Aid, Volatility and Growth,with special reference to Africa

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CENTRE D'ÉTUDES
ET DE RECHERCHES
SUR LE DÉVELOPPEMENT
INTERNATIONAL

Very preliminary draft
March 2006
Not for quotation

Document de travail de la série

Etudes et Documents

E 2006.40

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Abstract

In two previous papers we have argued that aid is likely to mitigate the negative effects of external shocks on economic growth (*i.e.* that aid is more effective in countries which are more vulnerable to external shocks). Recently an important debate has emerged about the possible negative effects of aid volatility itself. However, the cushioning effect of aid may involve some volatility in aid flows, hence not necessarily negative for growth. In this paper we examine to what extent the time profile of aid disbursements may contribute to an increase or a decrease of aid effectiveness in Africa. We first show that aid, even if volatile, is not clearly as pro-cyclical as often argued, and that, even if pro-cyclical, is not necessarily destabilizing. We measure aid volatility by two methods and assess pro-cyclicality of aid with respect to exports, thus departing from previous literature, which usually assess pro-cyclicality of aid with respect to national income or fiscal receipts. The stabilizing/destabilizing nature of aid is measured by the difference in the volatility of aid and the volatility of the a aid plus exports. We then evidence through growth regressions that the higher effectiveness of aid in vulnerable countries is to a large extent due to a stabilizing effect. Finally we consider the implications of this effect for income volatility.

1. Introduction

While a rising concern was perceptible about the problems raised by volatility, several recent papers, followed by more official documents and political declarations, have underlined the problem induced by *aid volatility* (Bulir and Hamann, 2001, 2003, 2005; Eifert and Gelb, 2005; Lensink and Morrissey, 2000; Pallage and Robe, 2001; Rand and Tarp, 2002; IMF and World Bank, 2005): if aid is unstable, it may contribute to macroeconomic instability, then be itself a factor of vulnerability. This concern has been reinforced by the prospect of an acceleration of disbursements in order to achieve the Millennium Development Goals. It may be particularly relevant for African countries, which are often vulnerable and where the prospects of aid increase mainly apply.

However, in the context of the aid effectiveness debate, we have argued in two previous papers (Guillaumont and Chauvet, 2001; Chauvet and Guillaumont, 2004) that aid is likely to cushion the negative effects of external shocks on economic growth (*i.e.* that aid is more effective in countries that are more vulnerable to external shocks). Aid volatility prosecution may thus be misplaced if aid has a compensatory profile: in that case aid volatility, rather than a problem, might be a solution. Indeed, any cushioning effect of aid involves some volatility in aid flows: if aid is to mitigate trade and climatic shocks, then aid will obviously be volatile. This kind of aid volatility should not have a negative impact on growth, since it is likely to protect the growth process of the developing countries vulnerable to external shocks.

This is why volatility of aid is not so much prosecuted than its unpredictability and its pro-cyclicality. Unpredictability of aid is supposed to be harmful, but is difficult to assess. Its assessment would need a forecasting model of aid at the recipient level, where the predicted level would depend among other factors on the kind of aid delivered and on shocks likely to occur. Pro-cyclicality is easier to measure, what has been done essentially with respect to national income or fiscal revenue. Here we analyse the pro or contra cyclicality of aid with respect to export, because export volatility, resulting in Africa mainly from commodity price shocks, is more likely to be exogenous than national income or fiscal revenue volatility. However pro-cyclicality may not be the most relevant concept to assess the economic consequences of aid volatility, what we intend to do in the framework of volatility and growth relationships. This is why in this paper we design another concept, which is the stabilizing effect of aid, here measured with respect to exports, and compare its level in Africa and elsewhere. On average, while African countries have more suffered from export volatility

than other developing countries, and have registered lower aid volatility, in these countries aid has been with regard to export more stabilizing.

Section 2 assesses the concepts and levels of aid volatility, of aid pro-cyclicality, and of the stabilizing character of aid. We argue that aid is not as pro-cyclical as it is often asserted. We also argue that a pro-cyclical aid can still be stabilizing and that there may be cases where aid is contra-cyclical and destabilizing, depending on the relative volatility of aid with respect to exports. We thus construct an indicator capturing the stabilizing character of aid. In section 3, using this indicator in growth regressions, we can explain that the higher aid effectiveness in vulnerable countries is due to a large extent to its stabilizing effect: exogeneous trade shocks have a negative impact on growth and aid mitigates this impact. Section 4 extends this analysis to the impact of aid and exports volatility on income volatility. Finally, section 5, presents the main conclusions of the paper.

2. Contra-cyclicality, volatility and stabilizing character of aid with regard to exports

The contra-cyclical character of aid can be measured by the correlation between the "cycle" of aid (*i.e.* its deviation from its trend) and the "cycle" of the aggregate to which aid is compared. Thus contra-cyclicality is always related to the choice of a reference aggregate and of a trend measurement.

2.1. Contra-cyclical aid: with reference to which aggregate?

Previous literature has so far assessed contra-cyclicality of aid with respect to national income (Pallage and Robe, 2001) or fiscal receipts (Bulir and Hamann, 2001, 2003, 2005). Here we compare aid cycles to that of exports of goods and services.[1] This can be justified on two grounds. First, as far as we are concerned by macroeconomic vulnerability to external shocks, better is to compare aid with the aggregate the most likely to be affected by exogeneous shocks. Many low income developing countries hugely suffer from export price shocks which can directly be assessed through exports instability. Second, national income

[1] Here we consider as a reference flow exports of goods and services, but not international capital flows, the volatility of which may exacerbate the consequences of trade shocks in middle income countries, as studied in the case of Chile (Cabalerro, 2002): extending the reference flow to capital movements seems less relevant in the case of African countries. In emerging economies the issue is less the pro-cyclicality of aid than of capital flows (underlined by Kaminsky *et al.,* 2003).

and fiscal revenues are more likely to be influenced by aid disbursements than exports, with the exception of countries suffering from Dutch disease, which however generally occurs with some delay. Anyway if Dutch disease effects were to occur immediately and symmetrically, aid volatility would be to some extent stabilizing: aid increase, leading to a real exchange rate appreciation, would induce a slow down of exports, and conversely.

2.2.Cycles: how are they measured?

