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# Performance Assessment: How it Depends on Structural Economic Vulnerabilty and Human Capital. Implications for the Allocation of Aid

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**Abstract**

Developing country performance with respect to economic policies and institutional behaviour is a common criterion for the allocation of aid among recipient countries. This paper questions the manner in which performance is used in this regard, arguing that performance is too narrowly defined. A more appropriate definition is one that controls for the economic vulnerability and human capital of developing countries. Econometric analysis of cross-section and panel data is presented that supports this contention. The paper also contends that performance and exogenous economic shocks are likely to be pro-cyclical. This implied a double punishment when aid is allocated according to performance. Evidence of such punishment is also provided in this paper. The paper concludes by arguing that economic vulnerability and human capital variables should augment performance measures in aid allocation decision making.

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## 1 - Introduction

Performance is an important criterion for the allocation of aid among developing countries. Some donors, such as the World Bank and the African Development Bank, allocate aid among recipient countries according to formal prescriptive models that incorporate performance as a determining variable. The amount of aid prescribed by these models for a given recipient country is an increasing function of its performance.

The World Bank IDA performance based allocation system is perhaps the best known model of this type. This system relies heavily on the well-known World Bank Country Institutional and Performance Assessment (CPIA).[1] Other donors allocate aid in a less systematic manner but often provide more aid to given countries than would otherwise be the case on the basis of superior performance. Performance, in this context, is defined in terms of the efficacy of economic and social policies and public sector management and institutions. The efficacy of public sector management is typically based on factors including the perceived quality of budgetary and financial management, revenue mobilisation and public administration and on the transparency and accountability of the public sector.

The rationale for basing aid receipts on performance, as defined, is twofold. The first reflects a widely held view in the donor community, that the incremental impact of aid on recipient country economic growth is an increasing function of the performance of these countries. Ensuring that the allocation of aid among recipient countries is an increasing function of their performance is consistent with maximising the global economic growth, and poverty reduction, efficiency of development aid. In short, it is thought to maximise aid effectiveness from these perspectives. This is consistent with the very well-known Burnside and Dollar (2000) and Collier and Dollar (2001, 2002) studies. The second rationale follows from a strategy of ex post conditionality. Better economic policies and institutional performance are (rightly) thought to better for economic growth. Rewarding high performing countries with more aid promotes further growth in them, and provides positive incentives for other countries to improve their performance.

There is much to be said in support of basing aid allocation on recipient country performance. Above all it ensures that developmental criteria are important for aid allocation rather than political or commercial criteria and imposes order to what can otherwise be a chaotic decision making process. It is not without weakness, however. Three weaknesses are especially apparent.

First, the way performance is assessed is narrow, ignoring what might be described as initial country conditions. An important such condition is human capital. It is reasonable to expect

1. The IDA performance based system allocates aid among recipient countries using the following equation:

$$A_i = CPR_i^5 \left(\frac{GNI_i}{P_i}\right)^{-0.125} P_i$$

where $A_i$ is IDA aid to country $i$ and $CPR_i$, $GNI_i$, and $P_i$ are the country performance rating, $GNI$ and population of $i$. The $CPR$ for country i is defined as follows:

$$CPR_i = 0.24 CPIA_{ABC,i} + 0.68 CPIA_{D,i} + 0.08 P_i$$

where $CPIA_{ABC,i}$ is the arithmetic mean of clusters A, B and C of the CPIA, $CPIA_{D,i}$ is cluster D of the CPIA and $P_i$ is i's portfolio performance assessed by the World Bank. Clusters A, B, C and D relate to economic management, structural policies, policies for social inclusion and equity and public sector management and institutions, respectively. There are no other CPIA clusters. Further details of the CPIA and the CPR can be found in World Bank (2010).

that countries with low human capital levels are likely to have low performance scores. They may have difficulties formulating economic and social policies and achieving high quality budgetary and financial outcomes, mobilising revenues and achieving public transparency. A country with low human capital might achieve relatively low performance assessments, despite the best of intentions and huge efforts. Penalising such a country with less aid than would otherwise be the case is not consistent with a strategy for providing positive incentive to improve performance.

Second, performance based allocative approaches are also highly reductionist with respect to aid effectiveness criteria. Aid effectiveness will be contingent on a number of factors in addition to performance. The literature on aid and growth has pointed to a number of contingencies, including economic vulnerability. Guillaumont and Chauvet (2001) show that the incremental impact of aid on growth is contingent on recipient country structural economic vulnerability, with the former being an increasing function of the latter.[2] Allocating more aid to economically vulnerable countries than would otherwise be the case is consistent with maximising the global growth and, by implication, poverty efficiency of aid. Ignoring this criterion reduces this efficiency.

The third weakness relates to the impact of exogenous economic shocks on performance. There is strong reason to expect that performance will be partly driven by these shocks or, more specifically, will be pro-cyclical with respect to them. A negative exogenous shock can be bad enough in its own right, but will be made all the worse if accompanied by lower aid. This is a case, therefore, of double punishment.

This paper empirically assesses these criticisms. While each might make sound intuitive sense *a priori*, and might be supported by country specific or anecdotal evidence, they have more veracity if the behavioural relationships they describe can be observed across reasonably large samples of developing countries. Such is specific interest of this paper. It provides a multivariate econometric analysis of developing country performance. Performance is measured using the World Bank CPIA and Country Performance Rating measures, which are used to allocate IDA funds among eligible developing countries. The explanatory variables of interest are economic vulnerability, human capital and measures of exogenous economic shocks.

The paper consists of three further sections. Section 2 provides a brief review of the literature on the determinants of performance. Section 3 looks at whether performance is determined by vulnerability, human capital and income. It reports the methods used by and results from an econometric analysis of these relationships. Section 4 looks at the issue of pro-cyclicality of performance with respect to exogenous shocks, reporting the results of an econometric analysis. Section 5 concludes.

