Economic Volatility and Inequality: Does Aid Matter?

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Abstract

We examine the adverse impact of macroeconomic volatility on inequality and the role that aid could play in mitigating this effect. Using a panel of 142 countries over 1973-2012, we find that macroeconomic volatility has an adverse impact on economic inequality and that the poorest are the most exposed to these fluctuations. However, while aid does not seem to have a clear direct impact on inequality, we find robust evidence that aid helps dampening the negative effects of volatility on the distribution of income.

Keywords: Aid, Income volatility, Inequality

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1. Introduction

The adverse impact of volatility on developing countries' performance has been documented at length. After several decades of analysis of the impact of export instability in developing countries, income volatility has been shown to have a negative impact on economic growth (Ramey and Ramey, 1995; Hnatkovska and Loayza, 2005). But not only does volatility affect the size of the pie, it also impacts its distribution. The fact that income contractions disproportionately affect the poorest households, combined with the asymmetry in the way recoveries and contractions affect the different portions of the population implies that output volatility is associated with higher inequality. Poor people are more vulnerable to volatility than richer people. They have less diversified sources of income, are less skilled and less mobile between sectors and areas (Agénor, 2004; Laursen and Mahajan, 2005). Likewise, they have little access to credit and insurance markets and depend more on public transfers and social services (Guillaumont Jeanneney and Kpodar, 2005). The inability of poor people to face negative shocks results in losses of human capital, which are difficult to reverse.[2]

A few cross-country econometric analyses of the effects of income volatility on inequality have been performed. Laursen and Mahajan (2005) find a negative effect of income volatility on the poorest quintile, while for Breen and Garcia-Penalosa (2005) the next two last quintile (rather than the last one) appear to be the most affected, suggesting that almost poor people may become durably poor under unstable conditions. More recently Calderon and Levy Yeyati (2009) have also evidenced the effect of output volatility on income distribution, captured both through the Gini coefficient and through a differentiated impact on each quintile. They find a non-linear impact of volatility, which depends on the level of public expenditures, considered as a mitigating factor.

In this paper, we examine whether foreign aid can mitigate the adverse effect of macroeconomic volatility on inequality. Even if internal factors such as political instability or economic mismanagement explain a large part of macroeconomic volatility (Raddatz, 2007), developing countries remain highly exposed to external shocks, such as the high price volatility of their main commodity exports. They are also exposed to climatic shocks which, given the share of the primary sector in their total income, largely impact their performance and their volatility. At the macroeconomic level, a major mitigating effect can be expected from aid through its stabilizing impact. Several papers (Guillaumont and Chauvet, 2001; Chauvet and Guillaumont, 2004, 2009; Guillaumont and Le Goff, 2010; Guillaumont and Wagner, 2012) have suggested that aid may be more effective in countries exposed to strong and/or recurrent exogenous shocks. Thus, foreign aid could, in principle and in the short to medium run, benefit the poor by dampening the negative effect of income volatility.

[2] e.g. nutritional status (Dercon and Krishnan, 2000, for Ethiopia), or removing children from school (Thomas et al., 2004, for Indonesia)

In this paper we examine whether this mitigating effect induces lower macroeconomic volatility, hence lower inequality.

However, to our knowledge, there is still limited research on the empirical relation between foreign aid and income inequality. Chase-Dunn (1975) provided one of the first empirical analyses of the aid-inequality relationship, although within the very different overall framework of Marxist dependency theory, and argued for a positive association between aid and inequality. The question has then virtually disappeared from the research agenda. In the 1990s, Boone (1996) provides a theoretical discussion of whether foreign aid reaches the poor or mainly benefits political elites, and concludes that his overall findings of the aid-growth association are consistent with a model where aid contributes to widen inequality, in favour of the wealthy elite. While the huge literature on aid effectiveness mainly concerns the aid effectiveness in terms of economic growth, a smaller part is related to its effects on poverty reduction and inequality (see Guillaumont and Wagner (2014) for a survey with a special focus on the interactions between aid, poverty, and macroeconomic volatility).

The aid-inequality relationship has been recently investigated without identifying the channels through which aid may affect income distribution. Calderón et al. (2009) examine the effect of foreign aid on income inequality and poverty reduction for the period 1971–2002. These authors find that there is no robust association between aid inflows and income inequality as measured by Gini coefficients. This result is quite different from those of Layton and Fuller (2008). Focusing on Asian and Latin American countries and meticulously addressing econometric issues, Layton and Fuller (2008) find that foreign aid tends to increase income inequality. This aid-inequality relationship has also been investigated in light of the political institutions prevailing in the receiving countries. Bjørnskov (2010) examines the joint effects of foreign aid and democracy on income quintiles for 88 countries over the 1960-2000 period. Bjørnskov (2010) finds that the combination of foreign aid and democracy is associated with a higher share of income held by the upper quintile. According to his study, foreign aid leads to a more skewed income distribution in democratic developing countries while this adverse effect is negligible in autocratic countries. He highlights some potential mechanisms explaining why aid may make income distribution more skewed in developing countries, such as rent-seeking activities induced by elections in weak democracies or Dutch disease-like phenomena. However, adopting similar data and identification strategy, Chauvet and Mesplé-Somps (2007) reach very different conclusions. They find that aid tends to increase the income share of the middle class in democracies.

In this paper we re-examine the aid-inequality nexus through the lens of the potential stabilizing role of aid. Whether or not aid has a stabilizing role to play regarding external shocks and macroeconomic volatility has been debated. The volatility of aid was presented as a potential source of macroeconomic volatility by several authors (Bulir and Hamann, 2001, 2008; Pallage and Robe, 2001): They argue that aid was very often more volatile than fiscal revenues and income, but also more often pro-cyclical than counter-cyclical with

respect to these variables, which however are not independent of aid. This finding has been challenged by Chauvet and Guillaumont (2009) who consider the evolution of aid with respect to exports. Moreover, whatever its pro or counter-cyclical evolution, aid appears to have more often a stabilising impact still with respect to exports (Ibid.). The same authors find that the average aid to GDP ratio lowers income volatility, while aid volatility (weighted by the aid to GDP ratio) has the opposite effect.

In this paper, we proceed in two steps. First, we estimate the impact of macroeconomic volatility on inequality, measured either using the Gini coefficient or the income shares by quintiles. Our specification also includes foreign aid and an interaction term of aid with volatility. We use the panel fixed effects and system GMM estimators. We find strong evidence suggesting that volatility increases inequality in line with the literature. We also find that while aid does not seem to impact inequality directly, the interaction term of aid with volatility is significantly associated with a less skewed income distribution. In a second step, we investigate the channels through which aid manages to reduce inequalities. We thus estimate the impact of aid on income volatility, accounting for different level of exports and external volatility. We find that aid dampens income volatility when countries are particularly open and experience significant exports volatility. Our results suggest that aid affects inequality both by reducing income volatility and by mitigating the adverse impact of income volatility on inequality.

The paper is structured as follows. The model and the data are presented in Section 2. The results of the baseline estimations are presented in Section 3, and robustness checks in Section 4. Section 5 discusses the transmission channels of aid on inequality, showing the mitigating effect of aid on income volatility. Finally Section 6 concludes.

2. Model and Data

We estimate an inequality equation in which we include macroeconomic volatility along with aid. In order to assess the mitigating effect of aid on income volatility we estimate the following equation:

$$INEQ_{i,t} = \lambda INEG_{i,t-5} + \alpha VOLATILITY_{i,(t,t-5)} + \beta AID_{i,(t,t-5)}$$

$$+ \delta AID_{i,(t,t-5)} \times VOLATILITY_{i,(t,t-5)} + \gamma X_{i,(t,t-5)} + \mu_i + \tau_t + \varepsilon_{i,(t,t-5)} \quad (1)$$

where $INEQ_{i,t}$ is the measure of inequality of country i, in year t. We include the lag in $t-5$ of $INEG_{i,t-5}$ on the right-hand side in order to account for a catching up effect. The model includes $AID_{i,(t,t-5)}$ and control variables, $X_{i,(t,t-5)}$, averaged over t and $t-5$. Volatility is also measured over this time span. In order to account for country unobservable heterogeneity

we include country fixed effects, μ_i. We also include period fixed effects, τ_t, to account for business cycles.