Several alternative methodologies are available to analyse the cyclical characteristics, and the volatility of aid and exports. Following Bulir and Hamann (2001, 2003, 2005), Pallage and Robe (2001) and Rand and Tarp (2002), an H-P filter (Hodrick et Prescott, 1997) can be used to extract the trend and cycle components of aid and of the reference flow, here exports. The H-P filter decomposes a series, x_t, (where x_t is the logarithm of the observed series X_t) in a cycle, x_t^c, and a trend, x_t^g, by minimising the following function:

$$\sum_t \left(x_t - x_t^g\right)^2 + \lambda \sum_t \left[\left(x_{t+1}^g - x_t^g\right) - \left(x_t^g - x_{t-1}^g\right)\right]^2 ,$$

where λ is the smoothing parameter of x_t^g. The choice of the value of λ depends on the frequency of observations. On annual data, Pallage and Robe (2001) use λ equals 100, while Bulir and Hamann (2001) use λ equals 7. The study of Ravn and Uhlig (2002) shows that on annual data, λ should be of the order of 6.25 so we follow Bulir and Hamann (2001) and choose λ equals 7. The pro or contra-cyclical character of aid is measured by the correlation between the cycle of aid and that of exports over a given time period.[2] The volatilities of aid and exports are measured by the respective standard errors of their cycles.

Another way of measuring trend and cycles, more frequently used for the analysis of export instability, is to perform an econometric estimate of the trend. Due to the uncertainty about the deterministic or stochastic nature of this trend, it is convenient to estimate an equation of the following form:

$$x_t = \alpha_1 + \alpha_2 time + \alpha_3 x_{t-1} + \varepsilon_t .$$

The predicted value, $\hat{x}_t$, is the trend component, while the residual, ε_t, is the cycle component. As previously, contra-cyclicality is measured by the correlation of the cycles of aid and exports. The respective volatilities of aid and exports are measured by the standard errors of the residuals.

Both aid and exports are measured in absolute terms, in constant dollars (100=1995). Aid data are from the OECD-CAD (deflated by the DAC deflator), and exports data are from the World Development Indicators (WDI, 2004).

2.3. Is aid really pro-cyclical?

Previous studies on aid volatility conclude that more often than contra-cyclical, aid is pro-cyclical, at best not correlated with the cycles of national income or fiscal revenues (Bulir and Hamann, 2001, 2003, 2005; Pallage and Robe, 2001): for instance Bulir and Hamman (2001) find that aid is modestly pro-cyclical with correlation coefficients mainly concentrated on the right of zero and with only a small number of countries with contra-cyclical aid. Referring to exports, Table 1 (with cycles measured with H-P filter) gives a slightly different picture. Results of Table 1 are confirmed by that of Appendix 1 which reports the same statistics descriptive when using the second methodology for cycle measurement.

Table 1 suggests that for the whole sample of developing countries and the entire 1970-1999 period aid is hardly more pro-cyclical with respect to export than contra-cyclical (243 cases versus 222). In Africa though, aid has been hardly more often contra-cyclical (97 cases) than pro-cyclical (95 cases). Over time, there is an evolution: aid to Africa has been relatively more contra-cyclical in the seventies, relatively more pro-cyclical in the eighties, and in the nineties, as contra-cyclical as pro-cyclical. This pattern appears whatever the measurement of the cycles. However, with method 2 aid appears a bit more contra-cyclical in the nineties in Africa (cf Appendix 1) than with the H-P method.

Figure 1 illustrates these results for Africa with some more details. Even if in the nineties, the number of cases with pro-cyclical aid equals those with contra-cyclical aid, Figure 1 suggests that the positive correlations have a higher value than the negative ones, with 20% of countries having a correlation greater than 0.5 in 1995-1999. The same seems to

[2] Our dataset for growth estimations is on five-year averages from 1970-74 to 1995-99. The correlations of cycles are measured on eight years: five years of the sub-period and three years before.

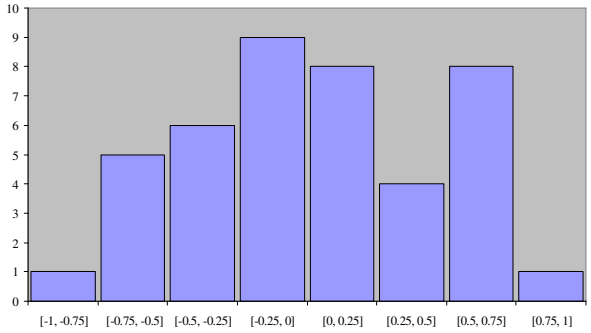
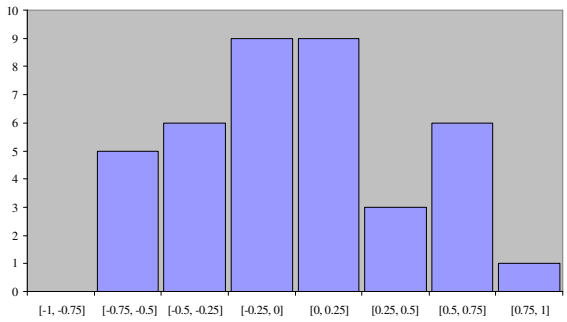
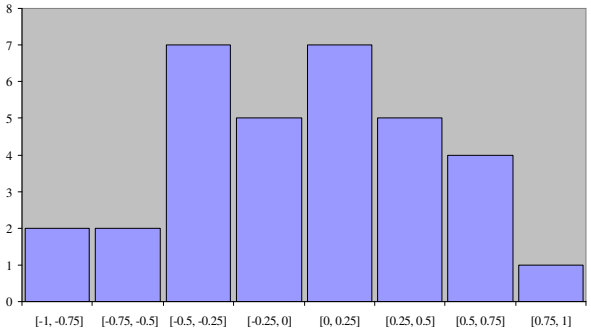
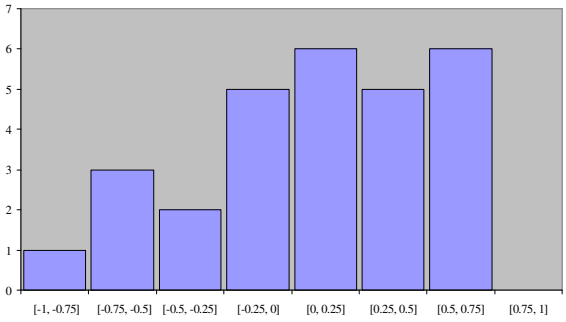
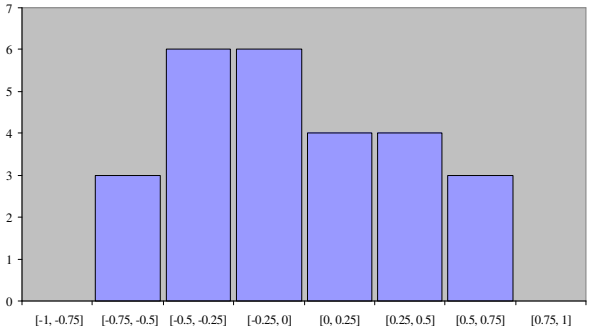
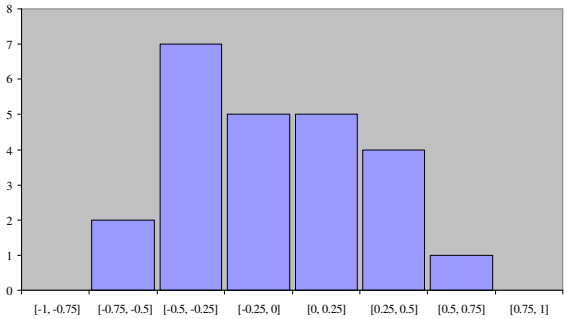
be true for the eighties: aid was clearly more pro-cyclical than contra-cyclical and more than 20% of countries had a correlation of cycles of aid and exports greater than 0.5.