## 2 - Literature Review

Poor institutional performance is in the relevant literature equated with state fragility or failure. Many studies have looked at the impact of fragility on development, either through its direct impact on income and growth, or through its indirect influence through aid allocation (see Chauvet and Collier (2008), McGillivray and Feeny (2008), Baliamoune-Lutz (2009), among others).

2. Also see Chauvet and Guillaumont (2004), Guillaumont and Chauvet (2010) and Collier and Goderik (2010).

Nevertheless there appear to be only two rigorous empirical studies of the determinants of state fragility. Those two studies rely on the literatures on the determinants of economic growth and on the impact of conflict or institutional instability on growth. More precisely, they both take as a strong reference the work of Goldstone *et al.* (2005) from the Political Instability Task Force (PITF). Using a conflict-based definition of state failure that focuses on rebellion, genocide, political repression, adverse regime change and revolutionary or ethnic wars, the PITF attempts to identify a limited number of conflict predictive factors that could be used to inform security policy. It highlights factors that predict political instability, such as infant mortality, openness to trade, the level of democracy as well as the level of conflict in contiguous states.

The first of these studies is Carment *et al.* (2008). Using the Country Indicators for Foreign Policy (CIFP) instability index as their dependent variable, they seek to establish the influence of a large number of socio-economic variables on fragility. The explanatory variables include per capita income, economic growth, infant mortality, openness to trade and the level of democracy. They also seek to establish whether other factors such as income inequality, human rights, ethnic risk and ethnic diversity are also determine state fragility. They find, over a world sample, that the per capita income level is the main factor influencing fragility, with higher incomes being associated to lower fragility.

Following Carment *et al.* (2008), Bertocchi and Guerzoni (2010) investigate the determinants of state fragility in sub-Saharan Africa. They find that institutional variables are a strong determinant of state fragility[3]. They also find that the probability of a country being fragile decreases with the level of civil liberties and increases with the number of revolutions. Economic determinants such as per capita GDP growth and investment are not found to be significant. They reach the same conclusion for the influence of geography and colonial history.

Carment *et al.* (2008), Bertocchi and Guerzoni (2010) provide interesting insights but it is clear that the literature is in an early stage of development. The explanatory variables are either largely taken from the literature on determinants of growth or conflict. It is not clear why these variables might be expected to influence fragility, defined in terms of institutional performance. So as interesting as the existing literature might be it provides insufficient guidance for the purpose of our study. With that in mind we choose to build a rather simple base empirical specification of an econometric model that is tested using variety of econometric estimation techniques, data sets and control variables. This specification is also tested using different measures of performance, vulnerability, human capital and exogenous economic shocks. We in particular use less control variables than Carment et al. and Bertocchi and Guerzoni. This is defensible to the extent that our chosen measures of structural vulnerability and human capital, identified below, are aggregations of a large number of variables that could serve as controls in their own right.

3. Bertocchi and Guerzoni used the following control variables: per capita GDP, per capita GPD growth, investment, primary school enrolment rate, government expenditure, openness to trade, price inflation, life expectancy, fertility rate, ethnic fractionalization, civil liberties, revolutions, former British, French, and Portuguese colony dummies, political status, settler mortality, latitude, landlocked country dummy, government effectiveness, rule of law and voice and accountability.

## 3 - Econometric Analysis

### a) Performance, Vulnerability and Human Capital

Our econometric analysis initially focuses on vulnerability and human capital, with exogenous shocks being examined later in the paper. Our econometric model for analysing performance and its relationships with economic vulnerability and human capital can be depicted as follows:

$$P_i = \alpha + \beta' V_i + \gamma' H_i + \delta' \Phi_i + \mu_i \qquad i = 1,\dots, n \qquad (1)$$

where $P_i$ is the performance of developing country $i$, $V_i$ is the economic vulnerability of country $i$, Hi is the human capital shortfall within country $i$, $\Phi_i$ is a vector of control variables relating to $i$, α is a constant, $\beta'$, $\lambda'$ and $\delta'$ are vectors of regression coefficients, and $\mu_i$ is a residual. All variables, unless otherwise indicated, are for period $t$. Variants of (1) will be estimated using cross section data for 2007 and two panel datasets covering for 1977 and 1999 and 1977 to 2007. The first of these panels includes all countries for which the CPIA scores were assigned, while the second includes all IDA recipient countries.

Equation (1) was first estimated using the cross data for 2007 and the ordinary least squares (OLS) method of estimation. The sample consists of 74 IDA countries. Breakdowns of the CPIA by its clusters are available for 2007, and it is on this criterion that we first use these data. In this estimation the arithmetic mean of clusters A, B and C of the CPIA ($CPIA_{ABC}$), cluster D of the CPIA ($CPIA_D$) and the CPR (CPR) are used as alternative measures of Pi and, therefore, as dependent variables. The economic vulnerability vector $V_i$ contained a single element only, the natural logarithm of the Economic Vulnerability Index (EVI).

The human capital shortfall vector $H_i$ contains one variable only, which was constructed using the Human Capital Index (HAI). The HAI is the arithmetic mean of the following components: the percentage of the population that is undernourished, the child mortality rate, the gross secondary school enrolment ratio and the adult literacy rate. Each of these variables scaled between the range of zero and one hundred, with one-hundred being assigned to the country with the highest level of human capital. The HAI is a decreasing function of the first and second of these variables and an increasing function of the third and fourth. For the purpose of this paper these variables are interpreted as proxies of the overall level of human capital within a country.[4] Our human capital shortfall variable is 100-HAI, since we are concerned with shortfalls in human capital. It follows that shortfall in this context is the gap between the actual level of human capital in a country and the maximum observable level, which according to the HAI is 100. The natural logarithm of 100-HAI is used in all regressions. The vector of control variables Φi contained the natural logarithm of PPP GDP per capita, a least developed country (LDC) binary (0,1) dummy and six binary regional dummies. Reasoning behind the inclusion of the Least Developed Country (LDC) dummy is provided below.