Measure of Inequality

To facilitate cross-country comparisons, several attempts have been made to produce harmonized inequality series. We list here four of the most recent and up-to-date attempts. The World Bank initiative, "Povcalnet", from Ravallion and Chen (2008) proposes harmonized and interpolated series inequality measures (Gini index and income deciles) from 1981 to 2011 on a 3 year interval for the majority of developing countries. Data are retrieved from individual household surveys and made comparable across countries and time. However, most of the data points are estimates interpolated from the most recent surveys available which for the poorest countries might lead to important bias. The second World Bank initiative, "World Income Distribution (WYD)", from Milanovic (2012), proposes average per capita income of various fractile of population expressed in domestic currency units, from 1988 to 2005 on a 5 years interval. Income or consumption data from surveys not conducted in the benchmark years (1988, 1993, 1998, 2002, and 2005) are adjusted by simply assuming an unchanged distribution and deflating/inflating incomes by country's Consumer Price Index between the actual survey year and the benchmark year.

The "World Income Inequality Database (WIID)", is produced by the United Nations University – WIDER, following the former work of Deninger & Squire (1996). It lists, aggregates, compares, and rates the results of all available income and consumption surveys from 1960 to 2012. The figures are ordered and labelled to be made comparable across time and countries but not interpolated meaning that the coverage of the database is more limited. Compared to the Povcalnet database, the WIID also includes data derived from low quality surveys in terms of design and coverage. The use of these data points can increase the coverage of the database but comes at the expense of precision.[3]

Following the recommendations of Atkinson and Brandolini (2001, 2009) we elected to work primarily with the WIID database as it includes many additional information allowing the select consistent inequality estimates. It also allows to work without interpolated data that might distort the end results. As a secondary data compilation about income inequality, the World Income Inequality Database (WIID) suffers from many caveats that must be clearly addressed to provide consistent results. The principal issue building cross-section time series on income inequality mainly stems from the lack of comparability of the underlying households surveys and the coverage and definitions they use, notably in terms of whether the data derive from a survey based on consumption/expenditure or income/earnings. Due

[3] It is also worth mentioning the work of Stolt (2014), who building on the WIID, proposed an interpolated version of the dataset, the "Standardized World Income Inequality Database (SWIID)". The SWIID provides comparable estimates of the Gini index for 174 countries from 1960 to 2012, as well as measures of absolute and relative redistribution. Data points are fully interpolated and should be used cautiously.

to data availability, we favour income rather than consumption.[4] Consumption data were used only when no income data was available. In that case a dummy variable, $CONSUMPTION_{i,t}$, is included in the model to control for the discrepancy in the measure of inequality. We also discarded data points that did not cover the whole population, namely urban or rural surveys. The WIID dataset includes both Gini and quantile data. In the regressions, we will use both sources of information.

Measure of Volatility

In many studies, macroeconomic volatility has been measured as the standard deviation of the growth rate of income or income per capita (Ramey and Ramey, 1995; Breen and Garcia-Peñaloza, 2005; Raddatz, 2007; Calderon and Levy Yeyati, 2009). Many alternative measures exist, that better account for the cyclical characteristics of the output. We favour a method that measures economic volatility as the standard deviation of the cycle (relative to the trend) of the output. The cycle of output is the residual of an econometric regression accounting for a time trend as well as a stochastic trend. For each country we therefore estimate an equation of the following form:

$$y_t = \alpha \tau_t + \beta y_{t-1} + \varepsilon_t \qquad (2)$$

where τ_t is a time trend, y_t is income per capita in year t and , y_{t-1} is income per capita in year $t-1$. Volatility of income is then measured as the standard deviation of ε_t / $\hat{y}_t$ over five years.

As a robustness check, we will also consider the simpler approach used by Calderon and Levy Yeyati (2009) who measure output volatility with the standard deviation of per capita GDP growth.

Aid and control variables

We measure foreign aid, $AID_{i,(t,t-5)}$, using the net disbursements of official development assistance provided by the OECD-DAC as a share of GDP. In order to maximize sample size, we choose to keep non aid recipient countries in the sample. However, we cannot simply use $\log(AID_{i,(t,t-5)})$ as the aid variable without losing the observations with zero aid, the log of which is undefined. Following Wagner (2003), the aid variable becomes $0.0001+AID_{i,(t,t-5)}$ and is then transformed using $\ln(\max\{0.0001, AID_{i,(t,t-5)}\}$. It is then complemented in the regressions by a "no aid" dummy variable, which equals 1 when $AID_{i,(t,t-5)} = 0.0001$. Following Calderon and Levy Yeyati (2009) and Bjørnskov (2010), we control for income per capita and its square, as well as the gross secondary school enrolment rate and the share of public expenditures over GDP. Following Bjørnskov (2011), we also introduce the share of rural population in total population, the rate of inflation, and the population growth rate. All variables (except population growth and income volatility) are in logarithm. Aid and the control variables are averaged over five-year periods, from 1973 to 2012. Our sample of

[4] Measures based on consumption data reflect more accurately income distribution, but would too much restrict our sample.

countries includes a maximum of 142 countries. All control variables are retrieved from the World Development Indicators.

Table 1 presents the basic summary statistics for our sample of countries. The 142 countries included in the sample are displayed in Table A0 in Appendix. Our sample of countries displays a rather unequal distribution of income, with an average Gini index of 38 and an income share of the lowest quintiles (Q1 +Q2) that only represents 40% of the highest quintile income share. Aid represents, on average 5.9% of the GDP. The sample shows an average income volatility of around 0.35%.

Table 1: Summary statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Gini index	520	38.37	9.57	19.40	69.20
Income share Q1	475	6.39	2.22	0.96	12.03
Income share Q2	473	10.92	2.51	3.03	15.90
Q1/Q5	475	0.152	0.074	0.013	0.411
(Q1+Q2)/Q5	473	0.408	0.171	0.055	0.930
Income volatility	520	0.348	0.842	0.010	13.03
Aid over GDP	330	5.87	8.52	-0.19	52.82
GDP per capita 2005 constant USD	520	11,97	15,500	133.3	81,445
Rural population (over total population)	520	42.76	22.28	0.654	95.01
Population Growth	520	1.33	1.24	-1.84	12.39
Government expenditures over GDP	520	16.09	6.23	4.20	84.06
Inflation rate	520	16.27	55.85	0.03	847.4
Secondary school enrollment rate (gross)	520	73.11	31.12	5.32	155.2
Polity IV index	494	5.163	5.926	-10	10
Remittances over GDP	470	3.192	6.869	0.0002	87.91
Number of country	142	142	142	142	142

Authors calculations on a sample of 142 countries

3. Baseline Results

Table 2 presents estimations results for equation (1) using simple fixed effects estimators. In columns (1) to (5), we first estimate the model without the introduction of aid and the interaction term of aid with income volatility, to check whether the impact of income volatility on inequality is in line with the literature (Breen and Garcia-Penalosa, 2005 ; Calderon and Levy Yeyati, 2009). From column (1) using the GINI index as dependant variable and columns (2) to (5) using quintiles of income shares as well as ratios with respect to the highest quintile, it clearly appears that economic volatility has a strong and significant impact on inequality and that this adverse impact is stronger on the poorest. Moreover, comparing the coefficient of volatility in regressions (2) and (5), it also seems that income volatility benefits the richest by increasing their share of income.

When introduced in the subsequent columns, aid does not seem to impact the level of inequality whatsoever[5]. However, the interaction variable of aid with income volatility turns out to be influencing inequality significantly when considering the absolute income shares of the two poorest quintiles, as well as the income share of the poorest quintile relative to the income share of the highest quintile. These results are thus consistent with the hypothesis that aid helps dampening the adverse effects of volatility.

However, the fixed effects estimator suffers from many caveats. The first one is that it does not control for the likely endogeneity of aid and volatility. The second is that it does not control for the high level of persistence in the data captured by $INEG_{i,t-5}$. To tackle these issues we now turn to a dynamic GMM system estimator that includes a lagged dependant variable on the right hand side of the equation. It also allows us to control for endogeneity by using lags of the right-hand side variables as instruments. More specifically, we assume that volatility, aid, and the interaction term of aid with volatility are endogeneous. These variables are instrumented using their lags and difference in lags from *t*-2 onward, using the collapse option. Results using both the Gini index and the quintiles income shares are displayed in columns (1) to (5) of Table 3. Results relative to aid and volatility are in line with the earlier results. When volatility is high, aid reduces inequality by dampening its adverse effects on inequality. Furthermore, it also appears that the mitigating effect of aid on inequality is focused on the poorest quintiles leading thus to improve their income shares in level and with respect to the richest quintile.