Table 1 : Aid contra-cyclicity, relative volatility and stabilizing character with respect to exports, Hodrick Prescott.

Averages, whole sample.	1970-99	1995-99	1990-94	1985-89	1980-84	1975-79	1970-74
Aid volatility	0.088	0.069	0.062	0.085	0.087	0.108	0.151
Exports volatility	0.088	0.094	0.085	0.078	0.098	0.093	0.078
Income volatility	0.031	0.030	0.029	0.029	0.034	0.034	0.028
Counter-cyclical character Correlation (cycle X, cycle A)	0.016	0.017	0.0001	-0.046	0.143	0.030	-0.052
Nb of countries with >0 correlation	243	59	46	37	46	30	25
Nb of countries with <0 correlation	222	57	41	42	24	30	28
Relative volatility Vol. of A / Vol. of X	0.994	0.739	0.729	1.092	0.892	1.158	1.949
Nb countries with relative volatility >1	161	41	34	38	28	14	6
Nb countries with relative volatility <1	304	75	53	41	42	46	47
Stabilizing character Vol. of X – Vol. of (X+A)	0.016	0.024	0.023	0.009	0.010	0.011	0.007
Total number of countries	465	116	87	79	70	60	53

Averages, Africa.	1970-99	1995-99	1990-94	1985-89	1980-84	1975-79	1970-74
Aid volatility	0.059	0.058	0.055	0.075	0.073	0.052	0.038
Exports volatility	0.112	0.127	0.114	0.093	0.123	0.111	0.094
Income volatility	0.034	0.029	0.031	0.032	0.040	0.043	0.036
Counter-cyclical character Correlation (cycle X, cycle A)	0.001	0.036	0.0004	0.010	0.086	-0.059	-0.103
Nb of countries with >0 correlation	95	21	19	17	17	11	10
Nb of countries with <0 correlation	97	21	20	16	11	15	14
Relative volatility Vol. of A / Vol. of X	0.529	0.456	0.478	0.802	0.593	0.474	0.405
Nb countries with relative volatility >1	38	8	9	14	4	3	0
Nb countries with relative volatility <1	154	34	30	19	24	23	24
Stabilizing character Vol. of X – Vol. of (X+A)	0.030	0.052	0.042	0.015	0.020	0.020	0.013
Total number of countries	192	42	39	33	28	26	24

Figure 1: Cyclical character of aid with respect to exports in Africa, 1970-1999, (HP filter).

Period 1995-1999	Period 1990-1994
N = 192, n(–) = 21, n(+) = 21	N = 39, n(–) = 20, n(+) = 19
	
Period 1985-1989	**Period 1980-1984**
N = 33, n(–) = 16, n(+) = 17	N = 28, n(–) = 11, n(+) = 17
	
Period 1975-1979	**Period 1970-1974**
N = 26, n(–) = 15, n(+) = 11	N = 24, n(–) = 14, n(+) = 10
	

Note: Total number of countries: N ; Number of countries for which the correlation is negative : n(–) ; Number of countries for which the correlation is positive : n(+).

2.4. Is volatility of aid higher than volatility of exports?

The pro or contra-cyclicality of aid with respect to exports does not have the same importance whether aid volatility is high or low compared to that of exports. Some of the previous studies related to aid volatility have compared it to that of tax revenues and argued that it was considerably higher. Here we compare the volatility of aid to that of exports. Table 1 shows that the average relative volatility of aid (ratio of the volatility of aid to the volatility of exports) is significantly smaller than one in Africa whatever the period, although in 1985-1989 the average relative volatility of aid was close to one (0.8). The proportion of countries with relative volatility greater than one is, in Africa always less than 25%, with the exception of the late eighties when around 43% of African countries had a relative volatility of aid with respect to exports greater than one. Table 1 also evidences that average exports volatility has been much higher in Africa than in the rest of the World, while aid volatility was slightly lower.

2.5. What makes aid stabilizing or not?

Pro or contra-cyclicality is indeed an important parameter. But it is not the only relevant one to determine whether aid inflows are stabilizing or destabilizing. Pro-cyclical aid can still be stabilizing if its volatility is lower than that of exports. On the reverse there may be cases where aid is contra-cyclical and destabilizing, when its volatility is significantly higher than that of exports, in a proportion depending on the relative level of aid and exports. Overall, the stabilizing character of aid with respect to export volatility is a function of both aid contra-cyclicality and its relative volatility with respect to exports, as well as of the average relative levels of aid and exports.