4. This is particularly so with respect to the health components of the HAI as we do not argue that undernourishment and child mortality will directly impact on CPIA scores. Rather, we see it these variables being indicative of the overall level of health within a country. There are of course many reasons why health might constrain CPIA scores. The relevant actors within countries being assessed might have to give a higher priority to private matters than professional duties than would otherwise be the case, there might be higher levels of absenteeism, less investment in future levels and education and training and so on than in countries with better health levels.

**Table 1.** Econometric Estimates Using 2007 Cross Section Data, IDA Countries Only

| | | (1) CPIA | (2) CPIA | (3) $CPIA_{ABC}$ | (4) $CPIA_{D}$ | (5) CPR |
|---|---|---|---|---|---|---|
| Constant | (α) | 1.495 (0.290)*** | 1.498 (0.283)*** | 1.546 (0.275)*** | 1.316 (0.361)*** | 1.309 (0.310)*** |
| EVI | (β) | -0.200 (0.084)** | -0.199 (0.099)** | -0.216 (0.084)*** | -0.153 (0.092)* | -0.144 (0.083)* |
| 100-HAI | (λ) | -0.137 (0.077)* | -0.136 (0.083)* | -0.112 (0.075) | -0.216 (0.092)** | -0.179 (0.078)** |
| GDP per capita | (δ1) | 0.016 (0.029) | 0.016 (0.045) | 0.012 (0.028) | 0.029 (0.033) | 0.028 (0.029) |
| LDC | (δ2) | | -0.001 (0.045) | | | |
| R-squared<br>N | | 0.28<br>74 | 0.28<br>74 | 0.31<br>74 | 0.32<br>74 | 0.31<br>74 |

Numerals in parentheses are robust standard errors and *, ** and *** denote significant at the ten, five and one percent levels, respectively. Results are shown in Table 1[5]. Results from five regressions are reported. The CPIA was used twice as the dependent variable while the CPIAABC, CPIAD and CPR were used once each, as indicated in the second row of Table 1.

From the results reported in Table 1 it appears that both the EVI and 100-HAI have strong and negative impacts on all performance measures. The only exception to this is the impact of the HAI on CPIAABC, which is statistically insignificant. The result using the full CPIA, based on all four of its clusters, is robust to the inclusion of the LCD dummy. LDC countries have mean CPIA that is significantly less than that of all other countries in our sample. Combined with the fact that income per capita, the HAI and the EVI are determinants of LDC status, this raises a question as to whether the results shown in column (1) simply reflect the dichotomy between LDC and non-LDC status. The results shown in column (2) indicate that this is not the case. Furthermore, it is interesting to see that LDC status is not associated with lower CPIA scores if structural vulnerabilities are accounted for. The coefficient attached to GDP per capita is insignificant in all regressions reported in Table 1.

Results shown in column (4) of Table 1 are obtained with the Public Sector Management and Institutions cluster (cluster D) of the CPIA as the dependent variable. This cluster is of special interest since it is assigned the highest weight in calculating the CPR. The results shown in column (5) have been obtained with the CPR is the dependent variable. Our human assets shortfall measure is negatively associated with these performance measures, and its coefficient is statistically significant at the five percent level. This result is consistent with our *a priori* expectations. We are conscious that this result might be due to endogeniety between human capital and performance. Our use of the OLS method makes no allowance for this, and might have produced statistically biased results as a consequence. We address this issue below.

We now turn to panel data estimation, initially using the data for 1977 to 1999 and then using the data for 1977 to 2007. As mentioned, the country coverage of the dataset is determined purely by data availability. Variations in sample sizes for which results are reported below are due to removal of outliers. As most of the variables we use do not display large year to year volatility and

5. The estimates of the regional dummy coefficients are not reported, here or elsewhere in this paper. These estimates are available on request from the authors.

since we are at first interested primarily in the medium to long run association between structural vulnerability and performance, we average our data over five year periods. Two econometric estimation procedures are used: random effects (RE) and two stage least squares (2SLS). RE was chosen over the alternative, fixed effects, based on the application of the well-known Hausman test. 2SLS was used in an attempt to account for the possible endogeneity of human capital. Accordingly, human capital shortfall is the endogenous explanatory variable in the 2SLS estimation and is instrumented by 100-HAI lagged one year. The vector of control variables consisted of the LDC dummy, in some regressions, along with the natural logarithm of PPP GDP per capita, the regional dummies and the five time period dummies (one for each of the five year averages except the first). All other explanatory variables are as per the OLS regressions reported above. The only dependent variable is the overall CPIA, as we did not have breakdowns by cluster for the period under consideration.

Results are shown in Table 2, for all parameter estimates except those for the time and regional dummies. The EVI coefficient is again statistically significant and negative in all regressions. The coefficient attached to the human assets variable is also negative and statistically significant in all regressions except regression (4), in which it is negative but no significant. Although not reported in Table 2, lagging 100-HAI by two years, made no difference to this result. We pursue this issue further, in the next stage of our regression analysis. Removing statistical outliers, identified using the Hadi (1992, 1994) procedure also made no difference to our results.

One possible caveat of our previous approach is that it does not take explicitly into account the dynamic nature of the relationship. More precisely, it does not control for the fact that those structural variables vary very slowly over-time. In order to further assess the robustness of our results, we turn to a dynamic panel approach. This methodology developed by Arellano and Bond (1991) and Blundell and Bond (1998) presents two advantages. It controls for the dynamic aspect of the relationship thus assessing the potential bias of our previous estimation. It also provides an alternative framework to deal with simultaneity issues.

GMM estimates obtained using the two panel data sets are shown in Table 3. We again do not report the coefficients assigned to the time and regional dummies as these variables are of statistical interest only. Nor do we report these estimates in the remaining regressions reported in this paper. As is shown in Table 3, the coefficient attached to the EVI is again statistically significant and negative in all the GMM regressions. Less robust results were obtained for human capital shortfall, as the coefficient attached is negative and significant in one of the four regressions reported, that being for the smaller sample of IDA countries.[6] In the three other regressions it is statistically insignificant. We return to this issue below. In the light of those last results, we are confident that our initial model is well specified and that simultaneity issues have been well accounted for.

