) | (2.10) | (2.97) | (3.39) | (3.24) | (3.20) | (3.54) |
| Aid (a_i) | (β_1 or δ_1) | -0.163 | -0.097 | -0.102 | 0.246* | 0.206 | 0.219* | 0.120 | 0.185 | 0.283* | 0.254* | 0.324* | 0.307* | 0.367* |
| | | (1.31) | (0.35) | (1.01) | (2.13) | (1.42) | (1.71) | (0.56) | (1.10) | (2.10) | (2.51) | (2.98) | (2.60) | (2.67) |
| Aid-squared (a_i^2) | (β_2 or δ_2) | -0.001 | -0.002 | -0.002 | -0.003* | -0.002 | -0.002 | 0.000 | -0.001 | -0.004 | -0.003* | -0.004* | -0.004* | -0.004* |
| | | (0.86) | (1.03) | (1.15) | (1.67) | (0.82) | (1.15) | (0.01) | (0.23) | (1.07) | (2.17) | (2.66) | (2.44) | (2.53) |
| Aid-policy ($a_i \cdot p_i$) | (β_3) | 0.121 | 0.106 | - | - | - | - | - | - | - | - | - | - | - |
| | | (1.53) | (1.25) | | | | | | | | | | | |
| Aid-policy-fragility ($a_i \cdot p_i \cdot f_i$) | (β_4) | 0.007 | - | 0.012 | - | - | - | - | - | - | - | - | - | - |
| | | (0.60) | | (0.50) | | | | | | | | | | |
| Aid-fragility ($a_i \cdot f_i$) | (δ_3) | - | - | - | - | 0.084 | 0.022 | -0.098 | -0.050 | -0.049 | -0.127 | 0.131 | -0.196* | -0.275* |
| | | | | | | (0.74) | (0.49) | (0.65) | (0.58) | (1.20) | (1.05) | (0.52) | (1.74) | (1.75) |
| ∞ Aid-fragility-squared ($(a_i \cdot f_i)^2$) | (δ_4) | - | - | - | - | -0.001 | - | 0.000 | - | 0.001 | - | -0.009 | - | - |
| | | | | | | (0.56) | | (0.10) | | (0.28) | | (1.14) | | |
| Policy and institutions (p_i) | ($\beta_{6,1}$ or $\delta_{6,1}$) | 1.595* | 1.691* | 1.691* | 2.723* | 2.930* | 2.696* | 2.455* | 2.571* | 2.635* | 2.470 | 2.242* | 2.076* | 1.834* |
| | | (2.31) | (2.15) | (2.15) | (7.32) | (6.23) | (5.39) | (4.77) | (5.01) | (5.38) | (5.79) | (4.66) | (4.52) | (3.12) |
| Initial income | ($\beta_{8,2}$ or $\delta_{6,2}$) | 2.186* | 2.530* | 2.530* | 2.302* | 1.858 | 1.811* | 1.341 | 1.931 | 2.378* | 2.361* | 3.006* | 2.525* | 3.084* |
| | | (2.21) | (2.23) | (2.23) | (2.22) | (1.59) | (1.69) | (1.06) | (1.34) | (2.00) | (2.36) | (2.62) | (2.40) | (2.66) |
| Assassinations | ($\beta_{8,3}$ or $\delta_{6,3}$) | -0.077 | -0.108 | -0.108 | -0.065 | 0.035 | -0.026 | -0.074 | -0.055 | -0.033 | -0.018 | -0.044 | -0.038 | -0.079 |
| | | (0.40) | (0.53) | (0.53) | (0.39) | (0.23) | (0.16) | (0.38) | (0.30) | (0.19) | (0.11) | (0.27) | (0.22) | (0.45) |
| Money supply | ($\beta_{8,4}$ or $\delta_{6,3}$) | 0.012 | 0.007 | 0.007 | -0.004 | 0.013 | 0.011 | 0.006 | 0.004 | 0.000 | -0.005 | -0.013 | -0.002 | -0.002 |
| | | (0.13) | (0.25) | (0.25) | (0.14) | (0.49) | (0.39) | (0.17) | (0.14) | (0.01) | (0.18) | (0.54) | (0.08) | (0.05) |
| Observations (n) | | 637 | 637 | 637 | 637 | 637 | 637 | 637 | 637 | 637 | 637 | 637 | 637 | 637 |
| Number of countries | | 113 | 113 | 113 | 113 | 113 | 113 | 113 | 113 | 113 | 113 | 113 | 113 | 113 |