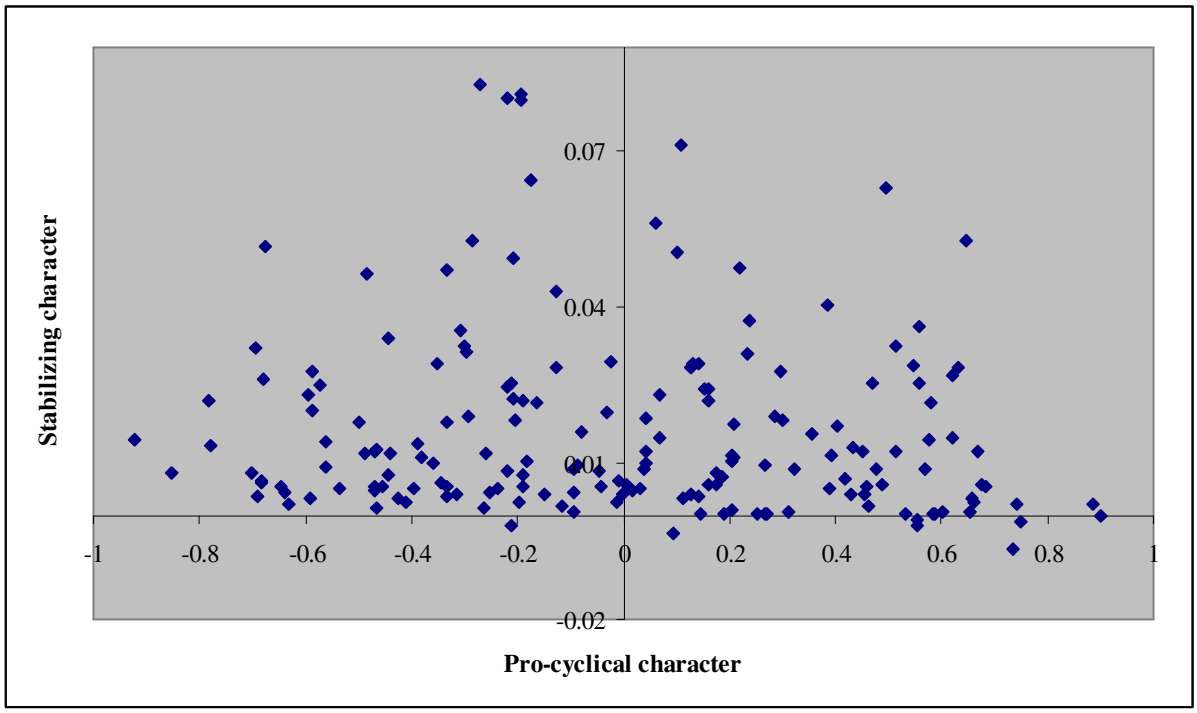
What is the real picture? To assess the stabilizing character of aid we build an index which is the difference between the volatility of exports and the volatility of aid plus exports:

Stabilizing character = Volatility of X – Volatility of (X + A).

If the difference is positive, aid is stabilizing; if it is negative, aid is destabilizing (with regard to exports). Figure 2 represents the pro-cyclical character of aid *versus* its stabilizing character in Africa over 1970-1999 (H-P method). Cases where aid was contra-cyclical as

well as destabilizing appear to be extremely rare. Over 97 cases of contra-cyclical aid only one appears to have a negative stabilizing indicator: Uganda 1985-1989. Interestingly, pro-cyclical aid most of the time is associated with a positive stabilizing indicator. Over 95 cases of pro-cyclical aid in Africa, only six cases correspond to destabilizing aid: Mauritius 1985-1989, 1990-1994, 1995-1999; Niger 1985-1989; Kenya 1980-1984 and Zimbabwe 1985-1989. Thus, the "paradoxical" cases where aid is both pro-cyclical and stabilizing seem to be the majority. It can be noted that in the six cases where aid is pro-cyclical and destabilizing aid volatility is much greater than export volatility.

Figure 2 : Pro-cyclical *versus* stabilizing aid, African countries, 1970-1999.



To summarize, aid volatility is high, but is a matter of concern only if it is destabilizing, which occurs in a minority of cases, more likely when it is pro-cyclical rather than contra-cyclical. The stabilizing character of aid is also a function of the relative volatility and of the relative level of aid flow compared to that of the flow of reference, here exports. If aid is pro-cyclical, but its relative volatility with respect to exports is low, then aid is still likely to be stabilizing. Thus the stabilizing character of aid with respect to exports basically depends on three characteristics of aid, its contra-cyclicality, its relative volatility and its

relative level, all the three with respect to exports, and compensating or reinforcing each others.

3. Stabilizing aid: its growth effectiveness

3.1. Aid more effective in countries vulnerable to external shocks

The debate initiated by the influential paper of Burnside and Dollar (1997, 2000) has at least made clear that aid effectiveness is likely to depend on specific features of the recipient country. The feature focused on by Burnside and Dollar was the quality of economic policy and of institutions. The resulting message of a priority to be given in aid allocation to countries with "good" policies and institutions met a moral sentiment not always grounded on a robust assessment of aid effectiveness. The debate on the Burnside and Dollar thesis has indeed been mainly related to the robustness of their econometric results, secondarily to the consistency of the relying hypotheses (see Hansen and Tarp, 2001). In two previous papers (Guillaumont and Chauvet, 2001; Chauvet and Guillaumont, 2004) we have argued that a major factor conditioning aid effectiveness in recipient countries was the economic vulnerability they face. In vulnerable countries foreign support has a high marginal productivity in avoiding collapses when shocks occur or long standing recessions afterwards; it is expected to smooth public expenditures and to lower the risk of fiscal deficit. Consequently the marginal contribution of aid to growth of recipient countries is expected to be higher in developing countries exposed to external shocks. This effect of vulnerability on aid effectiveness was captured in a growth regression by a multiplicative explanatory variable (aid to GDP ratio x vulnerability indicator), similar to the variable used by Burnside and Dollar (aid to GDP ratio x policy indicator), and found significantly positive.

The measure of the vulnerability variable was not the same in the two papers. Only the 2001 paper used a concept of vulnerability close to that used for LDCs identification, including (small) population size, export instability, agricultural production instability. The 2004 paper used a narrower concept, limited to export instability and (negative) terms of trade trend, but extended the analysis to the impact on aid effectiveness of political instability (negative effect), of present economic policy (positive effect) and of previous economic

policy (negative effect, due to the possible effect of aid on policy improvement from a "bad" initial situation, an effect neglected in the standard Burnside Dollar model).[3,4]

For the purpose of our present analysis we first use an even narrower concept of vulnerability; that is we focus on that part of vulnerability due to external trade shocks, as captured by exports instability. We do so because we intend to analyse aid effectiveness with respect to its contra-cyclicality and to its stabilizing impact and consequently need a reference aggregate (exports) to which we can compare aid cycles.

The first step of our econometric analysis of aid effectiveness consists in estimating a baseline model of the form:

$$y_{i,t} = \alpha_1 y_{t-5} + \alpha_2 Exports\ volatility._{i,t} + \alpha_3 ODA/GDP_{i,t} + \alpha_4 Exports\ volatility._{i,t}\ \text{x} ODA/GDP_{i,t} + \varepsilon_{i,t}$$

where $y_{i,t}$ is the logarithm of real income per capita (PWT 6.1) of country i ($i = 1...N$) in period t ($t = 1...T$). A GMM estimator is used. Lagged income and aid (as well as aid interacted with exports volatility) are instrumented. Instruments used for lagged income is income lagged twice. Instruments used for aid are those of Tavares (2003) i.e. the total budget of aid of the five major donors weighted by distance variables: cultural distance (same language, same religion) and geographical distance (distance from Brussels, Tokyo and Washington). This list of instruments is supplemented with the average growth of the two major donors of each receiving country and income squared. The validity of instruments is tested with an Hansen test of over-identification and the Shea partial R squared. Growth equations are estimated on five-year sub-periods from 1970 to 1999 on a sample of 38 African countries (listed in Appendix 2).