6. The differences in sample sizes used in the regressions shown in Table 3 are due to attempts to remove outliers. The same applies to Tables 5 and 8, shown below.

**Table 2.** Econometric Estimates Using Panel Data

| | | Full Sample of Countries, 1977 to 1999 | | | | IDA Countries, 1977 to 2007 |
|---|---|---|---|---|---|---|
| | | (1) RE | (2) Panel 2SLS | (3) Panel 2SLS | (4) Panel 2SLS | (5) RE |
| Constant | (α) | 2.085 (0.291)*** | 1.941 (0.314)*** | 1.556 (0.474)*** | 1.562 (0.472)*** | 1.485 (0.397)*** |
| EVI | (β) | -0.221 (0.054)*** | -0.184 (0.057)*** | -0.168 (0.057)*** | -0.147 (0.059)*** | -0.126 (0.062)** |
| 100-HAI | (λ) | -0.096 (0.036)*** | -0.096 (0.041)** | -0.091 (0.053)* | -0.078 (0.055) | -0.071 (0.035)** |
| GDP per capita | (δ1) | 0.024 (0.017) | 0.026 (0.018) | 0.068 (0.033)** | 0.056 (0.034) | 0.062 (0.019)*** |
| LDC | (δ2) | | | | -0.070 (0.059) | -0.027 (0.052) |
| R-squared | | 0.23 | 0.24 | 0.24 | 0.24 | 0.26 |
| n | | 476 | 410 | 401 | 401 | 368 |
| Number of Countries | | 112 | 112 | 111 | 111 | 67 |

Numerals in parentheses are robust standard errors and *, ** and *** denote significant at the ten, five and one percent levels, respectively.

**Table 3.** Econometric Estimates Using System GMM and Panel Data

| | | Full Sample of Countries, 1977 to 1999 | | | IDA Countries, 1977 to 2007 |
|---|---|---|---|---|---|
| | | (1) | (2) | (3) | (4) |
| Constant | (α) | -0.087 (0.918) | 0.481 (0.504) | 1.949 (0.621)*** | 1.086 (0.522) |
| EVI | (β) | -0.246 (0.115)** | -0.104 (0.055)* | -0.266 (0.091)*** | -0.193 (0.085)** |
| 100-HAI | (γ) | 0.137 (0.086) | -0.001 (0.043) | -0.087 (0.046)* | -0.039 (0.035) |
| GDP per capita | (δ1) | 0.123 (0.078) | 0.031 (0.035) | 0.011 (0.048) | 0.038 (0.037) |
| Lagged Dependant Variable | (δ2) | 0.663 (0.112)*** | 0.745 (0.063)*** | 0.397 (0.064)*** | 0.576 (0.058)*** |
| Test for AR(2) | | 0.100 | 0.168 | 0.088 | 0.249 |
| Hansen J Test | | 0.180 | 0.297 | 0.863 | 0.998 |
| n | | 390 | 686 | 302 | 444 |
| Number of Countries | | 111 | 113 | 55 | 55 |

Numerals in parentheses are robust standard errors and *, ** and *** denote significant at the ten, five and one percent levels, respectively. AR and Hansen J test statistics are $p$-values. Endogenous variables are EVI, 100-HAI and GDP per capita.

It is not beyond the realms of possibility that the relationships between performance, vulnerability and human capital might not hold or be robust at all levels of the CPIA. A means to testing for this is to estimate simultaneous quartile regressions. Results of such regressions are reported in Table 4. The control variables used in these regressions were the natural logarithm of PPP GDP per capita and the time and regional dummies. Shown are the results for all CPIA quartile groups except the highest, obtained using both panel datasets. Strong evidence of these relationships holding at all ranges of the CPIA distribution is presented, in that the coefficients attached to both the EVI and 100-HAI variables are negative and statistically significant.

It should be recalled that both the EVI and the HAI are composite indices, being based on the aggregation of a number of components. The EVI is the arithmetic mean of seven components: export instability, agricultural production instability, homelessness, population, the share of agriculture in GDP, export concentration and remoteness. It is an increasing function of each of these components. The first three components represent shocks, while the remainder represents exposure (Guillaumont (2009)). The specification of the HAI has been provided above, but it has the same basic structure as the EVI, being an arithmetic mean of its four components.

**Table 4.** Econometric Estimates Obtained from Simultaneous Quartile Regressions and Panel Data

| | Full Sample of Countries, 1977 to 1999 | | | IDA Countries, 1977 to 2007 | | |
|---|---|---|---|---|---|---|
| | Quartile | | | | | |
| | **Q25** | **Q50** | **Q75** | **Q25** | **Q50** | **Q75** |
| Constant (α) | 2.607<br>(0.342)*** | 2.469<br>(0.242)*** | 2.349<br>(0.191)*** | 1.787<br>(0.483)*** | 1.175<br>(0.351)* | 1.208<br>(0.273)*** |
| EVI (β) | -0.231<br>(0.047)*** | -0.216<br>(0.051)*** | -0.171<br>(0.036)*** | -0.201<br>(0.0546*** | -0.094<br>(0.043)** | -0.104<br>(0.038)*** |
| 100-HAI (γ) | -0.149<br>(0.038)*** | -0.138<br>(0.033)*** | -0.151<br>(0.032)*** | -0.111<br>(0.046)** | -0.061<br>(0.035)* | -0.054<br>(0.031)* |
| GDP per capita (δ1) | -0.016<br>(0.021) | -0.004<br>(0.007) | 0.011<br>(0.008) | 0.047<br>(0.037) | 0.070<br>(0.028)*** | 0.078<br>(0.019)*** |
| n | 476 | 476 | 476 | 368 | 368 | 368 |
| Number of Countries | 112 | 112 | 112 | 67 | 67 | 67 |
| Pseudo R-squared | 0.16 | 0.13 | 0.15 | 0.18 | 0.17 | 0.19 |

Numerals in parentheses are robust standard errors and *, ** and *** denote significant at the ten, five and one percent levels, respectively.