Finally in columns (6) to (10) of Table 3, we attempt to control further for the possible endogeneity issue by introducing a set of external instruments for aid, volatility, and the interaction variable. For the aid variable, we rely on the extensive literature initiated by Tavares (2003) that uses cultural and geographic linkages between the main bilateral donors and aid recipients as starting point for the design of exogenous instruments. In that regard, we use three external instruments for aid: an interaction variable combining past colonial linkages and the total amount of aid disbursed by the main bilateral donors, an interaction term combining legal origins of governance systems and the total amount of aid disbursed by the main bilateral donors and an interaction variable combining past colonial linkages and the fiscal positions of the main bilateral donors' budget. Macroeconomic volatility is instrumented by the volatility of a commodity price index. Finally, the interaction between aid and volatility is instrumented using the interaction between the two sets of instruments. While less significant, the results provided in columns (6) to (10) are in line with our previous findings. Aid seems to dampen the adverse effects of volatility on income inequality.

[5] When the aid variable is introduced without the interaction term aid x volatility, the coefficient of the aid variable is not significantly different from zero. Results available from the authors upon request.

Table 2: Income inequality (Gini & Income share quintiles), volatility and aid, panel fixed effects, 1973-2012, 5-year periods.

Fixed effects estimator	1	2	3	4	5	6	7	8	9	10
Dependent variables (in log)	Gini	Q1	Q2	Q1/Q5	(Q1+Q2)/Q5	Gini	Q1	Q2	Q1/Q5	(Q1+Q2)/Q5
GDP per capita volatility	**0.052*** **	**-0.079*** **	**-0.066*** **	**-0.123*** **	**-0.116*** **	**0.062*** **	**-0.106*** **	**-0.077*** **	**-0.160*** **	**-0.144*** **
	(0.015)	**(0.025)**	**(0.013)**	**(0.033)**	**(0.024)**	**(0.017)**	**(0.033)**	**(0.016)**	**(0.043)**	**(0.032)**
Net ODA (over GDP, in log)						-0.008	-0.035*	-0.006	-0.040+	-0.020
						(0.010)	(0.021)	(0.011)	(0.026)	(0.020)
No ODA dummy						-0.048	-0.381	0.012	-0.419	-0.148
						(0.135)	(0.291)	(0.195)	(0.371)	(0.305)
Volatility x ODA						**-0.004**	**0.013** **	**0.005+**	**0.017** **	**0.013***
						(0.004)	**(0.006)**	**(0.003)**	**(0.008)**	**(0.007)**
GDP per capita (in log)	0.514*	-1.135***	-0.573***	-1.563***	-1.172***	0.512*	-1.294***	-0.581**	-1.738***	-1.242***
	(0.262)	(0.405)	(0.219)	(0.522)	(0.398)	(0.263)	(0.414)	(0.226)	(0.537)	(0.410)
GDP per capita squared (in log)	-0.032**	0.072***	0.035**	0.100***	0.074***	-0.032**	0.081***	0.034**	0.108***	0.076***
	(0.015)	(0.026)	(0.013)	(0.034)	(0.025)	(0.015)	(0.027)	(0.014)	(0.035)	(0.026)
Population growth	-0.011	0.018	0.014	0.023	0.021	-0.008	0.020	0.015	0.025	0.022
	(0.018)	(0.039)	(0.021)	(0.049)	(0.037)	(0.018)	(0.040)	(0.022)	(0.051)	(0.039)
Rural population (in log)	-0.023	0.080	0.018	0.091	0.048	-0.022	0.090*	0.022	0.106+	0.059
	(0.037)	(0.059)	(0.032)	(0.075)	(0.056)	(0.038)	(0.054)	(0.032)	(0.069)	(0.055)
Inflation (in log)	0.010	-0.017	0.001	-0.020	-0.007	0.012	-0.013	0.002	-0.016	-0.006
	(0.011)	(0.024)	(0.010)	(0.030)	(0.020)	(0.012)	(0.023)	(0.010)	(0.029)	(0.021)
Secondary school enrollment (gross, in log)	-0.118**	0.284***	0.182***	0.395***	0.322***	-0.112**	0.265**	0.175***	0.372***	0.307***
	(0.055)	(0.102)	(0.061)	(0.136)	(0.109)	(0.056)	(0.102)	(0.062)	(0.136)	(0.109)
Government expenditures (over GDP, in log)	0.062	-0.221**	-0.144***	-0.274**	-0.241**	0.069	-0.198*	-0.139***	-0.250*	-0.232**
	(0.048)	(0.102)	(0.051)	(0.130)	(0.093)	(0.050)	(0.100)	(0.051)	(0.128)	(0.093)
Consumption dummy	-0.029	0.064	0.031	0.078	0.049	-0.032	0.069	0.033	0.085	0.054
	(0.028)	(0.057)	(0.035)	(0.076)	(0.062)	(0.028)	(0.058)	(0.036)	(0.078)	(0.063)
Number of observations	520	477	475	477	475	514	471	469	471	469
Number of countries	142	140	140	140	140	142	140	140	140	140

Notes: Robust standard errors in parentheses (using the Windmeijer's correction), + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Each specification includes period dummies and a constant.
Sources: Authors' calculations based on UNU-WIDER, World Bank and OECD data.

Table 3: Income inequality (Gini & Income share quintiles), volatility and aid, Sys-GMM, 1973-2012, 5-year periods.

Sys-GMM estimator	1	2	3	4	5	6	7	8	9	10
	Internal instruments only					Internal and external instruments				
Dependent variables (in log)	Gini	Q1	Q2	Q1/Q5	(Q1+Q2)/Q5	Gini	Q1	Q2	Q1/Q5	(Q1+Q2)/Q5
Lagged dependent	0.509***	0.311**	0.380***	0.293**	0.369***	0.790***	0.635***	0.798***	0.719***	0.817***
	(0.105)	(0.127)	(0.125)	(0.126)	(0.107)	(0.080)	(0.090)	(0.099)	(0.085)	(0.089)
GDP per capita volatility	**0.059****	**-0.086**	**-0.057+**	**-0.114+**	**-0.095***	**0.062****	**-0.061**	**-0.065***	**-0.093**	**-0.110***
	(0.027)	**(0.068)**	**(0.039)**	**(0.069)**	**(0.055)**	**(0.028)**	**(0.054)**	**(0.033)**	**(0.073)**	**(0.062)**
Net ODA (over GDP, in log)	0.019*	0.001	0.002	-0.007	0.006	0.002	-0.005	-0.001	-0.004	-0.002
	(0.010)	(0.025)	(0.016)	(0.030)	(0.025)	(0.010)	(0.024)	(0.017)	(0.033)	(0.026)
No ODA dummy	0.208*	0.262	0.119	0.208	0.241	0.041	0.023	-0.045	-0.052	-0.095
	(0.121)	(0.292)	(0.200)	(0.360)	(0.321)	(0.129)	(0.292)	(0.202)	(0.399)	(0.320)
Volatility x ODA	**-0.015***	**0.030+**	**0.019+**	**0.041***	**0.033***	**-0.013+**	**0.022**	**0.019***	**0.029+**	**0.031***
	(0.009)	**(0.021)**	**(0.012)**	**(0.022)**	**(0.018)**	**(0.009)**	**(0.016)**	**(0.010)**	**(0.021)**	**(0.018)**
GDP per capita (in log)	0.390***	-0.423**	-0.296***	-0.799**	-0.579***	0.168**	-0.245+	-0.052	-0.297	-0.127
	(0.085)	(0.211)	(0.104)	(0.320)	(0.204)	(0.079)	(0.153)	(0.091)	(0.213)	(0.168)
GDP per capita squared (in log)	-0.023***	0.023*	0.018***	0.045**	0.034***	-0.011**	0.013+	0.004	0.018	0.009
	(0.005)	(0.012)	(0.006)	(0.019)	(0.012)	(0.005)	(0.009)	(0.005)	(0.013)	(0.010)
Population growth	0.051***	-0.056*	-0.058***	-0.097**	-0.089**	0.031**	-0.037+	-0.035**	-0.056+	-0.052+
	(0.011)	(0.029)	(0.020)	(0.046)	(0.035)	(0.012)	(0.025)	(0.017)	(0.037)	(0.032)
Rural population (in log)	0.009	-0.021	0.004	-0.029	-0.008	0.004	0.009	0.010	0.019	0.019
	(0.018)	(0.031)	(0.021)	(0.045)	(0.034)	(0.011)	(0.022)	(0.010)	(0.028)	(0.020)
Inflation (in log)	0.010	-0.028	-0.012	-0.039	-0.032	0.001	-0.039	-0.010	-0.053	-0.030
	(0.011)	(0.026)	(0.012)	(0.034)	(0.026)	(0.010)	(0.030)	(0.013)	(0.039)	(0.027)
Secondary school enrollment (gross, in log)	0.014	0.004	0.003	0.038	0.025	0.031	0.028	-0.022	0.026	-0.015
	(0.035)	(0.079)	(0.038)	(0.105)	(0.077)	(0.033)	(0.060)	(0.030)	(0.075)	(0.058)
Government expenditures (over GDP, in log)	-0.109***	0.094*	0.059+	0.162**	0.127*	-0.050*	0.062	0.021	0.088	0.049
	(0.031)	(0.056)	(0.039)	(0.077)	(0.066)	(0.025)	(0.054)	(0.030)	(0.071)	(0.051)
Consumption dummy	-0.057***	0.105**	0.055*	0.115+	0.073	-0.045*	0.056	0.032	0.073	0.055
	(0.022)	(0.051)	(0.030)	(0.072)	(0.058)	(0.023)	(0.073)	(0.044)	(0.099)	(0.079)
Number of observations	415	354	351	354	351	404	345	342	345	342
Number of countries	122	116	115	116	115	116	111	110	111	110
AR1 (p-value)	0.000	0.055	0.003	0.046	0.005	0.000	0.033	0.001	0.021	0.002
AR2 (p-value)	0.430	0.837	0.471	0.965	0.886	0.734	0.697	0.338	0.784	0.730
Hansen test (p-value)	0.687	0.586	0.563	0.523	0.621	0.568	0.305	0.460	0.639	0.759