The first column of Table 2 presents the results of the estimation of the baseline model. It suggests that the volatility of exports has a strong negative impact on growth, but which can be mitigated by aid since aid interacted with the volatility of exports is significantly positive.

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[3] Another paper by Collier and Dehn (2001) also evidenced the role of aid as a factor mitigating export price shocks considered on a year by year basis, defined from a forecasting model, and retained only if they were on the tail of the distribution; although this model did not allow to measure the long term effect of instability on growth, it made a useful distinction between the effect of a change of aid, found to lower the negative effect of a negative shock, and the effect of aid level itself, found to increase the positive effect of a positive shock.

[4] A good survey of these papers is given by McGillivray (2003). Moreover, Roodman (2004) presents a thorough assessment of the econometric robustness of various papers, confirming the relative robustness of our 2001 results (the 2004 paper is not analyzed). These are found to be more robust than those by Collier and Dehn,

3.2. The stabilizing impact of aid on growth

The next step of our analysis is to assess the impact on growth of the stabilizing character of aid. Table 2 presents these results. The difference between columns (2)/(4) and (3)/(5)/(6) is that in regressions (3), (5) and (6) the stabilizing character of aid is instrumented (using the same instruments as for aid). Columns (2) and (3) show that when the stabilizing character of aid is introduced into the baseline model, aid interacted with exports volatility loses its significance. Results regarding the stabilizing character of aid are reinforced when aid interacted with exports volatility is dropped (columns (4) and (5)). Finally, regression (6) suggests that estimating the model with fixed effects does not alter the results. In Appendix 3 the same regressions are performed using the second (mixed trend) method for measuring cycles and results are very close to that of Table 2.

themselves more robust (for the effect of aid change) than those of Burnside and Dollar, but less robust than the results of Hansen and Tarp, who do not address the vulnerability issue.

Table 2: The stabilizing impact of aid on growth, 1970-1999, African countries.

Ln income pc t	(1)	(2)	(3)	(4)	(5)	(6)
	GMM	GMM	GMM	GMM	GMM	Within IV
Ln income pc t-5	**1.0019**	**1.0196**	**1.0203**	**1.0126**	**1.0230**	**0.8727**
	(53.31)* **	**(55.13)*** **	**(50.84)*** **	**(65.84)*** **	**(61.44)*** **	**(7.66)*** **
Volatility of X (HP)	-1.401	-0.480	-1.4060	-0.684	-1.127	-0.450
	(1.91)*	(1.14)	(1.98)**	(2.36)**	(2.27)**	(0.85)
ODA/GDP	**-0.715**	**0.099**	**-0.369**	**-0.107**	**-0.143**	**-2.815**
	(1.71)*	**(0.29)**	**(0.92)**	**(0.68)**	**(0.90)**	**(2.12)****
ODA/GDP x Volatility of X (HP)	**6.382**	**-2.305**	**1.925**			
	(1.72)*	**(0.68)**	**(0.48)**			
Stabilizing character of Aid		1.8489	**2.129**	1.2954	**2.299**	**6.416**
		(1.67)*	**(1.69)***	(1.74)*	**(2.24)****	**(1.94)***
Dummy 1970-1974	-0.0415	-0.0341	-0.031	-0.038	-0.0307	0.0111
	(1.15)	(1.05)	(0.89)	(1.18)	(0.94)	(0.22)
Dummy 1975-1979	0.020	0.028	0.0303	0.0273	0.031	0.070
	(0.44)	(0.72)	(0.69)	(0.70)	(0.76)	(1.34)
Dummy 1980-1984	-0.0644	-0.0631	-0.050	-0.063	-0.0515	-0.0111
	(1.63)	(1.80)*	(1.27)	(1.82)*	(1.40)	(0.19)
Dummy 1985-1989	-0.034	-0.019	-0.0140	-0.0230	-0.011	0.006
	(0.89)	(0.60)	(0.39)	(0.75)	(0.36)	(0.09)
Dummy 1990-1994	-0.1415	-0.1213	-0.1336	-0.121	-0.1266	-0.1655
	(2.86)***	(3.17)***	(2.87)***	(3.20)***	(3.15)***	(2.04)**
Dummy 1995-1999	-0.0214	-0.0134	-0.0324	-0.0145	-0.0301	-0.0877
	(0.58)	(0.52)	(0.98)	(0.57)	(1.07)	(1.29)
Constant	0.1880	-0.0591	0.0238	0.0192	-0.0290	1.1686
	(1.07)	(0.36)	(0.13)	(0.16)	(0.24)	(1.45)
Observations (Countries)	200 (38)	200 (38)	200 (38)	200 (38)	200 (38)	200 (38)
R-squared	0.95	0.96	0.96	0.96	0.96	0.31
Nb of instruments	29	29	29	29	29	29
Hansen p-value	0.35	0.34	0.43	0.37	0.38	
Shea Partial R2 for income t-5	0.69	0.62	0.59	0.85	0.71	
Shea Partial R2 for ODA/GDP	0.15	0.18	0.15	0.36	0.35	
Shea Partial R2 for ODA/GDP x Vol. X	0.11	0.15	0.13			
Shea Partial R2 for Stabi. character			0.22		0.18	
Test that all time dummies=0 (*p*-value)	0.005	0.004	0.004	0.004	0.003	0.02

T statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. In bold: instrumented variables