Is it the case that statistically significant, negative associations between economic vulnerability and human capital shortfall exist between performance and the components of the EVI and HAI? And if the answer to this question is no, which if any components share a statistically significant relationship with performance? The answer to these questions we initially divide the EVI into its shocks and exposure sub-components, which are obtained by taking the logarithms of the arithmetic means of the three shocks variables and four exposure variables. We then regress each these two sub-components on the CPIA using the RE, 2SLS and simultaneous quartile regression methods in single regressions. Included in these regressions is 100-HAI, the natural logarithm of PPP GDP per capita and the time and regional dummies. This exercise is repeated, but instead using the logarithm of the seven individual components of the EVI. We undertake a very similar exercise for the HAI. Initially we regress, using each of the 2SLS, RE and simultaneous quartile regression methods, the health and education components of the HAI on the CPIA. These components were obtained by taking the logarithms of 100 minus the means of the each of the HAI's health and education variables. Included in these regressions is the logarithm of the EVI and PPP GDP per capita, and the time and regional dummies. We finally repeat this exercise by regressing the logarithm of 100 minus each of the individual components of the HAI on the CPIA using the same control variables.

The results of these regressions are shown in Tables 5 to 10. These results are particularly interesting. For the EVI, we find that from the RE and 2SLS regressions that is it the shocks and not the exposure variables that drive performance. This is based on the coefficient on the shocks components being statistically significant and negative while that on the exposure components being statistically insignificant, as is reported in Table 5. If, however, we consider the results of the quartile regressions, a slightly different picture emerges. These results are shown in Table 6. For the full sample of countries for the years 1977 to 1999 the coefficients on both the EVI shocks and exposure sub-components are significant and negative. A slightly more complicated picture emerges for based on the regressions for the panel containing IDA countries only. The mean of the shocks components are significant and negative for the bottom quartile only (Q25), while the mean of the exposure components is significant for the middle and second highest quartiles (Q50 and Q75) but is insignificant for the bottom quartile.

**Table 5.** Econometric Estimates Using Panel Data

| | | Full Sample of Countries, 1977 to 1999 | | | IDA Countries, 1977 to 2007 |
|---|---|---|---|---|---|
| | | **(1) RE** | **(2) 2SLS** | **(3) 2SLS** | **(4) RE** |
| Constant | (α) | 1.867<br>(0.354)*** | 1.712<br>(0.324)*** | 1.413<br>(0.456)*** | 1.368<br>(0.382)*** |
| Shocks | (β1) | -0.101<br>(0.045)** | -0.074<br>(0.035)** | -0.066<br>(0.035)* | -0.070<br>(0.037)* |
| Exposure | (β2) | -0.071<br>(0.047) | -0.047<br>(0.053) | -0.054<br>(0.049) | -0.031<br>(0.069) |
| 100-HAI | (γ) | -0.091<br>(0.038)** | -0.098<br>(0.042)*** | -0.095<br>(0.052)* | -0.070<br>(0.035)** |
| GDP per capita | (δ1) | 0.026<br>(0.028) | 0.025<br>(0.018) | 0.064<br>(0.032)** | 0.061<br>(0.017) |
| R-squared | | 0.21 | 0.22 | 0.24 | 0.26 |
| n | | 476 | 410 | 399 | 368 |
| Number of Countries | | 112 | 112 | 111 | 67 |

Numerals in parentheses are robust standard errors and *, ** and *** denote significant at the ten, five and one percent levels, respectively.

Table 7 shows results when all seven EVI components are used as regressors. More consistent results for the two samples of data are reported, with the export instability and export concentration being statistically significant and negative.[7] The conclusion to draw from these results is that while overall economic vulnerability is an important driver of what seems to matter most is vulnerability due to shocks.

7. We acknowledge that multicollinearity may be an issue in estimating the equations for which results are shown in Table 7, and this is probably why more coefficients of the EVI were not statistically significant.

**Table 6.** Econometric Estimates Obtained from Quartile Regressions and Panel Data

| | | Full Sample of Countries, 1977 to 1999 | | | IDA Countries, 1977 to 2007 | | |
|---|---|---|---|---|---|---|---|
| | | **Q25** | **Q50** | **Q75** | **Q25** | **Q50** | **Q75** |
| Constant | (α) | 2.594<br>(0.291)*** | 2.395<br>(0.215*** | 2.326<br>(0.383) | 1.570<br>(0.753)*** | 1.215<br>(0.310)*** | 1.203<br>(0.239)*** |
| Shocks | (β1) | -0.112<br>(0.044)*** | -0.112<br>(0.043)*** | -0.060<br>(0.027)*** | -0.083<br>(0.036)** | -0.013<br>(0.034) | -0.015<br>(0.028) |
| Exposure | (β2) | -0.097<br>(0.039)*** | -0.091<br>(0.037)*** | -0.097<br>(0.037)*** | -0.071<br>(0.061) | -0.089<br>(0.042)** | -0.074<br>(0.027)*** |
| 100-HAI | (γ) | -0.162<br>(0.029)*** | -0.132<br>(0.031)*** | -0.151<br>(0.031)*** | -0.101<br>(0.043)** | -0.070<br>(0.031)** | -0.077<br>(0.027)*** |
| GDP per capita | (δ1) | -0.018<br>(0.019) | -0.001<br>(0.008) | 0.011<br>(0.005)** | 0.048<br>(0.037) | 0.073<br>(0.027)*** | 0.083<br>(0.017)*** |
| Pseudo R-squared | | 0.16 | 0.12 | 0.14 | 0.18 | 0.17 | 0.19 |
| n | | 476 | 476 | 476 | 368 | 368 | 368 |
| Number of Countries | | 112 | 112 | 112 | 67 | 67 | 67 |

Numerals in parentheses are robust standard errors and *, ** and *** denote significant at the ten, five and one percent levels, respectively.