Note: t statistics in parenthesis. * denotes significantly different from zero at the 90 per cent level or greater.

from the IV results, shown below in columns 1 to 4 of Appendix Table A2.¹² These and all other IV results reported below should, however, be seen as indicative, given the comments made above about this method of estimation. On the basis of all of the results obtained from estimating (1) and its variants, and many others not reported in Tables 1 and A2, no evidence is found in support of the view that while the quality of policies and institutional performance are in general important for aid effectiveness, they are additionally important in countries with critically low CPIA scores. Nor was any evidence found in support of the view that only the quality of policies and institutional performance below particular threshold matters for aid effectiveness.¹³

Estimates of various specifications of equation (2) are shown in columns 5 to 12 of Table 1. These estimates allow one to test the view that it is only fragility per se which matters. According to this view it is not a country's CPIA score that matters for aid effectiveness, only whether this score falls below a critical threshold. The key parameters for testing this view are δ_3 and δ_4 . Columns 5 and 6 report results obtained using the first above-mentioned fragile states classification (a country with a CPIA score in the bottom two quintiles or that has not been rated), while columns 7 and 8 report results obtained from the second above-mentioned classification (a low-income country with a CPIA score of less than or equal to 3.0). The results in columns 9 and 10 are obtained after deeming a country fragile if it is a low-income country with a CPIA of less than 2.0. Rather poor results were obtained, all of the coefficients attached to the aid-fragility interactions (δ_3 and δ_4) and most of those attached to the non-interacted aid variables (δ_1 and δ_2) being insignificantly different from zero. Although not reported in Table A2, the results obtained from IV estimation were in general in conformity with the results shown in columns 5 to 10 of Table 1.

The results reported in columns 11 to 12 of Table 1 have been obtained by setting the threshold p^* such that a country is fragile if it belongs to the bottom CPIA quintile. Such a country can be considered to be highly fragile. Much better results are obtained. In particular, they are consistent with the consensus that there is an inverted U-shaped relationship between aid and growth given the signs attached to and significance of δ_1 and δ_2 . The preferred specification, of all those for which results are reported in Table 1, is that for which results are shown in column 12. There is some support for these results given the IV results shown in column 4 of Table A2. Combined with the results reported above, these results tell us that one can only observe differences in aid effectiveness between fragile and non-fragile states if one uses a lower CPIA threshold than those used by the donor community. Put differently, the difference is between the highly fragile states and all others and not between fragile states per se and all others.

Two other sets of results are worth mentioning. The first is the estimates of the parameter attached to the policies and institutions variable, the CPIA. This parameter is positive and significant in all specifications, both GMM and IV. While there is little evidence from this paper's econometric work that the quality of policies and institutional

¹² The IV regressions contain both the CPIA and the institutional quality variable. The correlation coefficient between these variables is low, indicating that they seem to be measuring different characteristics and that multicollinearity between them is not problematic.

¹³ These conclusions still hold if the second classification mentioned above (a low-income country with a CPIA score of less than or equal to 3.0) or lower CPIA thresholds to classify a country as fragile. Further details are available from the authors.

performance matter at all levels for aid effectiveness, it is apparent that they certainly do matter at all levels for growth. The second set of results worthy of mention are those reported in column 13 of Table 1. A country can remain in the bottom or bottom two CPIA quintiles even if its CPIA score increases over time. This reflects the very essence of a quintile, which is based on rankings of the variable under question rather than its values. One wonders whether this is appropriate in the context of fragile states, as it involves a relative CPIA threshold rather than an absolute one that is invariant with respect to time.¹⁴ In particular, one can question whether the estimates reported in column 12 are robust with respect to using a threshold that is fixed over time. The results reported in column 13 of Table 1 shed some light on this issue. They are based on a CPIA threshold fixed at 2.2 over the time period under question. This value equates to average CPIA values that a country must achieve to avoid being placed in the bottom CPIA quintiles over this time period. Using this threshold makes no effective difference, given the results shown in column 12 and the purposes of this paper.