4. Broader perspective: aid and growth volatility n order to assess the extent to which aid was contra or pro-cyclical with regard to exogeneous shocks and correspondingly stabilizing, we had to focus on a major but specific source of shocks, namely export volatility. Developing countries are facing other kinds of shocks (e.g. climatic instability) and aid may have a mitigating effect also with regard to them. It is indeed possible to aggregate several kinds of shocks in an index of vulnerability, such as the UN economic vulnerability index, or in an appropriate index as we have done earlier (Guillaumont and Chauvet, 2001; Chauvet and Guillaumont, 2004), in order to test the hypothesis of a higher aid effectiveness in more vulnerable countries through one multiplicative variable. But it is more difficult to do it respectively with several shock variables, both additive and multiplicative, and not very meaningful to consider the contra-cyclicality and stabilizing character of aid relatively to each of them taken separately. A synthetic way by which we can try to assess whether aid has been stabilizing or destabilizing is thus to examine to what extent income volatility has been influenced by the average level of aid inflow and the level of its volatility. In the next step we thus estimate an equation where income volatility is a function of mean lagged income,respective aid and export to GDP ratios andrespective volatilities of aid and exports. We also introduce aid and export ratios interacted with their respective volatilities in order to check whether there is any threshold in the impacts of these variables

$$Volatility\ of\ y_{i,t} = \beta_1 y_{\cdot i,t-5} + \beta_2 X/GDP_{i,t} + \beta_3 VolX_{i,t} + \beta_4 ODA/GDP_{i,t} + \beta_5 Vol.A_{i,t} + \beta_6 X/GDP_{i,t} \text{x} Vol.X_{i,t} + \beta_7 ODA/GDP_{i,t} \text{x} Vol.A_{i,t} + \varepsilon_{i,t}$$

In Table 3 are presented the results of the estimations of income volatility. Initial income and aid ratio (as well as aid ratio interacted with aid volatility) are instrumented as previously. When it is in bold, aid volatility is also instrumented, using the same instruments as for aid (columns (2), (4), (5) and (6)). The regressions support the view that export volatility is a highly significant factor of the volatility of income. Aid leveland aid volatility coefficients, which were not significant in columns (1) and (2) (but significant and both negative with the second measure of volatility Table Annex 4)l , are significant in regression (3):the level of aid and its volatility contribute to income instability, but as functions of each others. Table 3 suggests that the level of aid lowers income volatility only when aid volatility is lower than 7.5% of the trend level of aid (average aid volatility in Africa is 6%, c.f. Table 1,

and 5.7% in our sample). Similarly, aid volatility increases income volatility when the level of aid is greater than 5% (average level of aid is 12% in our sample). In regression (4), when aid volatility is instrumented it loses some of its significances (*p*-value=10.7), but the signs and thresholds remain similar to that of regression (3).

In columns (5) and (6) we introduce another kind of volatility likely to influence income volatility, the volatility of agricultural production (a proxy for climatic shocks), which is not significant. Estimations of Table 3 have also been performed using the second measurement (trend related) of cycles and give rather similar resultssuggesting even more clearly that on the whole aid tends to dampen rather to amplify the volatility of income (Appendix 4).

The previous results support the approach adopted above which only referred to export instability to test the contra-cyclicality and the stabilizing character of aid. They suggest that aid has an overall stabilizing effect, through and beyond its stabilizing effect with respect to exports, which are the main exogeneous source of macro instability.

Table 3 : Volatility of income equation, African countries, 1970-1999.

Volatility of income (HP)	(1)	(2)	(3)	(4)	(5)	(6)
Ln income pc t-5	**-0.0042**	**-0.0039**	**-0.0047**	**-0.0037**	**-0.0029**	**-0.0031**
	(1.43)	**(1.25)**	**(1.49)**	**(1.10)**	**(0.91)**	**(0.88)**
X/GDP	0.007	0.006	0.048	0.0564	0.010	0.0581
	(0.64)	(0.61)	(1.99)**	(2.23)**	(0.91)	(2.28)**
Volatility of X (HP)	0.152	0.1514	0.2348	0.249	0.1537	0.249
	(5.40)***	(5.39)***	(3.62)***	(3.76)***	(5.54)***	(3.95)***
X/GDP x Vol. X			-0.439	-0.5233		-0.5005
			(1.94)*	(2.22)**		(2.16)**
ODA/GDP	**-0.017**	**-0.016**	**-0.105**	**-0.137**	**-0.020**	**-0.140**
	(1.01)	**(0.95)**	**(2.02)****	**(2.23)****	**(1.19)**	**(2.09)****
Volatility of Aid (HP)	-0.0190	**-0.029**	-0.0631	**-0.135**	**-0.056**	**-0.145**
	(0.93)	**(0.57)**	(4.27)***	**(1.62)**	**(1.22)**	**(1.72)***
ODA/GDP x Vol. A			**1.420**	**1.986**		**1.897**
			(1.85)*	**(2.07)****		**(1.86)***
Vol. Agri Production					0.000	0.000
					(0.31)	(0.88)
Constant	0.048	0.047	0.047	0.042	0.0406	0.0368
	(2.36)**	(2.22)**	(2.16)**	(1.89)*	(1.83)*	(1.56)
Observations	200	200	200	200	186	186
Countries	38	38	38	38	38	38
R-squared	0.11	0.11	0.08	0.03	0.11	0.02
Nb of instruments	29	29	29	29	29	29
Hansen p-value	0.17	0.14	0.13	0.15	0.30	0.36
Shea partial R2 for income t-5	0.86	0.77	0.85	0.81	0.80	0.82
Shea partial R2 for ODA/GDP	0.49	0.48	0.40	0.30	0.50	0.32
Shea partial R2 for Aid volatility		0.23		0.14	0.31	0.21
Shea partial R2 for Aid.Vol Aid			0.40	0.28		0.32
Test for all dt=0 (p-values)	0.61	0.60	0.26	0.24	0.51	0.24

GMM estimator. Robust t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. In bold: instrumented variables

5. Conclusion

Somewhat diverging from the current concern about aid volatilitythis paper shows that aid has a stabilizing impact with respect to exports volatility. This stabilizing effect is due to the mix of : (i) a level effect; (ii) a contra-cyclical effect; (iii) a relative volatility effect. It explains why aid seems more efficient in terms of growth in <countries more affected by export instability.

Because this paper focuses mainly on the cushioning impact of aid with respect to export volatility, it does not allow to conclude regarding the stabilizing influence of aid when other external shocsks occur. However, income volatility estimations suggest that the stabilizing impact of aid may go beyond mitigating the impact of export volatility. A next step of this analysis will therefore be to analyse whether and how a global stabilizing impact of aid with respect to income volatility contributes to income growth. It has not indeed been possible in this paper to examine how aid can contribute to the average long term growth by mitigating the negative impact of the growth volatility evidenced in the literature (Ramey and Ramey 1995, Hnatkovska and Loyaza 2004, Guillaumont 2005). Testing this effect needs to move from a medium term (adopted in this paper) to a long term framework.