**Table 7.** Econometric Estimates Obtained from Panel Data

| | | Full Sample of Countries, 1977 to 1999 | IDA Countries, 1977 to 2007 |
|---|---|---|---|
| | | **(1) RE** | **(2) RE** |
| Constant | (α) | 1.268<br>(0.473)*** | 0.612<br>(0.495) |
| Export instability | (β1) | -0.087<br>(0.031)*** | -0.037<br>(0.021)* |
| Agricultural production instability | (β2) | 0.009<br>(0.019) | 0.017<br>(0.015) |
| Homelessness | (β3) | -0.008<br>(0.011) | -0.021<br>(0.012)* |
| Population | (β4) | -0.018<br>(0.012) | -0.036<br>(0.021)* |
| Share of agriculture | (β5) | 0.001<br>(0.041) | 0.062<br>(0.043) |
| Export concentration | (β6) | -0.037<br>(0.019)** | -0.056<br>(0.025)** |
| Remoteness | (β7) | 0.073<br>(0.072) | 0.118<br>(0.083) |
| 100-HAI | (γ) | -0.066<br>(0.046) | -0.077<br>(0.041)* |
| GDP per capita | (δ1) | 0.035<br>(0.027) | 0.089<br>(0.018)*** |
| R-squared | | 0.24 | 0.32 |
| n | | 435 | 357 |
| Number of Countries | | 106 | 65 |

Numerals in parentheses are robust standard errors and *, ** and *** denote significant at the ten, five and one percent levels, respectively.

A far more complex story needs to be told of the relationship between performance and human capital. Intuitively one would expect that the shortfalls in education would be a more important driver of performance than shortfalls in health. This is consistent with the components made at the outset of this paper about difficulties in such areas as formulating economic and social policies and achieving high quality budgetary and financial outcomes. It is reasonable to expect that with respect to human capital shortfalls these difficulties would be due primarily to deficiencies in education and training. This is not to imply that health is unimportant, just that it is unlikely to be as important as education. The results shown in Tables 8 and 9 do not support this thinking. These tables show RE, 2SLS and quartile regression estimation results obtained from regressions in which the means of the health and education components of the HAI are used, expressed as the logarithm of 100 minus these means in order to capture human capital shortfalls. In all regressions reported the coefficients attached to the mean of the health components expressed are statistically significant and negative, while those attached to the mean of the education components of this index are insignificant.

**Table 8.** Econometric Estimates Using Panel Data

| | | Full Sample of Countries, 1977 to 1999 | | | IDA Countries, 1977 to 2007 |
|---|---|---|---|---|---|
| | | **(1) RE** | **(2) 2SLS** | **(3) 2SLS** | **(4) RE** |
| Constant | (α) | 2.058<br>(0.305)*** | 1.941<br>(0.304)*** | 1.485<br>(0.463)*** | 1.621<br>(0.325)*** |
| EVI | (β) | -0.218<br>(0.050)*** | -0.185<br>(0.057)*** | -0.156<br>(0.056)*** | -0.132<br>(0.049)*** |
| 100-Health | (γ1) | -0.076<br>(0.212)*** | -0.059<br>(0.026)** | -0.059<br>(0.034)* | -0.099<br>(0.034)*** |
| 100-Education | (γ2) | -0.006<br>(0.021) | -0.028<br>(0.039) | -0.009<br>(0.058) | 0.005<br>(0.016) |
| GDP per capita | (δ1) | 0.018<br>(0.026) | 0.022<br>(0.018) | 0.058<br>(0.033)* | 0.053<br>(0.018)*** |
| R-squared | | 0.25 | 0.25 | 0.24 | 0.29 |
| n | | 476 | 408 | 393 | 368 |
| Number of Countries | | 112 | 112 | 109 | 67 |

Numerals in parentheses are robust standard errors and *, ** and *** denote significant at the ten, five and one percent levels, respectively.

**Table 9.** Econometric Estimates Obtained from Quartile Regressions and Panel Data

| | | Full Sample of Countries, 1977 to 1999 | | | IDA Countries, 1977 to 2007 | | |
|---|---|---|---|---|---|---|---|
| | | **Q25** | **Q50** | **Q75** | **Q25** | **Q50** | **Q75** |
| Constant | (α) | 2.256 (0.271)*** | 2.275 (0.197)*** | 2.097 (0.245)*** | 2.127 (0.686)*** | 1.706 (0.566)*** | 1.130 (0.028)*** |
| EVI | (β) | -0.181 (0.039)*** | -0.192 (0.046)*** | -0.158 (0.039)*** | -0.167 (0.052)*** | -0.105 (0.037)*** | -0.079 (0.031)*** |
| 100-Health | (γ1) | -0.142 (0.022)*** | -0.109 (0.019)*** | -0.088 (0.019)*** | -0.196 (0.065)*** | -0.127 (0.043)*** | -0.081 (0.022)*** |
| 100-Education | (γ2) | 0.002 (0.027) | 0.001 (0.022) | -0.026 (0.027) | 0.013 (0.025) | 0.017 (0.015) | 0.021 (0.015) |
| GDP per capita | (δ1) | -0.027 (0.016) | -0.014 (0.009) | 0.003 (0.011) | 0.024 (0.057) | 0.030 (0.051) | 0.072 (0.026)*** |
| Pseudo R-squared | | 0.19 | 0.14 | 0.15 | 0.21 | 0.19 | 0.21 |
| n | | 476 | 476 | 476 | 368 | 368 | 368 |
| Number of Countries | | 112 | 112 | 112 | 67 | 67 | 67 |

Numerals in parentheses are robust standard errors and *, ** and *** denote significant at the ten, five and one percent levels, respectively.