Notes: Robust standard errors in parentheses (using the Windmeijer's correction), + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Each specification includes period dummies and a constant.
Columns 6 to 10 include a set of external instruments for income volatility, aid and their interaction term.
Sources: Authors' calculations based on UNU-WIDER, World Bank and OECD data.

4. Robustness checks and alternative hypothesis testing

In the next tables, we assess the robustness of our core results by using different definition of income volatility. We also check the validity of our results against alternative or even competing hypothesis.

First, we provide estimation results in table A1 using an alternative measure of income volatility. In this table, we use a simpler methodology as proposed in Calderon and Levy Yeyati (2009) by using the 5-year standard deviation of the GDP per capita growth rate. The new results are in line with our previous findings regarding the interaction variable aid x volatility. However, it turns out that using this methodology provide insignificant results relative to the direct impact of volatility on income inequality, except when considering the Gini as measure of inequalities.

The impact of aid on inequality has already been explored by Chauvet and Mesplé-Somps (2007) and Bjornskov (2011), but the two studies, while adopting similar empirical strategies and data, lead to very different results. Both papers use income shares, by quintiles or deciles, as dependent variables. They also both use an interaction variable of aid with democracy. However, while Chauvet and Mesplé-Somps (2007) find that in democracies aid increases the income share of the middle class, Bjornskov (2011) finds that aid benefits disproportionately to the 20% highest income elite. In Table 4 we assess the robustness of our results to the introduction of a democracy variable from the Polity IV database and its interaction term with aid. While this interaction term is overall not significant, results tend to be more in line with those of Chauvet and Mesplé-Somps (2007). More importantly, our result on the relationship between inequality, aid, and volatility is not altered.

Finally, in Table 5 we introduce the ratio of remittances over GDP in the equation. For many developing countries, foreign aid is far from being the main source of external financing and remittances sometimes represent the largest share of their international financial inflows. We include remittances over GDP as well as the interaction of aid with this variable. It appears that the results relative to remittances are not significant and that, while being less significant, the results remain consistent with our baseline estimations in Tables 2 and 3.

Table 4: Income inequality (Gini & Income share quintiles), volatility, democracy and aid, Sys-GMM, 1973-2012, 5-year periods.

	1	2	3	4	5
Sys-GMM – Internal instruments Dependent variables (in log)	Gini	Q1	Q2	Q1/Q5	(Q1+Q2)/Q5
Lagged dependent	0.405***	0.401***	0.556***	0.430***	0.544***
	(0.104)	(0.128)	(0.117)	(0.115)	(0.101)
GDP per capita volatility	**0.067*** **	**-0.036**	**-0.052***	**-0.070**	**-0.086***
	(0.024)	**(0.043)**	**(0.027)**	**(0.055)**	**(0.047)**
Net ODA (over GDP, in log)	0.013	-0.011	-0.001	-0.017	-0.006
	(0.011)	(0.021)	(0.014)	(0.029)	(0.023)
No ODA dummy	0.041	0.252	0.122	0.217	0.249
	(0.140)	(0.285)	(0.185)	(0.387)	(0.308)
Volatility x ODA	**-0.017****	**0.021***	**0.018****	**0.032****	**0.032****
	(0.007)	**(0.011)**	**(0.008)**	**(0.015)**	**(0.013)**
Polity IV index	0.004+	-0.003	-0.001	-0.003	-0.001
	(0.003)	(0.008)	(0.004)	(0.010)	(0.007)
Polity x ODA	**-0.001**	**0.002+**	**0.000**	**0.002**	**0.001**
	(0.001)	**(0.001)**	**(0.001)**	**(0.002)**	**(0.001)**
GDP per capita (in log)	0.437***	-0.496**	-0.163+	-0.696***	-0.394**
	(0.091)	(0.192)	(0.101)	(0.255)	(0.187)
GDP per capita squared (in log)	-0.027***	0.028**	0.010+	0.040***	0.023**
	(0.006)	(0.011)	(0.006)	(0.015)	(0.011)
Population growth	0.060***	-0.051*	-0.037**	-0.083**	-0.063**
	(0.014)	(0.028)	(0.017)	(0.038)	(0.030)
Rural population (in log)	-0.006	0.003	0.003	0.007	0.006
	(0.023)	(0.035)	(0.016)	(0.044)	(0.030)
Inflation (in log)	0.007	-0.042*	-0.011	-0.053*	-0.033+
	(0.008)	(0.024)	(0.011)	(0.030)	(0.021)
Secondary school enrollment (gross, in log)	0.003	0.052	0.002	0.069	0.031
	(0.034)	(0.064)	(0.033)	(0.082)	(0.064)
Government expenditures (over GDP, in log)	-0.080***	0.081+	0.033	0.130*	0.080
	(0.027)	(0.053)	(0.031)	(0.072)	(0.055)
Consumption dummy	-0.056**	0.096+	0.045	0.124+	0.085
	(0.023)	(0.063)	(0.038)	(0.082)	(0.066)
Number of observations	401	343	340	343	340
Number of countries	114	109	108	109	108
AR1 (p-value)	0.001	0.016	0.000	0.007	0.000
AR2 (p-value)	0.353	0.670	0.391	0.790	0.755
Hansen test (p-value)	0.930	0.333	0.345	0.228	0.202

Notes: Robust standard errors in parentheses (using the Windmeijer's correction), + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Each specification includes period dummies and a constant.
Sources: Authors' calculations based on UNU-WIDER, World Bank and OECD data.

Table 5: Income inequality (Gini & Income share quintiles), remittances and aid, Sys-GMM, 1973-2012, 5-year periods.

	1	2	3	4	5
Sys-GMM – Internal instruments Dependent variables (in log)	Gini	Q1	Q2	Q1/Q5	(Q1+Q2)/Q5
Lagged dependent	0.567***	0.391***	0.544***	0.456***	0.559***
	(0.071)	(0.120)	(0.124)	(0.102)	(0.095)
GDP per capita volatility	0.065	-0.114	-0.072	-0.082	-0.112
	(0.054)	(0.218)	(0.093)	(0.243)	(0.251)
Net ODA (over GDP, in log)	0.002	-0.014	0.007	-0.011	-0.001
	(0.009)	(0.023)	(0.014)	(0.033)	(0.029)
No ODA dummy	0.062	-0.017	0.105	-0.013	0.013
	(0.129)	(0.302)	(0.186)	(0.431)	(0.366)
Volatility x ODA	**-0.003**	**0.045+**	**0.022***	**0.042+**	**0.025**
	(0.013)	**(0.028)**	**(0.013)**	**(0.034)**	**(0.033)**
Remittances (over GDP, in log)	-0.010	0.025	0.002	0.029	0.000
	(0.016)	(0.032)	(0.021)	(0.041)	(0.030)
Remittances x ODA	**0.031**	**-0.036**	**0.015**	**-0.033**	**0.034**
	(0.039)	**(0.084)**	**(0.051)**	**(0.149)**	**(0.121)**
GDP per capita (in log)	0.393***	-0.496*	-0.231**	-0.665**	-0.479**
	(0.103)	(0.264)	(0.115)	(0.333)	(0.240)
GDP per capita squared (in log)	-0.024***	0.028*	0.015**	0.039**	0.029**
	(0.006)	(0.015)	(0.007)	(0.020)	(0.014)
Population growth	0.050***	-0.074***	-0.058***	-0.098***	-0.079**
	(0.015)	(0.026)	(0.017)	(0.036)	(0.039)
Rural population (in log)	0.005	-0.003	0.010	0.011	0.021
	(0.014)	(0.032)	(0.016)	(0.034)	(0.032)
Inflation (in log)	0.014+	-0.035	-0.008	-0.041+	-0.020
	(0.009)	(0.025)	(0.013)	(0.028)	(0.028)
Secondary school enrollment (gross, in log)	-0.032	0.004	-0.008	0.023	0.033
	(0.039)	(0.060)	(0.043)	(0.082)	(0.073)
Government expenditures (over GDP, in log)	-0.063**	0.128**	0.040	0.173**	0.104
	(0.025)	(0.054)	(0.034)	(0.076)	(0.072)
Consumption dummy	-0.053*	0.118**	0.047+	0.135+	0.086
	(0.028)	(0.055)	(0.031)	(0.090)	(0.085)
Number of observations	381	329	326	329	326
Number of countries	117	111	110	111	110
AR1 (p-value)	0.000	0.052	0.001	0.025	0.002
AR2 (p-value)	0.988	0.547	0.276	0.553	0.481
Hansen test (p-value)	0.974	0.739	0.623	0.728	0.541