Growth rates due to aid (g_i^{af} and g_i^{anf}) the growth efficient aid levels (a_i^{*f} and a_i^{*nf}) consistent with the preferred GMM specification are shown in Table 2. The growth rates have been obtained using equations (4a) and (4b) and the growth efficient aid levels using (6a) and (6b), albeit with δ_4 set to zero. To be clear, the non-highly fragile states group includes many countries classified as fragile by the donor community. In particular, it includes all countries in the second CPIA quintile in the years under consideration. As is shown, aid has contributed to 1.37 percentage points to growth in highly fragile states, those in the bottom CPIA quintile, compared to 2.47 percentage points in all other countries. The difference is 1.1 percentage points in favour of the non-highly fragile countries. The level of aid that maximizes per capita GDP growth in non-highly fragile states corresponds to 38.38 per cent of GDP. This is roughly three times the corresponding amount in highly fragile countries, levels of aid relative to GDP in the highly fragile states, which is 13.88 per cent.

The results reported in Table 2 provide important information for the donor community. Donors are currently scaling up their aid programmes. Total ODA flows from OECD Development Assistance Committee Members increased from US\$69 billion in 2003 to US\$106 billion in 2005 (OECD 2005a, 2006). There is pressure to increase aid flows even further, given widespread calls to increase ODA to US\$135 billion per year to help achieve the MDGs (UN Millennium Project Report 2005). It is vitally important that in such an environment donors avoid providing more aid to recipients than these can efficiently absorb. If donors are concerned about the impact of aid on growth (and they are, given especially the implications for poverty reduction), they should in general avoid over-aiding countries by providing allocations greater than the growth efficient levels. This is justified on the grounds that aid is in principle about poverty reduction, and that growth is an important way of achieving this. Given the information in Table 2, this would see donors providing aid levels that do not exceed 13.88 per cent of highly fragile state GDP and 38.38 per cent of the GDPs of all other countries.

¹⁴ A case for using a relative threshold is that CPIA scores are subjectively determined by a group whose membership changes over time.

Table 2
Estimates of key statistics

| Statistic | Estimate |
|---|----------|
| Growth due to aid (%) | |
| (Highly) fragile states (g_i^{af}) | 1.37 |
| All other countries (g_i^{anf}) | 2.47 |
| Growth efficient aid levels (% of GDP) | |
| (Highly) fragile states (a_i^{*f}) | 13.88 |
| All other countries (a_i^{*anf}) | 38.38 |

Actual and growth efficient allocations are compared in Table 3. Some further remarks are warranted prior to examining these comparisons. The growth efficient aid levels shown in Table 2 should be seen as a rough allocation decision rule-of-thumb for donors. Allocations in excess of the growth efficient level for certain recipients in the all other country group could perhaps be easily justified, given the diversity of countries within it. But such a case would presumably be more difficult to support for the highly fragile states group. Aid in excess of the growth efficient level would need to be examined very carefully by the donor or donors in question using recipient country specific information. For example, some donors might want to allocate more aid than the growth efficient level to a country to prevent it sliding back into conflict. Alternatively, donors might provide large amounts of humanitarian aid to deal with a food shortage or distribution crisis. In both cases growth is not the immediate objective of donors, instead they might be more concerned with establishing the pre-conditions for growth. Aid should be cut back to the growth efficient level if a case such as this cannot be made. The decision rule should not however be ignored where such a case can be made, as it shows the potential opportunity cost, in terms of growth forgone, of such a strategy. One might even interpret aid provided in excess of the decision rule over a given number of years to be the sign of a failing aid programme.

It should also be emphasized that the growth efficient decision rule does not necessarily tell donors how they should be allocating aid among the countries they support. Nor does it necessarily advocate allocating additional aid to countries receiving less than the growth efficient amount. A growth efficient inter-recipient aid allocation is one that equalizes the marginal impact of aid across all recipients. This impact is zero at the growth efficient level. A donor's budget might be sufficiently large to allow for the growth efficient level to be provided to all countries. In the absence of such a budget the optimal allocation is one that gives each country less than the growth efficient amount.¹⁵ The decision rule outlined above is thus a partial rule, simply providing an upper limit to the amounts of aid that donors should provide to each recipient if poverty reduction via income growth is their sole objective. It does, however, provide an additional implicit rule of thumb. If donors are unable to equalize the marginal growth impact of aid among the countries they support, they should re-allocate aid from

¹⁵ The growth efficient amount is in effect the optimal solution derived from an unconstrained maximization problem in which the rate of growth is the only variable in the objective function.

countries that are over-aided to those that are the most under-aided relative to the growth efficient amount so that no countries receive more than this amount.¹⁶