These results justify further examination of the data, as we can legitimately question whether educational levels are not relevant to performance and hence their econometric veracity. The results of such examination are shown in Tables 10 to 12. Education and health shortfalls will be mutually interdependent, as is evidenced by the simple correlation coefficient between these variables, which is 0.69. On these grounds we re-estimate the regression for which results are shown in Tables 8 and 9 but without 100 minus the mean of the HAI health variables. Results are shown in Table 10 and 11. Mixed evidence of the relevance of education shortfalls for performance, with four of the ten coefficients attached to education shortfall variable being significant and negative. Results of further estimation are shown in Table 12. This estimation was conducted using each of the two HAI education variables, expressed as the logarithm of 100 minus their actual values, instead of their mean. Only one of the four estimates of these coefficients is significant and negative.

What overall conclusions do we draw from the results reported in Tables 1 to 12? There are two. The first is that the empirical relationship between performance and economic vulnerability is highly robust. This is based on the estimates of the coefficient $\beta$, showing the relationship between the CPIA and the EVI. Thirty-nine estimates of $\beta$ are provided above. Every one of these estimates was statistically significant and negative. Less unambiguous results were obtained for the relationship between human capital shortfall and performance based on the estimates of the parameter $\gamma$. The econometric evidence points to there being an inverse relationship between these variables, based on the estimates of this parameter being statistically significant and negative. This is reasonably clear. The ambiguity is over whether this relationship is driven by shortfalls in health or in education.

**Table 10.** Econometric Estimates Using Panel Data

| | | Full Sample of Countries, 1977 to 1999 | | | IDA Countries, 1977 to 2007 |
|---|---|---|---|---|---|
| | | **(1) RE** | **(2) 2SLS** | **(3) 2SLS** | **(4) RE** |
| Constant | (α) | 1.716<br>(0.369)*** | 1.709<br>(0.313)*** | 1.093<br>(0.457)** | 1.252<br>(0.288)*** |
| EVI | (β) | -0.191<br>(0.052)*** | -0.200<br>(0.058)*** | -0.173<br>(0.060)*** | -0.133<br>(0.051)*** |
| 100-Education | (γ) | -0.039<br>(0.028) | -0.046<br>(0.037) | -0.032<br>(0.055) | -0.025<br>(0.015)* |
| GDP per capita | (δ1) | 0.031<br>(0.030) | 0.040<br>(0.018)** | 0.103<br>(0.030)*** | 0.071<br>(0.017)*** |
| R-squared | | 0.24 | 0.24 | 0.22 | 0.24 |
| n | | 504 | 410 | 400 | 368 |
| Number of Countries | | 114 | 112 | 110 | 67 |

Numerals in parentheses are robust standard errors and *, ** and *** denote significant at the ten, five and one percent levels, respectively.

**Table 11.** Econometric Estimates Obtained from Quartile Regressions and Panel Data

| | | Full Sample of Countries, 1977 to 1999 | | | IDA Countries, 1977 to 2007 | | |
|---|---|---|---|---|---|---|---|
| | | **Q25** | **Q50** | **Q75** | **Q25** | **Q50** | **Q75** |
| Constant | (α) | 1.583<br>(0.460)*** | 2.094<br>(0.278)*** | 2.023<br>(0.244)*** | 1.541<br>(0.383)*** | 0.877<br>(0.267)*** | 0.927<br>(0.222)*** |
| EVI | (β) | -0.210<br>(0.053)*** | -0.199<br>(0.045)*** | -0.169<br>(0.039)*** | -0.194<br>(0.056)** | -0.073<br>(0.046)*** | -0.087<br>(0.040)* |
| 100-Education | (γ1) | -0.042<br>(0.039) | -0.073<br>(0.033)** | -0.107<br>(0.035)*** | -0.039<br>(0.019)** | -0.001<br>(0.015) | -0.011<br>(0.017) |
| GDP per capita | (δ1) | 0.037<br>(0.032) | 0.002<br>(0.019) | 0.015<br>(0.014) | 0.048<br>(0.028)* | 0.070<br>(0.020)*** | 0.079<br>(0.015)*** |
| Pseudo R-squared | | 0.12 | 0.09 | 0.12 | 0.17 | 0.16 | 0.18 |
| n | | 504 | 504 | 504 | 368 | 368 | 368 |
| Number of Countries | | 114 | 114 | 114 | 65 | 65 | 65 |

Numerals in parentheses are robust standard errors and *, ** and *** denote significant at the ten, five and one percent levels, respectively.

**Table 12.** Econometric Estimates Obtained from Panel Data

| | | Full Sample of Countries, 1977 to 1999 | IDA Countries, 1977 to 2007 |
|---|---|---|---|
| | | **(1) RE** | **(2) RE** |
| Constant | (α) | 1.745<br>(0.342)*** | 1.276<br>(0.302)*** |
| EVI | (β) | -0.202<br>(0.053)*** | -0.139<br>(0.052)*** |
| 100-Literacy | (γ1) | -0.079<br>(0.025)*** | -0.025<br>(0.016) |
| 100-Gross Secondary Enrolment | (γ2) | 0.038<br>(0.029) | -0.003<br>(0.022) |
| GDP per capita | (δ1) | 0.030<br>(0.027) | 0.071<br>(0.017)*** |
| R-squared | | 0.19 | 0.23 |
| n | | 501 | 363 |
| Number of Countries | | 114 | 65 |

Numerals in parentheses are robust standard errors and *, ** and *** denote significant at the ten, five and one percent levels, respectively.