Notes: Robust standard errors in parentheses (using the Windmeijer's correction), + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Each specification includes period dummies and a constant.
Sources: Authors' calculations based on UNU-WIDER, World Bank and OECD data.

5. Discussion

In line with the literature, our results indicate that output volatility has an adverse effect on income distribution and poverty. We also find that aid tends to dampen this adverse effect. The remaining question relates to the mechanisms that may be at play and explain why aid mitigates the negative effect of output volatility on inequality.

One way volatility affects income distribution is by impacting the poorest and richest households in an asymmetric way. The income of the poor can decrease by more during a period of recession than it increases during a period of growth, especially in the absence of adequate social safety nets. This is because the least educated workers are the first to be made redundant and remain unemployed for longer, which makes it less easy for them to find employment when the situation is reversed. Their income, which is generally not indexed to the price of goods, is especially affected in real terms by the variability of inflation (the last one being then unanticipated) that accompanies financial instability (Guillaumont Jeanneney and Kpodar, 2011). Moreover output contractions tend to disproportionately affect the poorest households (Calderon and Levy Yeyati, 2009). It is more difficult for the poorest households to cope with adverse income shocks. Their sources of income are less diversified than that of the richest households, and they have little access to credit. In time of output contractions, the poorest people are therefore more likely to cut their investments in physical and human capital. This in turn has long term effects on income distribution and poverty which are difficult to reverse in time of expansion.

One way of getting some insight on this disinvestment channel is to simply look at the correlation between education enrollment rates and output volatility. Figure 1 shows that high output volatility is associated with lower education outcomes,[6] the direction of the causality being unclear. However, foreign aid seems to mitigate this effect. In Figure 2, we plot the same relationship, but dividing our sample according to the median level of aid in our sample (around 5% of GDP). Clearly, the negative relationship between output volatility and education appears for the sample of countries receiving small amounts of aid (grey line), while the fit is flat in the case of the sub-sample of countries receiving larger amounts of aid (black line). This pattern also appears when we divide the sample of countries according to the median value of aid to the social sectors (around 1% of GDP) (Figure 3).[7]

[6] The same pattern appears when education is purged from the effect of income per capita.

[7] Aid to social sectors is from the Creditor Reporting system dataset (CRS) and includes aid to education, health population, and water and sanitation. It is only available for 2002 onwards.

Figure 1. Enrollment rate and income volatility, 1973-2012, five-year averages

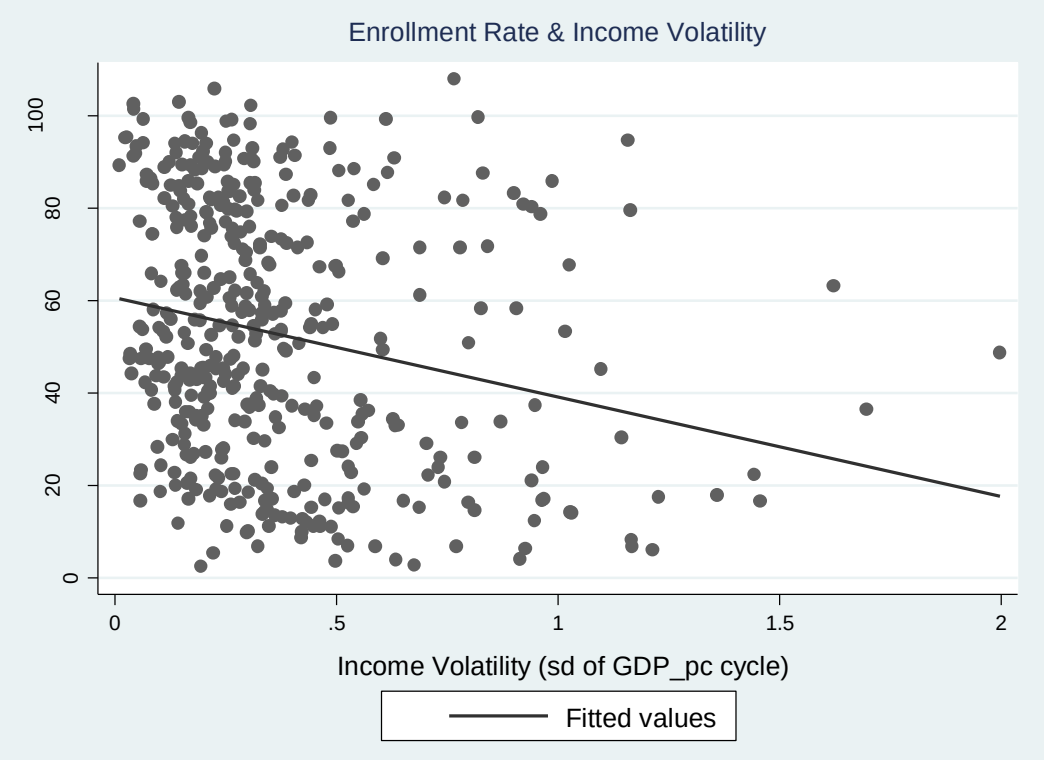


Figure 2. Enrollment rate and income volatility, by levels of aid, 1973-2012, five-year averages.