Also in a future work, we intend to consider the corresponding impact on poverty reduction. Indeed the estimation of the growth effectiveness of aid does not allow to obtain satisfactory estimations of the impact of aid on poverty, since aid may have such an impact either through growth or directly, i.e. independently from growth (or by influencing the income elasticity of poverty). This issue is all the more important that we consider the effect of aid in relation to shocks, instability, volatility, etc. and that volatility may precisely have an impact on poverty independently from its impact on growth (i.e. directly) (Guillaumont, 2005).

References

Bulíř, Aleš, and Hamann, A. Javier, 2001. How Volatile and Unpredictable Are Aid Flows, and What Are the Policy Implications ? *IMF Working Paper* 167, October.

Bulíř, Aleš, and Hamann, A. Javier, 2003. Aid Volatility : An Empirical Assessment. *IMF Staff Papers* 50(1), p. 64-89.

Bulíř, Aleš, and Hamann, A. Javier, 2005. Volatility of Development Aid : From the Frying Pan into the Fire ? IMF, mimeo.

Burnside C. and Dollar D. (2000), "Aid, Policies and Growth" *American Economic Review*, Vol. 90 (4): 847-68, former (1997) World Bank Policy Research Paper, no. 1777. Washington DC: World Bank

Caballero R.J. in. (2002), "Coping with Chil's External Vulnerability: a Financial Problem", Loayza N. and Soto R., eds. *Central Banking analysis and economic policies*, Vol. 6, Santiago, Banco Central de Chile, p. 377-416.

Chauvet, Lisa and Guillaumont, Patrick, 2001, "Aid and Performance: a Reassessment", *Journal of Development Studies*, vol. 37, n° 6, August 2001, p. 66-92.

Chauvet, Lisa and Guillaumont, Patrick, 2004, "Aid and Growth Revisited : Policy, Economic Vulnerability and Political Instability". *Toward Pro-Poor Policies - Aid, Institutions and Globalization*. B. Tungodden, N. Stern, I. Kolstad (eds), World Bank/Oxford University Press, 2004, p. 95-109.

Eifert and Gelb, 2005, " Improving the dynamics of aid: towards more predictable budget support", *World Bank Policy Research Paper*, n° 3732, Washington DC: World Bank

Guillaumont Patrick, 2005, "Macroeconomic Vulnerability in Low-Income Countries and Aid Responses", Bourguignon F., Pleskovic B., Van der Gaag J. (Eds.), in *Securing Development in an Unstable World,* Annual Bank Conference on Development Economics, Europe 2005, Washington DC., The World Bank, 2006, p. 65-108.

Hansen H. and Tarp F. (2001), "Aid and growth regressions", *Journal of Development Economics*, Vol.64 (2):547-570.

Hnatkovska V. and Loyaza N., 2004, "Volatility and Growth" *World Bank Policy Research Working Paper* n° 3184.

Hodrick, Robert J., and Prescott, Edward C., 1997. Postwar U.S. Business Cycles: An Empirical Investigation. Journal of Money, Credit, and Banking 29(1), p. 1-16.

Kaminsky, Graciela L. Carmen M. Reinhart, and Carlos A. Végh (2003), "When It Rains, It Pours : Procyclical Capital flows and Policies", *Economic activity.*

Lensink, R. and O. Morrissey, 2000. Aid Instability as a Measure of Uncertainty and the Positive Impact of Aid on Growth. *Journal of Development Studies* 36(3), 30-48.

Pallage, Stéphane and Robe, Michel A., 2001. Foreign Aid and the Business Cycle. *Review of International Economics* 9(4), p.641-672.

Ramey G. and Ramey V., 1995, "Cross Country Evidence on the Link between Volatility and Growth", *The American Economic Review*, 85(5):1138-51.

Rand, John, and Tarp, Finn, 2002. Business Cycles in Developing Countries : Are They Different ? *World Development* 30(12), p. 2071-2088.

Ravn, Morten O., and Uhlig, Harald, 2002. On Adjusting the Hodrick-Prescott Filter for the Frequency of Observations. *The Review of Economics and Statistics* 84(2), p. 371-380.

Tavares, José, 2002. Does Foreign Aid Corrupt? *Economics Letters* 79, p. 99-106.

World Bank, 2005, *Global Monitoring Report*.

Appendix 1 : Aid contra-cyclicity, relative volatility and stabilizing character with respect to exports, Method 2.

Averages, whole sample	1970-99	1995-99	1990-94	1985-89	1980-84	1975-79	1970-74
Aid volatility	0.043	0.044	0.034	0.051	0.049	0.030	0.037
Exports volatility	0.052	0.054	0.050	0.047	0.059	0.028	0.045
Income volatility	0.018	0.018	0.017	0.018	0.021	0.013	0.017
Stabilizing character Vol. of X – Vol. of (X+A)	0.009	0.013	0.013	0.005	0.007	0.007	0.004
Counter-cyclical character Correlation (cycle X, cycle A)	0.027	0.015	-0.0174	0.042	0.158	-0.024	-0.016
Nb of countries with >0 correlation	249	58	43	47	48	28	25
Nb of countries with <0 correlation	216	53	44	34	23	32	30
Relative volatility Vol. of A / Vol. of X	0.825	0.817	0.679	1.097	0.841	1.063	0.820
Nb countries with relative volatility >1	175	48	35	40	26	13	13
Nb countries with relative volatility <1	290	63	52	41	45	47	42
Total number of countries	465	111	87	81	71	60	55

Averages, Africa	1970-99	1995-99	1990-94	1985-89	1980-84	1975-79	1970-74
Aid volatility	0.037	0.036	0.032	0.046	0.042	0.032	0.032
Exports volatility	0.065	0.075	0.067	0.054	0.074	0.065	0.052
Income volatility	0.021	0.018	0.019	0.020	0.024	0.025	0.022
Stabilizing character Vol. of X – Vol. of (X+A)	0.018	0.031	0.015	0.009	0.013	0.013	0.007
Counter-cyclical character Correlation (cycle X, cycle A)	-0.012	-0.208	-0.0474	-0.002	0.105	-0.021	-0.084
Nb of countries with >0 correlation	92	20	16	18	19	11	8
Nb of countries with <0 correlation	100	22	23	15	9	15	16
Relative volatility Vol. of A / Vol. of X	0.560	0.484	0.478	0.849	0.563	0.486	0.607
Nb countries with relative volatility >1	46	12	10	14	4	3	3
Nb countries with relative volatility <1	146	30	29	19	24	23	21
Total number of countries	192	42	39	33	28	26	24

Appendix 2 : List of African countries in regressions

Benin
Burundi
Burkina Faso
Botswana
Cameroon
Cap Verde
Chad
Côte d'Ivoire
Congo, Rep.
Comoros
Ethiopia
Gabon
Ghana
Guinea
Gambia
Guinea-Bissau
Kenya
Lesotho
Madagascar
Mali
Mozambique
Mauritania
Mauritius
Malawi
Namibia
Niger
Nigeria
Rwanda
Senegal
Sierra Leone
Seychelles
Togo
Tanzania
Uganda
South Africa
Conge, Dem. Rep.
Zambia
Zimbabwe

Appendix 3: The stabilizing impact of aid on growth (Method 2), 1970-1999, Africa.