Let us now examine Table 3 in light of these comments. The countries listed in Table 3 belong to the bottom two 2004 CPIA quintiles or those that were not rated in the 2004 CPIA exercise, for which requisite data are available. The list was obtained from World Bank (2004). The actual aid allocations shown in Table 3 are net disbursements of ODA in 2004, obtained from OECD (2005b). Obtained from World Bank (2004), the most recent GDP data available are for the year 2002.¹⁷

Ten of the countries listed in Table 3 are over-aided relative to the growth efficient amount. The two most over-aided countries are the Solomon Islands and Burundi. Expressed as percentages of GDP, actual aid levels to these countries are close to four times the growth efficient levels. The contribution of aid to growth falls to zero when aid reaches twice the growth efficient level and is negative for any amounts above this threshold.¹⁸ Given that aid to the Solomon Islands and Burundi in 2004 was more than twice that level, it follows that if we accept the estimates reported above aid actually contributed to negative growth in that year. There may be good reasons why aid levels in 2004 were of the amounts indicated in Table 3. Both are post-conflict countries, for instance. But they do seem to have had a very high opportunity cost in terms of growth forgone. Moreover, keeping aid at such levels for any prolonged period of time would appear to be hard to sustain on growth efficiency grounds. Similar comments apply to a number of the other over-aided highly fragile (bottom quintile) countries. These countries are Eritrea, Guinea-Bissau, Liberia and Timor Leste, each of which receives close to twice the growth efficient level of aid. The donors that support these countries, along with those supporting the Solomon Islands and Burundi, need to look very closely at their aid levels to them if current or intended future levels resemble those provided in 2004.

Of the 22 countries listed in Table 3 that received less aid in 2004 than the growth efficient level, Uzbekistan, the Republic of Congo and Guinea appear to have been the most under-aided relative to their absorptive capacities. All but two of the fourth quintile countries have received less aid than the growth efficient level, and most of these countries could have efficiently absorbed more than an additional 20 per cent of their GDPs as aid. These countries have ability to efficiently absorb much larger amounts of aid than they received in 2004, therefore.

¹⁶ Country specific information could also be factored into this decision, in the same way it could be used to justify over-aiding. For instance, Zimbabwe is shown below to be under-aided. Given current political conditions in that country it would appear to be difficult to make a case for providing it with additional official aid, especially through traditional channels.

¹⁷ It follows that the growth efficient aid for countries experiencing positive GDP growth in 2003 and 2004 will be (slightly) under-estimated. The reverse applies to countries that have experienced negative growth. These caveats need to be kept in mind when examining the data in Table 3.

¹⁸ According to equation (2a), the incremental impact of aid on growth falls to zero at $-(\delta_1+\delta_2)/(\delta_2+\delta_4)$. On comparison with equation (6a) it is clear this impact falls to zero at twice the growth efficient amount.