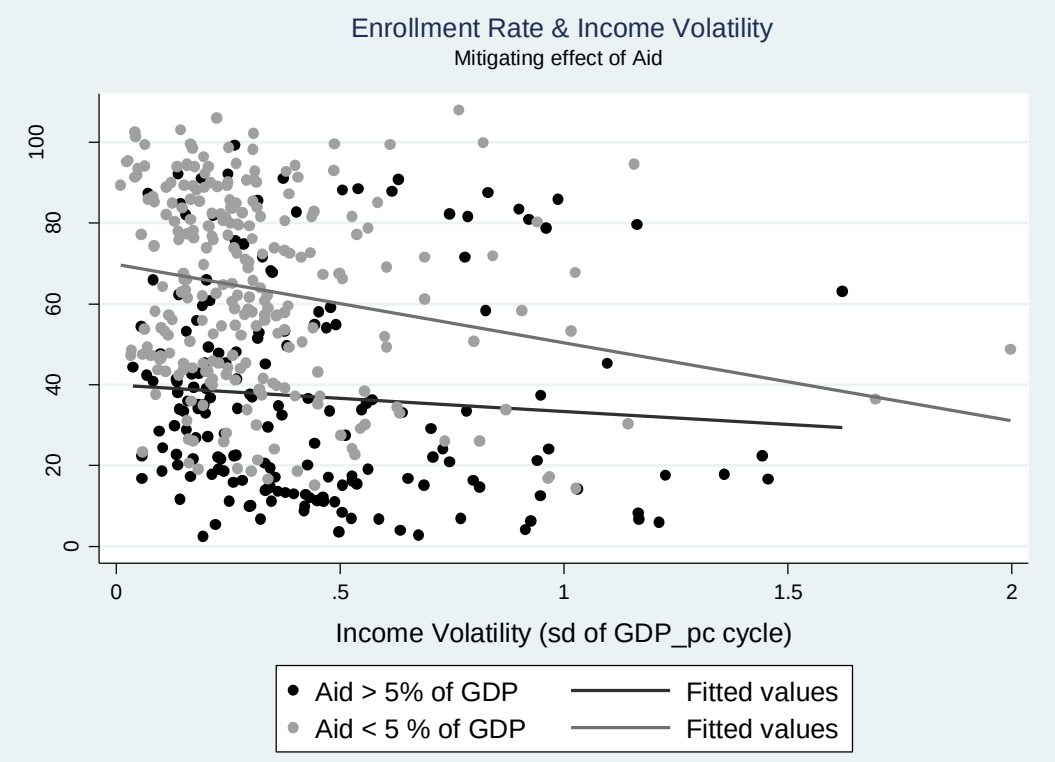
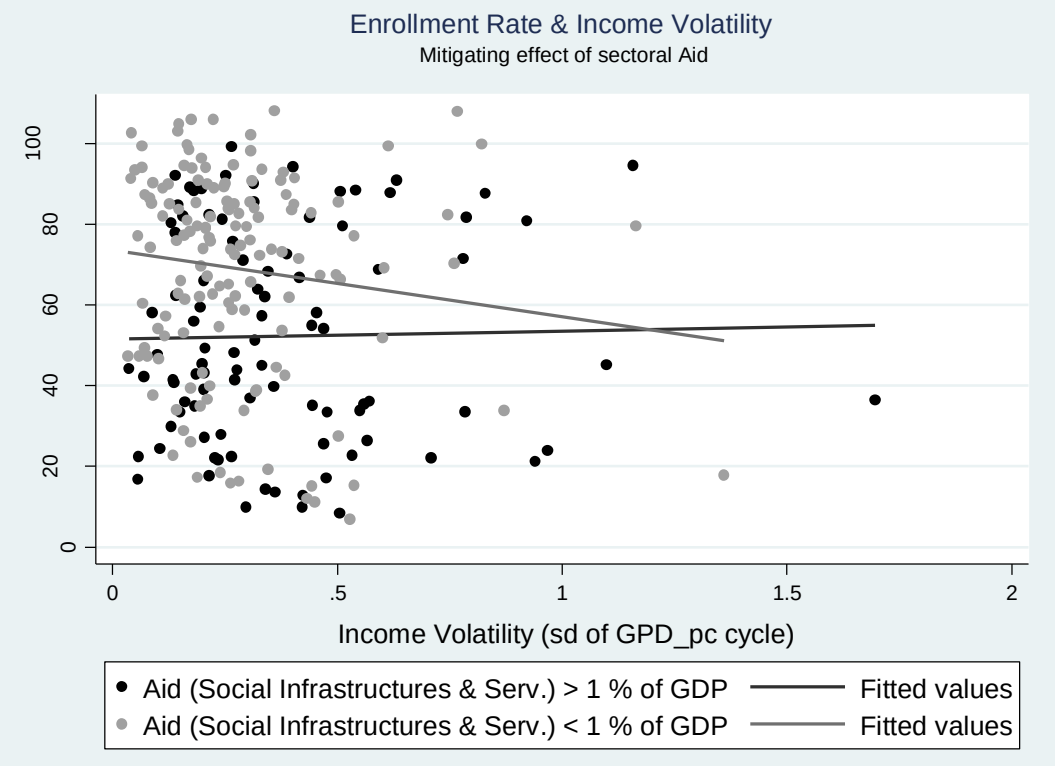


Figure 3. Enrollment rate and income volatility, by levels of aid to the social sectors, 1998-2012, five-year averages



Note: Observations for period 1998-2002 are dropped for aid recipients with no data on aid to social sectors.

Aid is likely to reduce the positive impact of income volatility on inequality as far as it allows more public spending in favour of the poor (as safety nets or social expenditure). It may also be the case that aid mitigates the negative effect of macroeconomic volatility on the poor by decreasing income volatility directly. Developing countries' volatility comes both from internal and external factors (Raddatz, 2007). The compensating effect of aid regarding the external sources of volatility is easier to assess than with respect to the internal ones given that the former are more likely to be exogenous to aid and to the economic conditions prevailing in the recipient country. In what follows, we provide suggestive evidence that aid tends to dampen the negative effect of macroeconomic volatility by stabilizing the flow of external resources. Figure 4 first shows the slightly positive relationship existing between inequality and exports volatility (measured in the same way as income volatility, see Equation (2) in Section 2). However, Figure 5 shows that for the sub-sample of countries in which aid is counter-cyclical with respect to exports,[8] then export volatility is no longer associated with higher inequality (black line). On the contrary, when aid is pro-cyclical, exports volatility is associated with higher inequality (grey line).

[8] Aid counter-cyclicality is measured using the correlation of the cycles of aid with the cycles of exports. When the correlation is negative, aid is assumed to be counter-cyclical. Aid and exports are measured in constant US dollars deflated by US unit import prices.

Figure 4. Inequality and exports volatility, 1973-2012, five-year averages

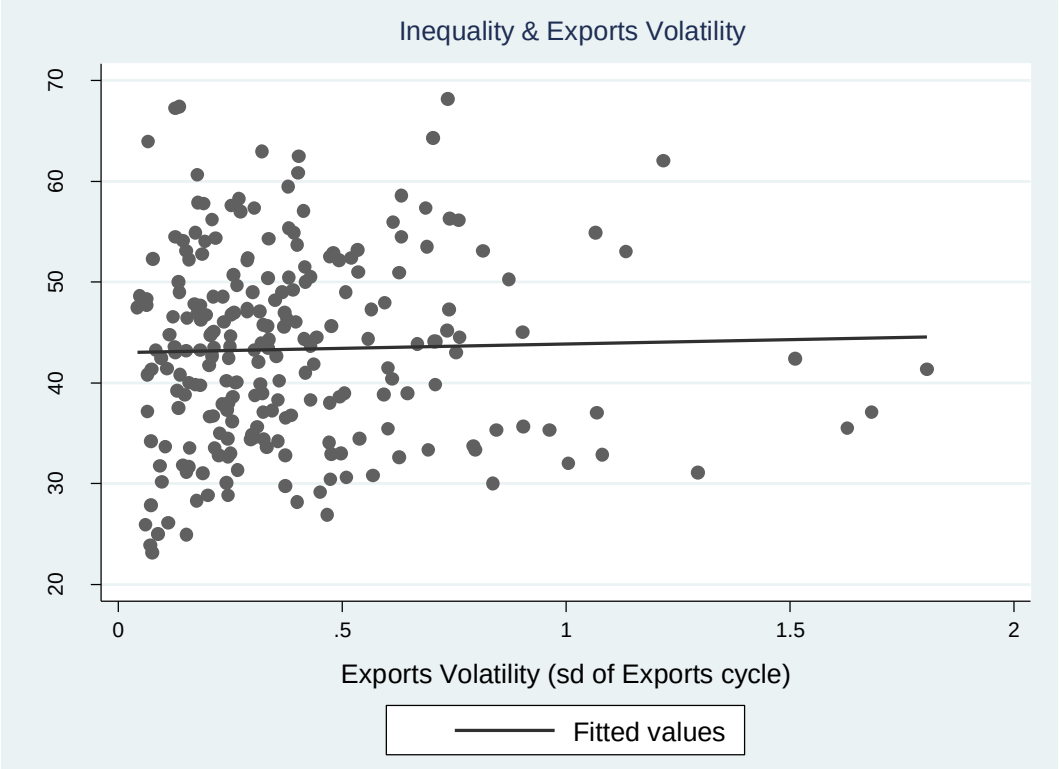
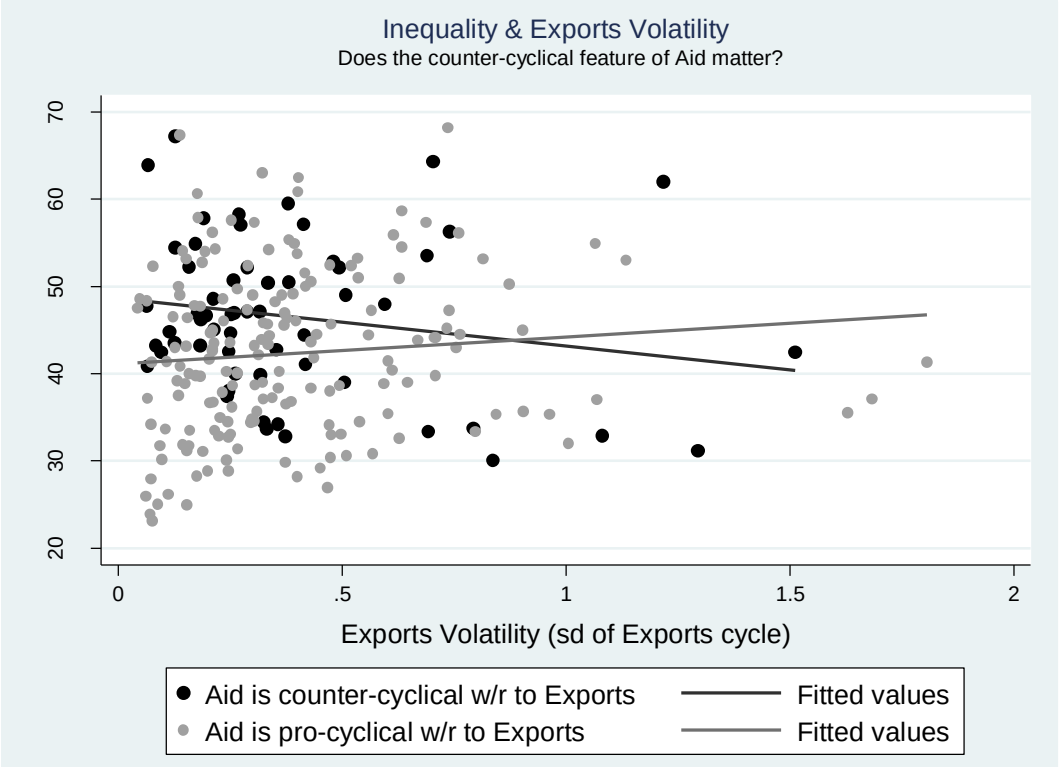


