**Economic Volatility and Inequality: Do Aid and Remittances Matter?**

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**Abstract**

We examine the adverse impact of macroeconomic volatility on inequality and the role that aid and remittances 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 and remittances do not seem to have a clear direct impact on inequality, we find robust evidence that aid helps to dampen the negative effects of volatility on the distribution of income, while remittances do not.

Keywords: Aid, Income volatility, Inequality

JEL codes: F35

**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). 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. The 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).

But not only does volatility affect the size of the pie, it also impacts its distribution. Volatility increases income inequality, making growth less favourable to the poor. 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, 2011). The poor engage in suboptimal ways of smoothing income shocks, by instance in investing in livestock, which is subject to lumpiness. The inability of poor people to face negative shocks results in losses of human capital, which are difficult to reverse.[[2]](#footnote-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 through both the Gini coefficient and the differentiated impact on each quintile. They find a non-linear impact of volatility, which depends on the level of public expenditure, considered as a mitigating factor.

In this paper, we explore additional channels by examining whether foreign aid and remittances can mitigate the adverse effect of macroeconomic volatility on inequality. In 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. For this reason, the impact of remittances is also analysed. The aid-inequality and remittances-inequality nexus is examined through the lens of the potential stabilizing role of aid and remittances. 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 or remittances through their stabilizing impact (Guillaumont and Chauvet, 2001; Chauvet and Guillaumont, 2004, 2009; Guillaumont and Le Goff, 2010; Le Goff 2010, Guillaumont and Wagner, 2012).

To the best of our knowledge, research on the empirical relation between foreign aid or remittances and income inequality is still limited. While most literature focuses on aid effectiveness in terms of economic growth, only a smaller body examines the effects on poverty reduction and inequality (see for instance Guillaumont and Wagner 2013 for a survey with a special focus on the interactions between aid, poverty, and macroeconomic volatility). 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. The aid-inequality relationships has been more recently investigated but still without reference to the potential stabilising role of aid. Indeed Calderón et al. (2009) examine the effect of foreign aid on income inequality and poverty reduction for the period 1971–2002, suggesting the role of public expenditure. But these authors find that no robust association between aid inflows and income inequality as measured by Gini coefficients. This aid-inequality relationship has often 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, since aid is less likely to be captured by the elite.

The literature on the relationship between remittances and income distribution or poverty is prolific and has not reached a consensus[[3]](#footnote-3). Moreover the potential stabilizing effect of remittances is no more taken into account. According to the review of the literature by [Rapoport](http://www.sciencedirect.com/science/article/pii/S1574071406020173) and [Docquier](http://www.sciencedirect.com/science/article/pii/S1574071406020173) (2006), at the macro level, “there is considerable evidence that remittances (in the form of savings repatriated by return migrants) promote access to self-employment and raise investment in small businesses, and there is also evidence that remittances contribute to raise educational attainments of children in households with migrant members. However the relationship between remittances and inequality appears to be non-monotonic: remittances seem to decrease economic inequality in communities with a long migration tradition but to increase inequality within communities at the beginning of the migration process. This is consistent with different theoretical arguments regarding the role of migration networks and/or the dynamics of wealth transmission between successive generations.” It seems that the impact of remittances on income inequality actually depends on who migrates, i.e. on the location migrants occupy in income distribution in their home country ([Ebeke](http://cerdi.org/christian-ebeke/perso/) and Le Goff, 2009).

Whether or not aid and remittances have a stabilizing role to play regarding external shocks and macroeconomic volatility has also 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. It results 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. In this paper we examine whether this mitigating effect induces lower macroeconomic volatility, hence lower inequality.

The conclusion is rather similar for remittances. [Combes,](http://cerdi.org/jean-louis-combes/perso/) Ebeke and Ntsama Etoudi (2014) have shown that in low income countries and especially in the Sub-Saharan African region where most countries are vulnerable to food price shocks, remittances and aid inflows dampen the effect of food price shocks and instability on household consumption.

According to Le Goff and Guillaumont (2010) at the country level each kind of flows (aid and remittances) exerts a stabilizing impact with regard to the fluctuations of exports, as distinct from their countercyclical character. Most often than the opposite, both kinds of flows appear stabilizing. Second, on a cross-country basis aid and remittances dampen the growth volatility. While at the country level, remittances appear to dampen the instability of exports more often than aid does so, on a cross-country basis, aid more than remittances lowers growth volatility.