Table 3
Actual and growth efficient aid, fragile states, 2004

| | Actual aid | | Growth efficient aid | | Growth efficient minus actual aid | | |
|-------------------------------|------------|--------|----------------------|---------|-----------------------------------|--------|------------------|
| | % GDP | US\$ | % GDP | US\$ | % GDP | US\$ | % ^(a) |
| Fifth quintile ^(b) | | | | | | | |
| Angola | 10.17 | 1144.1 | 13.88 | 1561.3 | 3.71 | 417.22 | 36 |
| Burundi | 48.77 | 350.68 | 13.88 | 99.80 | -34.89 | -250.9 | -72 |
| Central African Rep. | 9.99 | 104.54 | 13.88 | 145.17 | 3.89 | 40.635 | 39 |
| Comoros | 9.58 | 24.51 | 13.88 | 35.52 | 4.30 | 11.006 | 45 |
| Congo Dem. Rep | 31.80 | 1815 | 13.88 | 792.13 | -17.92 | -1023 | -56 |
| Cote d'Ivoire | 1.31 | 153.56 | 13.88 | 1621.51 | 12.57 | 1467.9 | 956 |
| Eritrea | 40.40 | 259.52 | 13.88 | 89.17 | -26.52 | -170.4 | -66 |
| Guinea-Bissau | 37.49 | 76.23 | 13.88 | 28.23 | -23.61 | -48 | -63 |
| Haiti | 7.06 | 242.7 | 13.88 | 476.81 | 6.82 | 234.11 | 96 |
| Laos | 16.05 | 269.6 | 13.88 | 233.15 | -2.17 | -36.45 | -14 |
| Liberia | 37.47 | 210.48 | 13.88 | 77.98 | -23.59 | -132.5 | -63 |
| Nigeria | 1.32 | 573.4 | 13.88 | 6043.38 | 12.56 | 5470 | 954 |
| Solomon Islands | 51.01 | 122.19 | 13.88 | 33.25 | -37.13 | -88.94 | -73 |
| Sudan | 6.53 | 882.27 | 13.88 | 1876.07 | 7.35 | 993.8 | 113 |
| Timor Leste | 39.37 | 152.75 | 13.88 | 53.85 | -25.49 | -98.9 | -65 |
| Togo | 4.44 | 61.39 | 13.88 | 192.03 | 9.44 | 130.64 | 213 |
| Zimbabwe | 2.25 | 186.49 | 13.88 | 1152.66 | 11.63 | 966.17 | 518 |
| Fourth quintile | | | | | | | |
| Cambodia | 11.94 | 478.27 | 38.38 | 1537.04 | 26.44 | 1058.8 | 221 |
| Chad | 15.93 | 318.91 | 38.38 | 768.34 | 22.45 | 449.43 | 141 |
| Congo. Rep. | 3.84 | 115.97 | 38.38 | 1158.02 | 34.54 | 1042.1 | 899 |
| Djibouti | 10.75 | 64.13 | 38.38 | 228.97 | 27.63 | 164.84 | 257 |
| Gambia | 17.62 | 62.84 | 38.38 | 136.87 | 20.76 | 74.032 | 118 |
| Guinea | 8.69 | 279.25 | 38.38 | 1233.18 | 29.69 | 953.93 | 342 |
| Kiribati | 31.32 | 16.71 | 38.38 | 20.48 | 7.06 | 3.7697 | 23 |
| Mauritania | 18.56 | 179.8 | 38.38 | 371.84 | 19.82 | 192.04 | 107 |
| Papua New Guinea | 9.46 | 266.27 | 38.38 | 1080.16 | 28.92 | 813.89 | 306 |
| Sao Tomé & Príncipe | 66.53 | 33.42 | 38.38 | 19.28 | -28.15 | -14.14 | -42 |
| Sierra Leone | 45.94 | 359.65 | 38.38 | 300.47 | -7.56 | -59.18 | -16 |
| Tajikistan | 19.87 | 240.85 | 38.38 | 465.11 | 18.51 | 224.26 | 93 |
| Tonga | 14.16 | 19.26 | 38.38 | 52.21 | 24.22 | 32.945 | 171 |
| Uzbekistan | 3.10 | 245.53 | 38.38 | 3044.48 | 35.28 | 2799 | 1140 |
| Vanuatu | 16.11 | 37.77 | 38.38 | 89.97 | 22.27 | 52.201 | 138 |

Note: ^a of actual aid. ^b or in the cases of Liberia and Timor Leste, countries not rated in the 2004 CPIA exercise. Dollar amounts are in millions.

5 Conclusion

A consensus has emerged over recent years regarding the effectiveness of aid. Aid in general appears to work, to the extent that economic growth would have been lower in its absence. Yet lingering doubts remain, particularly among official donor agencies over its impact in so-called fragile states: those countries with critically low policy and institutional performance ratings. The empirical aid-growth literature has been silent on this issue to the extent that it has not been addressed directly. This paper examined possible links between aid and economic growth in fragile states, thus attempting to

offset the above-mentioned void, employing panel data econometrics. The period under consideration was 1977 to 2001.

It was found that there is no observable difference between the impact of aid in countries the international community deems as fragile and other aid-receiving countries. A difference does emerge, however, if a lower policy and institutional performance threshold is used to classify a state as fragile. Aid is associated with higher growth in these highly fragile states, those in the bottom CPIA quintile, but much less so than in other countries. Decreasing and negative returns between aid and growth are also predicted in these highly fragile states at much lower levels of aid than in other countries. They can only efficiently absorb roughly one-third the amount of aid that non-highly fragile states can: 13.88 as compared to 38.38 per cent of GDP. According to the evidence presented in this paper, providing aid in excess of these amounts will reduce aid effectiveness by decreasing its incremental impact on per capita GDP growth. If aid levels are more than twice this amount, its contribution to per capita income growth and per capita incomes levels is negative.