Figure 5. Inequality and exports volatility, depending on counter-cyclicality of aid, 1973-2012, five-year averages



In order to examine whether aid decreases output volatility by mitigating the destabilizing impact of exports instability, we build on Chauvet and Guillaumont (2009) and estimate the following model:

$$VOLY_{i,(t,t-5)} = \lambda VOLY_{i,(t-5,t-10)} + \alpha X_{i,(t,t-5)} + \beta X_{i,(t,t-5)}.VOLX_{i,(t,t-5)} + \beta X_{i,(t,t-5)}.VOLX_{i,(t,t-5)}.AID_{i,(t,t-5)}$$

$$+ \gamma AID_{i,(t,t-5)} + \delta AID_{i,(t,t-5)} \times VOLA_{i,(t,t-5)} + \varpi X_{i,(t,t-5)} + \mu_i + \tau_t + \varepsilon_{i,(t,t-5)} \quad (3)$$

where $X_{i,(t,t-5)}$ stands for exports of goods and services over GDP, averaged over *t* and *t*-5, and $VOLX_{i,(t,t-5)}$ is the volatility of exports. The volatility of aid and exports is measured in the same way as the volatility of income per capita (see Section 2) on series in constant US dollars, deflated using US unit import prices. The volatility of income per capita is a function of the volatility of exports weighted by the size of exports (exports in GDP, as a proxy for the exposure of the economy to exports volatility), and controlling for exports in GDP. Aid as a function of GDP may directly decrease income volatility. However, the volatility of aid may be an additional source of external volatility, which is more pervasive in country highly dependent on aid. Aid volatility is therefore weighted by the share of aid in GDP. We control for a set of country characteristics (initial income volatility, inflation rate, GDP per capita, etc.). This Chauvet and Guillaumont (2009) model is augmented with a triple interaction term of export volatility weighted by the share of exports in GDP and multiplied by aid. A negative coefficient of this variable would indicate that aid dampens the output volatility inducing effect of export instability. Table 6 exposes the results.

In line with Chauvet and Guillaumont (2009), results show that exports volatility tends to increase income fluctuations, especially when the country is largely open. However, we find weak evidence that aid volatility plays a similar role on income volatility. Aid volatility indeed leads to larger income instability only when an extra set of control variables is added and only when the whole sample is considered. Moreover income volatility does not seem to be characterized by high persistence since the lagged dependent variable is never significant across the different specifications.

Turning to our variable of interest, results expose a negative and significant coefficient for the triple interaction variable which is robust across the different control variables sets and samples considered. Although, the magnitude of the coefficient remains rather small, this shows that aid significantly reduces income volatility in large exporting countries with important exports volatility. This result therefore highlights the role played by international aid on the adverse effects of exports volatility on income fluctuations and points out one of the channels through which aid reduces income inequalities.

Table 6: Income volatility and aid, Sys-GMM, 1973-2012, 5-year periods.

	Dependent variables: GDP per capita volatility											
Sys-GMM – Internal instruments	1	2	3	4	5	6	7	8	9	10	11	12
Lagged dependent	0.111	0.032	0.123	0.224	0.088	0.070	-0.031	0.239	0.060	0.114	-0.004	0.304
	(0.101)	(0.102)	(0.117)	(0.195)	(0.124)	(0.071)	(0.115)	(0.233)	(0.122)	(0.146)	(0.091)	(0.242)
ODA (over GDP)	-0.008	-0.003	-0.009	0.001	-0.005	0.019	0.022	-0.009	-0.010	0.048	0.016	0.018
	(0.006)	(0.014)	(0.008)	(0.013)	(0.020)	(0.018)	(0.024)	(0.009)	(0.063)	(0.049)	(0.022)	(0.043)
ODA (over GDP) * ODA volatility	0.003	0.020***	0.006	-0.000	0.000	-0.003	0.003	-0.003	0.012	-0.008	0.006	-0.004
	(0.004)	(0.006)	(0.004)	(0.007)	(0.004)	(0.006)	(0.008)	(0.011)	(0.021)	(0.020)	(0.010)	(0.022)
No ODA dummy	0.044	-0.332+	0.078	0.043	0.461	-0.185	0.076	-0.090	0.329	-0.246	0.051	0.128
	(0.086)	(0.207)	(0.129)	(0.327)	(0.512)	(0.183)	(0.453)	(0.296)	(0.358)	(0.266)	(0.344)	(0.398)
Exports (over GDP)	0.002	0.003	0.000	-0.006*	0.001	0.002	-0.001	-0.006	0.001	0.002	-0.001	0.000
	(0.001)	(0.004)	(0.002)	(0.003)	(0.002)	(0.003)	(0.010)	(0.006)	(0.003)	(0.003)	(0.006)	(0.003)
Exports (over GDP) * Exports volatility	0.005***	-0.006	0.003+	0.006**	0.006**	-0.000	0.017	0.005*	0.005	-0.000	0.016	-0.003
	(0.002)	(0.011)	(0.002)	(0.003)	(0.002)	(0.006)	(0.021)	(0.003)	(0.007)	(0.008)	(0.011)	(0.007)
Exports (over GDP) * Exports volatility * ODA (over GDP)					**-0.000***	**-0.000***	**-0.002****	**0.001**	**-0.002*****	**-0.001***	**-0.002*****	**0.000**
					(0.000)	**(0.000)**	**(0.001)**	**(0.001)**	**(0.000)**	**(0.000)**	**(0.001)**	**(0.001)**
GDP per capita (in log)	-0.160**	-0.012	-0.167*	-0.799	-0.291	-0.079	-0.259**	-1.068*	-0.226*	-0.021	-0.219*	-0.471
	(0.081)	(0.240)	(0.099)	(0.636)	(0.208)	(0.200)	(0.127)	(0.633)	(0.117)	(0.233)	(0.118)	(0.477)
GDP per capita squared (in log)		0.005		0.055		0.006		0.072+		0.005		0.036
		(0.014)		(0.044)		(0.013)		(0.045)		(0.015)		(0.037)
Population growth		-0.034		0.055		-0.017		0.052		-0.021		0.028
		(0.035)		(0.094)		(0.038)		(0.082)		(0.039)		(0.102)
Rural population (in log)		-0.045		-0.097		-0.031		-0.108		-0.022		-0.086
		(0.043)		(0.090)		(0.033)		(0.100)		(0.034)		(0.071)
Inflation (in log)		0.033		0.015		0.034		0.014		0.047		0.055
		(0.033)		(0.025)		(0.026)		(0.031)		(0.038)		(0.050)
Secondary school enrollment (gross, in log)		-0.164*		0.036		-0.090		0.045		-0.035		-0.029
		(0.088)		(0.116)		(0.097)		(0.137)		(0.136)		(0.146)
Government expenditures (over GDP, in log)		0.040		0.015		0.035		-0.015		-0.004		0.011
		(0.133)		(0.086)		(0.079)		(0.119)		(0.102)		(0.160)
Number of observations	642	483	447	329	642	483	447	329	642	483	447	329
Number of countries	174	155	118	102	174	155	118	102	174	155	118	102
Developing countries only	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
AR1 (p-value)	0.487	0.037	0.564	0.122	0.260	0.005	0.125	0.141	0.171	0.041	0.133	0.249
AR2 (p-value)	0.329	0.354	0.263	0.249	0.603	0.303	0.352	0.163	0.822	0.265	0.343	0.695
Hansen test (p-value)	0.237	0.702	0.871	0.331	0.356	0.683	0.689	0.273	0.143	0.530	0.776	0.544

Notes: Robust standard errors in parentheses (using the Windmeijer's correction), + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Each specification includes period dummies and a constant.
In columns 9 to 12 technical cooperation and debt relief are dropped from ODA.
Sources: Authors' calculations based on UNU-WIDER, World Bank and OECD data.