Ln income pc t	(1)	(2)	(4)	(3)	(5)	(6)
	GMM	GMM	GMM	GMM	GMM	Within IV
Ln income pc t-5	**1.0012**	**1.0184**	**1.0190**	**1.0107**	**1.0174**	0.8686
	(53.65)* **	**(52.97)*** **	**(50.36)*** **	**(63.79)*** **	**(60.91)*** **	(7.56)***
Volatility of X (M2)	-1.847	-1.099	-1.8939	-1.368	-1.769	−0.167
	(1.64)*	(1.69)*	(1.71)*	(2.80)***	(2.11)**	(0.31)
ODA/GDP	**-0.511**	**0.039**	**-0.216**	**-0.156**	**-0.159**	-5.072
	(1.33)	**(0.12)**	**(0.56)**	**(1.00)**	**(0.98)**	(2.09)**
ODA/GDP x Volatility of X (M2)	**7.273**	**-3.724**	**0.308**			
	(1.33)	**(0.67)**	**(0.05)**			
Stabilizing character		3.3402	**3.477**	2.2624	**3.193**	10.975
		(1.75)*	**(1.66)***	(2.01)**	**(1.97)***	(1.88)*
Dummy 1970-1974	-0.0439	-0.0335	-0.034	-0.038	-0.0356	0.0019
	(1.18)	(0.99)	(0.95)	(1.17)	(1.07)	(0.04)
Dummy 1975-1979	0.014	0.026	0.0261	0.0240	0.026	0.061
	(0.31)	(0.63)	(0.59)	(0.61)	(0.64)	(1.16)
Dummy 1980-1984	-0.0681	-0.0636	-0.055	-0.065	-0.0584	-0.0132
	(1.68)*	(1.73)*	(1.39)	(1.81)*	(1.58)	(0.22)
Dummy 1985-1989	-0.036	-0.024	-0.0187	-0.0252	-0.019	-0.023
	(0.92)	(0.72)	(0.51)	(0.80)	(0.60)	(0.35)
Dummy 1990-1994	-0.1380	-0.1240	-0.1295	-0.123	-0.1270	-0.2008
	(2.84)***	(3.06)***	(2.80)***	(3.11)***	(3.06)***	(2.26)**
Dummy 1995-1999	-0.0200	-0.0189	-0.0286	-0.0196	-0.0281	-0.1084
	(0.53)	(0.67)	(0.86)	(0.73)	(0.97)	(1.43)
Constant	0.1674	-0.0292	0.0124	0.0516	0.0167	1.1885
	(0.97)	(0.18)	(0.07)	(0.43)	(0.14)	(1.46)
Observations	200	200	200	200	200	200
Countries	38	38	38	38	38	38
R-squared	0.96	0.96	0.96	0.96	0.96	0.28
Instruments	29	29	29	29	29	29
Hansen p-value	0.25	0.25	0.32	0.27	0.29	
Shea Partial R2 for income t-5	0.67	0.57	0.57	0.80	0.73	
Shea Partial R2 for ODA/GDP	0.14	0.17	0.14	0.34	0.33	
Shea Partial R2 for ODA/GDP x Vol. X	0.11	0.15	0.13			
Shea Partial R2 for Stabi. character			0.22		0.18	
Test that all time dummies=0 (*p*-value)	0.005	0.007	0.006	0.007	0.006	0.02

GMM estimator. Robust t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. In bold: instrumented variables

Appendix 4 : Volatility of income equation (Method 2), African countries, 1970-1999.

Volatility of income (M2)	(1)	(2)	(3)	(4)	(5)	(6)
Ln income pc t-5	**-0.0018**	**-0.0014**	**-0.0021**	**-0.0016**	**-0.0008**	**-0.0011**
	(1.05)	**(0.78)**	**(1.18)**	**(0.86)**	**(0.40)**	**(0.59)**
X/GDP	0.003	0.003	0.018	0.0252	0.006	0.0288
	(0.50)	(0.53)	(1.35)	(1.87)*	(1.01)	(2.09)**
Volatility of X (M2)	0.169	0.1668	0.2129	0.231	0.1714	0.244
	(6.45)***	(6.33)***	(3.79)***	(4.02)***	(6.47)***	(4.26)***
X/GDP x Vol. X			-0.254	-0.3794		-0.3983
			(1.20)	(1.70)*		(1.76)*
ODA/GDP	**-0.018**	**-0.017**	**-0.052**	**-0.080**	**-0.020**	**-0.075**
	(1.89)*	**(1.74)***	**(1.55)**	**(1.94)***	**(1.98)****	**(1.72)***
Volatility of Aid (M2)	-0.0304	**-0.077**	-0.0631	**-0.160**	**-0.088**	**-0.162**
	(1.34)	**(1.40)**	(2.62)***	**(1.75)***	**(1.50)**	**(1.77)***
ODA/GDP x Vol. A			**0.921**	**1.662**		**1.441**
			(1.10)	**(1.56)**		**(1.30)**
Vol. Agri Production					0.000	0.000
					(0.38)	(0.68)
Constant	0.025	0.024	0.025	0.024	0.0186	0.0196
	(2.09)**	(1.97)**	(2.07)**	(1.94)*	(1.48)	(1.47)
Observations	200	200	200	200	186	186
Countries	38	38	38	38	38	38
R-squared	0.12	0.11	0.10	0.04	0.11	0.03
Nb of instruments	29	29	29	29	29	29
Hansen p-value	0.14	0.14	0.09	0.13	0.38	0.38
Shea partial R2 for income t-5	0.87	0.80	0.85	0.83	0.81	0.83
Shea partial R2 for ODA/GDP	0.49	0.49	0.39	0.27	0.50	0.30
Shea partial R2 for Aid volatility		0.22	0.40	0.13	0.28	0.19
Shea partial R2 for AidxVol.Aid				0.27		0.31
Test for all dt=0 (p-values)	0.91	0.86	0.78	0.79	0.86	0.83

GMM estimator. Robust t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. In bold: instrumented variables