An examination of aggregate ODA allocations to 32 states deemed as fragile by the donor community in 2004 found that most were under-aided relative to their capacities to efficiently convert aid into economic growth. This is an important policy issue, given recent proposals and pledges to substantially increase aid flows. Most of these countries can absorb far more aid than they received in 2004 and growth in them will be higher as a result of such increases, provided the increases do not take aid above 13.88 per cent of GDP in countries in the bottom 2004 CPIA quintile and 38.38 per cent GDP in those in the second bottom quintile. Ten of the 32 states are over-aided, in that their 2004 receipts exceeded their absorptive capacities. Most of these countries are highly fragile, in the bottom 2004 quintile. The two most over-aided countries were the Solomon Islands and Burundi, both of whom received in 2004 more than twice the amounts they can efficiently absorb, at which the incremental impact of aid on growth is maximized. As such there is reason to believe that the incremental impact of aid on growth in the Solomon Island and Burundi was negative in 2004, leading one to speculate that aid might have actually increased the number of people living in poverty in these countries in that year. Other substantially over-aided countries in 2004 were Eritrea, Guinea-Bissau, Liberia and Timor Leste. While there might be valid, recipient country-specific reasons for providing more aid to these countries than they can efficiently absorb from a growth perspective, it is clear that the opportunity cost of such allocations is high in terms of growth and most probably poverty reduction forgone.

This findings reported in this paper have a number of implications for donors. Donors should be particularly concerned with the very fragile states, those in the bottom CPIA quintile. Donors should also be concerned with aid and growth relationships in states in the second-bottom quintile, but no more than in countries in the higher quintiles. The concern for the bottom quintile countries is of course a concern for the quality of recipient country policy regimes and the performance of their institutions. What appears to matter for aid effectiveness, given the findings of this paper, is that policies and institutions in recipient countries are such that they do not fall below a certain CPIA threshold. That threshold is the score that assigns a country to the bottom CPIA quintile. How far above this threshold a country might be appears to make no difference to aid effectiveness: all that matters is that it does not fall below it. Donors should also be concerned about policies and institutions in recipient countries, as this paper found that they are important for growth, independently of aid. Efforts aimed at increasing this by

improving policies and institutional performance have a double edged sword, therefore, and should be prioritized by the donor community. Finally, the donor community urgently needs to examine the amounts of ODA it provides to countries that this found to be over-aided, the Solomon Islands and Burundi in particular, if current or intended future levels resemble those provided in 2004. Unless compelling justifications, not directly related to growth, can be found for such allocations, donors either need to cut back aid to these countries or work very quickly to increase their absorptive capacities.

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Appendix

Appendix Table A1
Variable definitions and data sources

| Variable | Data Source | Notes |
|--|--|---|
| Per-capita GDP growth | World Bank (2003) | |
| Initial GDP per capita | Summers and Heston (1991), updated using World Bank (2003) | Natural logarithm of GDP/capita for first year of period; constant 1985 dollars . |
| Ethno-linguistic fractionalization, 1960 | Roeder (2001) | Probability that two individuals will belong to different ethnic groups. |
| Assassinations | Banks (2002) | Assassinations, per capita |
| Institutional quality | PRS Group's IRIS III dataset (Knack and Keefer 1995) | Revised version of variable. Computed as the average of the three components still reported after 1997. |
| Country policy and institutional assessment ratings (CPIA) | World Bank | |
| Sub-Saharan Africa | World Bank (2003) | Dummy variable taking the value of one if the nation is located in sub-Saharan Africa or zero if otherwise. |
| East Asia | | Dummy variable taking the value of one for China, Indonesia, South Korea, Malaysia, Philippines, and Thailand or zero if otherwise. |
| Net overseas development assistance disbursements, as a ratio of nominal GDP | OECD (2002), World Bank (2003) | |
| Tropical area fraction | Gallup and Sachs (1999) | |
| Population | World Bank (2003) | Mid-year estimate, natural logarithm. |
| Money supply | World Bank (2003) | M2 - money and quasi money, comprising the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government. |
| Fragile state dummy 1 | World Bank | A country is classified as fragile if its average CPIA rating during the period falls into the bottom two quintiles. |
| Fragile state dummy 2 | World Bank | A country is classified as fragile if its average CPIA rating during the period falls into the bottom quintile. |
| Fragile state dummy 3 | World Bank | A country is classified as fragile if it is a low-income country (for any year in the period) and has an average CPIA score of 3 or below. |
| Fragile state dummy 4 | World Bank | A country is classified as fragile if it is a low-income country (for any year in the period) and has an average CPIA score of less than 2. |
| Fragile state dummy 5 | World Bank | A country is classified as fragile if its average CPIA rating during the period is less than 2.2. |