### b) Performance and Exogenous Shocks

Our attention now turns to the relationship performance and exogenous economic shocks. The econometric model used for analysing this relationship is as follows:

$$\Delta P_{i,t} = \sigma + \pi P_{i,t-1} + \theta' S_{i,t} + \rho' \Omega_{i,t} + \nu_{i,t} \qquad (2)$$

where $\Delta P_i$,t is the percentage change in performance for country between years $t$ and period $t\text{-}1$, $P_{i,t-1}$ is country i's performance in year $t\text{-}1$, $S_{i,t}$ is a measure of exogenous economic shocks between year t and $t\text{-}1$, $\Omega_{i,t}$ a vector of exogenous control variables, $\nu_{it}$ is an error term, $\sigma$ is a constant, $\pi$ a coefficient and $\theta'$ and ρ' are a vectors of coefficients. Our measure of performance is confined to the CPIA. The exogenous shock variable is the annual percentage change in country $i'$s net barter terms of trade, denoted $\Delta ToT_{i,t}$. The contents of $\Omega_i$,t shall be were $i'$s exports as a ratio of its GDP, the annual net change in $i'$s net barter terms of trade multiplicatively interacting with the export ratio and the change in $I'$s exports. These variables are respectively denoted $X_{i,t}$, $\Delta ToT_{i,t} \bullet X_{i,t}$ and $\Delta x_{i,t}$.

Variants of equation (2) were estimated using data for 1980 to 2007 covering IDA countries using the RE and GMM methods. The starting year of 1980 was determined purely on the basis of data availability. Table 13 reports the results. The key coefficient is that relating shocks to performance, which is $\pi$. This coefficient was found to be negative and highly significant, at the one percent level, in all of the variants of (2) for which results are reported in Table 13. We interpret this as strong evidence of the pro-cyclicality of performance and shocks. Concerns of the double punishment referred to at the outset of this paper, in which countries suffering from adverse shocks receive less aid as an indirect consequence, appear to be valid, therefore.

**Table 13.** Econometric Estimates Using Panel Data 1980 to 2007
Data Panel Data for IDA Countries

| | (1) Panel RE | (2) Panel RE | (3) System-GMM | (4) Panel RE | (5) System-GMM | (6) Panel RE | (7) System-GMM |
|---|---|---|---|---|---|---|---|
| Constant ($\lambda$) | 0.280 (0.045)*** | 0.285 (0.027)*** | 0.286 (0.128)** | 0.337 (0.030)*** | 0.309 (0.202)° | 0.589 (0.054)*** | 0.542 (0.260)** |
| $P_{i,t-1}$ ($\pi$) | -0.085 (0.013)*** | -0.084 (0.008)*** | -0.079 (0.029)*** | -0.099 (0.009)*** | -0.116 (0.051)** | -0.182 (0.013)*** | -0.169 (0.081)** |
| $\Delta ToT_{i,t}$ ($\theta$) | -0.022 (0.032) | -0.059 (0.048) | -0.479 (0.304)° | | | | |
| $X_{i,t}$ ($\rho 1$) | | -0.0159 (0.032) | -0.003 (0.098) | | | | |
| $\Delta ToT_{i,t} \cdot X_{i,t}$ ($\rho 2$) | | 0.141 (0.098)° | 1.051 (0.606)* | | | | |
| $\Delta x_{i,t}$ ($\rho 3$) | | | | 0.062 (0.032)** | 0.104 (0.058)* | 0.374 (0.155)*** | 0.465 (0.191)*** |
| Test for AR(2) | | | 0.295 | | 0.596 | | 0.810 |
| Hansen J Test | | | 0.849 | | 0.755 | | 0.619 |
| N | 1017 | 974 | 974 | 962 | 962 | 309 | 309 |
| Number of Countries | 53 | 52 | 52 | 47 | 47 | 46 | 46 |

Data are averaged over a three year periods for results in columns (6) and (7). Numerals in parentheses are robust standard errors and °, *, ** and *** denote significant at the fifteen, ten, five and one percent levels, respectively. AR and Hansen J test statistics are p-values. Endogenous variables in GMM estimation are $P_{i,t-1}$, $X_{i,t}$ and $\Delta ToT_{i,t}$ in (3) and $P_{i,t-1}$ and $\Delta x_{i,t}$ in (5) and (7).

## 4 - Conclusion

Developing country performance with respect to economic policies and institutional behaviour is a common criterion for the allocation of aid among recipient countries. This paper questioned the manner in which performance is used in this regard, arguing that performance is too narrowly defined. A more appropriate definition is one that controls for the economic vulnerability and human capital of developing countries given that these variables are likely to be inversely related with performance. The paper presented the results of an econometric analysis of cross-section and panel data is presented that provided strong support this contention. Specifically, it was shown that both the well-known Economic Vulnerability Index (EVI) and a human capital shortfall measure constructed from the Human Assets Index (HAI) were negatively and significantly association with the scores provided widely-used measure of performance, the World Bank's Country Performance and Institutional Assessment (CPIA). The first of these associations, between the EVI and the CPIA, was especially robust. The paper also contended that performance and exogenous economic shocks are likely to be pro-cyclical. This implied a double punishment when aid is allocated according to performance. Robust econometric evidence of such punishment was also provided in this paper.

The prime motivation for undertaking the econometric analysis reported in this paper was to critique the structure of performance based aid allocation systems, specific their heavy reliance on the CPIA. That the EVI and the CPIA are inversely related, especially after controlling for income per capita, another variable used in performance based allocation systems, is provides a case for augmenting these systems with the EVI in a way that ensures that the aid allocations they prescribe are an increasing function of it. Given the research that shows that economic vulnerability is a robust determinant of the impact of aid on recipient country growth, such an augmentation will increase the development effectiveness of the aid that these systems prescribe. That human capital shortfall is also inversely related is suggestive of basing aid on performance is unlikely to provide sufficient incentives for countries to improve their performance, which is a key design feature of performance based systems. Such a relationship also provides a case for augmenting these systems, with one or more indicators of human capital in a way that ensures the cross-country allocations of aid they prescribe do not penalise low income countries. We leave it to further research to provide guidelines on precisely how these augmentations should be implemented.

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