6. Conclusion

Exogenous sources of instability, either due to external trade shocks or natural and climatic disasters, and the volatility they induce are significant factors lowering average income growth and also increasing income inequality, making growth less favourable to the poor. This effect is particularly severe in countries that are highly exposed to exogenous fluctuations. It is now well established that macroeconomic volatility has harmful consequences for development (see a review in Guillaumont 2006, 2009). Indeed, numerous works have shown the negative effect on the average growth of income either of income growth instability (Ramey and Ramey, 1995; Hnatkovska and Loayza, 2005; Norrbin and Yigit, 2005), or of specific exogeneous instabilities, more particularly export instability, especially in Africa (Guillaumont et al., 1999).

The negative effects of income volatility on growth come both from uncertainty and risk-aversion (ex-ante effect) and from asymmetric responses to positive and negative shocks (ex-post effect). As income growth is a major factor in poverty reduction income volatility hurts the poor through its negative effect on income growth. Moreover, if macroeconomic volatility generates inequality and if aid has a stabilizing impact, it should be expected that due to this impact aid contributes to poverty reduction not only by increasing the rate of growth but also by making this growth less volatile and more pro-poor by mitigating the adverse effect of volatility on income distribution.

In this paper, we test the hypothesis that foreign aid dampens the adverse effects of macroeconomic volatility on income inequality. We find that volatility has a robust and positive impact on inequality but that aid tends to reduce volatility and simultaneously to dampen its positive impact on inequality (or negative impact on the poor). We address the endogeneity of aid and volatility by implementing System-GMM estimators, which results are robust to the use of both internal and external instruments. Our results are also robust to estimations on reduced samples, as well as to specification tests. We also examine alternative hypotheses (the role of remittances and the way political institutions affect the inequality-aid-volatility relationship) which do not seem to be corroborated by the data. Still, further robustness checks should be implemented. An instrumental strategy that does not rely on internal instruments, but only on external ones should be implemented, given the fact that the results of SYS-GMM estimations highly depend on the lag structure of the instruments. In this paper we opted for constraining as little as possible the lag structure of the internal instruments, but a next step would be to find stronger and more valid instruments for both aid and volatility.

Appendix

Table A0: Sample of countries

Country Name	Freq.	Country Name	Freq.	Country Name	Freq.
Afghanistan	2	Guyana	1	Senegal	2
Albania	4	Honduras	5	Serbia	3
Algeria	2	Hong Kong, China	3	Seychelles	2
Angola	2	Iceland	2	Slovak Republic	4
Armenia	4	India	5	Slovenia	3
Australia	4	Indonesia	4	South Africa	5
Austria	7	Iran, Islamic Rep.	4	Spain	7
Azerbaijan	2	Iraq	1	Sri Lanka	3
Bahamas, The	5	Ireland	6	St. Lucia	1
Bangladesh	5	Israel	7	Sudan	1
Barbados	2	Italy	7	Suriname	1
Belarus	3	Japan	5	Swaziland	3
Belgium	7	Jordan	4	Sweden	7
Belize	2	Kazakhstan	2	Switzerland	4
Benin	1	Kenya	3	Syrian Arab Republic	1
Bhutan	1	Korea, Rep.	7	Tajikistan	3
Bolivia	3	Kyrgyz Republic	4	Tanzania	2
Botswana	3	Lao PDR	3	Thailand	7
Bulgaria	6	Latvia	2	Togo	1
Burkina Faso	2	Lesotho	3	Trinidad and Tobago	2
Burundi	3	Lithuania	1	Tunisia	5
Cambodia	3	Luxembourg	6	Turkey	6
Cameroon	1	Macedonia, FYR	4	Uganda	3
Canada	7	Madagascar	2	Ukraine	3
Central African Republic	1	Malawi	5	United Kingdom	5
Chile	1	Malaysia	6	United States	7
China	4	Mali	4	Uruguay	7
Colombia	7	Malta	3	Venezuela	1
Comoros	1	Mauritania	5	Vietnam	1
Congo, Dem. Rep.	1	Mauritius	6	West Bank and Gaza	2
Congo, Rep.	1	Mexico	6		
Costa Rica	7	Moldova	4	Total	520
Cote d'Ivoire	2	Mongolia	3		
Croatia	3	Montenegro	2		
Cyprus	3	Morocco	5		
Czech Republic	4	Mozambique	3		
Denmark	7	Namibia	1		
Dominican Republic	5	Nepal	3		
East Timor	1	Netherlands	7		
Ecuador	5	New Zealand	6		
Egypt, Arab Rep.	4	Nicaragua	2		
El Salvador	5	Niger	2		
Estonia	3	Nigeria	2		
Ethiopia	3	Norway	7		
Fiji	3	Pakistan	4		
Finland	7	Panama	6		
France	7	Papua New Guinea	1		
Gabon	1	Paraguay	5		
Gambia, The	2	Peru	7		
Georgia	2	Philippines	6		
Germany	5	Poland	4		
Ghana	3	Portugal	6		
Greece	7	Qatar	1		
Guatemala	5	Romania	5		
Guinea	1	Russian Federation	4		
Guinea-Bissau	1	Rwanda	3		

Table A1: Income inequality (Gini & Income share quintiles), alternative measure of volatility (the 5-year standard deviation of the GDP per capita growth rate), panel fixed effects, 1973-2012, 5-year periods.

	1	2	3	4	5
Sys-GMM estimator – Internal instruments Dependent variables (in log)	Gini	Q1	Q2	Q1/Q5	(Q1+Q2)/Q5
Lagged dependent	0.559***	0.005	0.153	0.061	0.135
	(0.096)	(0.136)	(0.125)	(0.136)	(0.136)
GDP per capita growth volatility	0.012**	0.014	-0.001	0.024	0.007
	(0.005)	(0.028)	(0.015)	(0.036)	(0.028)
Net ODA (over GDP, in log)	0.007	0.004	0.015	-0.005	0.014
	(0.011)	(0.040)	(0.020)	(0.054)	(0.039)
No ODA dummy	0.085	0.202	0.291	0.174	0.379
	(0.128)	(0.494)	(0.247)	(0.674)	(0.487)
Volatility x ODA	-0.000	**0.005****	**0.002+**	**0.007****	**0.005****
	(0.001)	**(0.002)**	**(0.001)**	**(0.003)**	**(0.002)**
GDP per capita (in log)	0.367***	-1.014***	-0.471***	-1.382***	-0.976***
	(0.089)	(0.285)	(0.168)	(0.397)	(0.323)
GDP per capita squared (in log)	-0.022***	0.060***	0.028***	0.082***	0.059***
	(0.005)	(0.018)	(0.010)	(0.025)	(0.020)
Population growth	0.046***	-0.148***	-0.079***	-0.200***	-0.154***
	(0.012)	(0.046)	(0.026)	(0.066)	(0.051)
Rural population (in log)	0.001	0.000	-0.004	0.016	0.004
	(0.012)	(0.039)	(0.021)	(0.052)	(0.039)
Inflation (in log)	0.002	-0.027	-0.009	-0.038	-0.024
	(0.009)	(0.033)	(0.013)	(0.040)	(0.027)
Secondary school enrollment (gross, in log)	-0.024	0.093	0.064*	0.136+	0.118*
	(0.025)	(0.067)	(0.038)	(0.086)	(0.066)
Government expenditures (over GDP, in log)	-0.077***	0.112+	0.051	0.164+	0.114+
	(0.024)	(0.075)	(0.042)	(0.099)	(0.076)
Consumption dummy	-0.057***	0.143**	0.067*	0.161*	0.114*
	(0.022)	(0.061)	(0.036)	(0.083)	(0.066)
Number of observations	466	393	389	392	389
Number of countries	123	116	115	116	115
AR2 (p-value)	0.000	0.066	0.022	0.079	0.050
Hansen test (p-value)	0.478	0.317	0.944	0.450	0.748

Notes: Robust standard errors in parentheses (using the Windmeijer's correction), + p<0.15, * p<0.10, ** p<0.05, *** p<0.01. Each specification includes period dummies and a constant.
Sources: Authors' calculations based on UNU-WIDER, World Bank and OECD data.

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