Appendix Table A2
IV estimation of aid-growth-fragility relationships

| | | 1 | 2 | 3 | 4 | 5 |
|--|---------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Constant | (β_0 or δ_0) | -17.960* (2.50) | -13.584* (2.17) | -13.637* (2.60) | -16.538* (2.60) | -11.702* (1.73) |
| Aid (a_i) | (β_1 or δ_1) | 1.060* (1.73) | 0.223 (0.78) | 0.227 (1.54) | 0.330* (1.84) | 0.310* (1.68) |
| Aid-squared (a_i^2) | (β_2 or δ_2) | -0.015* (2.20) | -0.004 (0.66) | -0.003 (1.21) | -0.005 (1.32) | -0.007 (1.23) |
| Aid-policy ($a_i \bullet p_i$) | (β_3) | -0.148 (0.97) | -0.005 (0.07) | - | - | - |
| Aid-policy-fragility ($a_i \bullet p_i \bullet f_i$) | (β_4) | -0.228 (1.54) | - | -0.225 (1.02) | - | - |
| Aid-fragility ($a_i \bullet f_i$) | (δ_3) | - | - | - | - | -0.323* (1.79) |
| Aid-fragility-squared($(a_i \bullet f_i)^2$) | (δ_4) | - | - | - | - | - |
| Policy and institutions (p_i) | ($\beta_{6,1}$ or $\delta_{6,1}$) | 1.385* (3.43) | 1.521* (4.01) | 1.219* (4.38) | 1.299* (4.18) | 0.919* (2.38) |
| Initial income | ($\beta_{6,2}$ or $\delta_{6,2}$) | 1.053 (1.50) | 0.384 (0.70) | 0.911 (1.42) | 0.965 (1.48) | 0.696 (1.05) |
| Assassinations | ($\beta_{6,3}$ or $\delta_{6,3}$) | -0.343 (1.31) | -0.404* (1.70) | -0.406* (2.25) | -0.466* (2.25) | -0.253 (0.96) |
| Money supply | $\beta_{6,4}$ or $\delta_{6,4}$ | -0.020 (1.48) | -0.013 (1.19) | -0.011 (1.34) | -0.014 (1.30) | -0.014 (1.25) |
| Population | ($\beta_{6,5}$ or $\delta_{6,5}$) | 0.474* (3.03) | 0.436* (3.11) | 0.418* (3.17) | 0.413* (3.15) | 0.332* (2.36) |
| Institutional quality | ($\beta_{6,6}$ or $\delta_{6,6}$) | 0.062 (0.48) | 0.245* (1.96) | 0.213 (0.01) | 0.113 (1.01) | 0.117 (1.03) |
| Ethno-linguistic fractionalization | ($\beta_{6,7}$ or $\delta_{6,7}$) | -0.696 (0.86) | -0.865 (1.27) | -0.521 (0.67) | -0.401 (0.61) | -0.406 (0.60) |
| Assassinations-ethno-linguistic fractionalization | ($\beta_{6,8}$ or $\delta_{6,8}$) | 0.467 (0.89) | 0.762* (1.88) | 0.749* (1.89) | 0.743* (1.85) | 0.248 (0.45) |
| Sub-Saharan Africa | ($\beta_{6,9}$ or $\delta_{6,9}$) | -0.222 (0.31) | -0.652 (1.18) | -0.686 (1.11) | -0.586 (1.03) | -0.462 (0.79) |
| East Asia | ($\beta_{6,10}$ or $\delta_{6,10}$) | 2.477* (3.56) | 1.870* (3.00) | 2.108* (3.27) | 2.038* (3.51) | 2.460* (3.84) |
| Tropical area | ($\beta_{6,11}$ or $\delta_{6,11}$) | -1.281* (2.90) | -0.865* (1.94) | -1.034* (2.71) | -1.156* (2.86) | -1.272* (3.17) |
| R ² | | 0.32 | 0.34 | 0.29 | 0.29 | 0.28 |
| Observations (n) | | 442 | 442 | 442 | 442 | 442 |

Notes: Robust z statistics in parenthesis.

* denotes significantly different from zero at 90 per cent level or greater.