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. We then add to our specification foreign aid and an interaction term of aid with volatility and alternately remittances and an interaction term of remittances with volatility. We use the panel fixed effects and system GMM estimators. We find robust 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. At the opposite the results relative to remittances, although similar when using the fixed effects estimators, are found to be not robust to the GMM specification. 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 our variables representing external financing (either foreign aid or remittances). In order to assess the mitigating effect of these flows on income volatility we estimate the following equation:

*INEQi,t*= *INEQi,t-5* + *VOLATILITYi,(t,t-5)* + *EXT.FINANCINGi,(t,t-5)*

+ *EXT.FINANCINGi,(t,t-5)* x *VOLATILITYi,(t,t-5)* + *Xi,(t,t-5)* + *i* + *t* + *i,t*  (1)

where *INEQi,t* is the measure of inequality of country *i*, in year *t*. We include the lag in *t-5* of *INEQi,t-5* on the right-hand side in order to account for a catching up effect. The model includes *EXT.FINANCING,(t,t-5)* which will alternatelyrepresent foreign aid or remittances, and control variables, *Xi,(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, *i*. We also include period fixed effects, *t*, to account for global 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 Chen and Ravallion (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 (2013), 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 and 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.[[4]](#footnote-4)

Following the recommendations of Atkinson and Brandolini (2001, 2009) we chose to work with the WIID database as it includes much 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 when 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 to data availability, we favour income rather than consumption.[[5]](#footnote-5) Consumption data were used only when no income data was available. In that case a dummy variable, *CONSUMPTIONi,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 as this measure is based on a less restrictive formalisation of the process underlying the change in the trend of economic series. 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:

*yt* = α*t* +*yt−1* + *εt* (2)

where *t* is a time trend, *yt* is income per capita in year *t* and , *yt-1* is income per capita in year *t-1*. Volatility of income is then measured as the standard deviation of *εt* / 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, *AIDi,(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(*AIDi,(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+*AIDi,(t,t-5)* and is then transformed using ln(max{0.0001, *AIDi,(t,t-5)*}. It is then complemented in the regressions by a “no aid” dummy variable, which equals 1 when *AIDi,(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 (2010), 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 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 of 142 countries shows an average income volatility of around 0.35%, which hides a large heterogeneity with Sub-Saharan Africa exposing higher levels of volatility (0.7%) while Latin America and Asia a lower level (0.3%)

Table 1: Summary statistics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) |
| VARIABLES | N | Mean | Sd | min | 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**

First, we 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). Table 2presents estimations results for equation (1) using simple fixed effects estimators but without the introduction of aid or remittances and their interaction term with income volatility. 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 (4), it also seems that income volatility benefits the richest by increasing their share of income.

When introduced in Table 3, aid does not seem to impact the level of inequality whatsoever.[[6]](#footnote-6) 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, the interaction term of aid with income volatility is significantly positive. These results are consistent with the hypothesis that aid helps to dampen the adverse effects of volatility.

Turning then to the effect of remittances on inequality, results tend to show that the level of remittances negatively affects the income share of the poorest. We also find that the interaction with income volatility is significant, positive and in all cases tends to offset the negative effect of remittances expressed in level. Findings for remittances thus also emphasize a kind of mitigating effect when income volatility is high.

However, the fixed effects estimator suffers from many caveats. The first one is that it does not control for the likely endogeneity of our variables of external financing and income volatility with inequality. The second is that it does not control for the high level of persistence in the data captured by *INEGi,t-5*. To tackle these issues we now turn to a dynamic GMM system estimator and include a lagged dependant variable on the right hand side of the model. 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, remittances and the interaction terms of aid and remittances with volatility are endogeneous. These variables are instrumented using their lags and difference in lags from *t*-2 onward, (we also use the collapse option to restrain the proliferation of instruments). Results using both the Gini index and the quintiles income shares are displayed in Table 4 from columns (1) to (5) for foreign aid and from columns (6) to (10) for remittances. 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.

However, when tackling endogeneity with GMM estimators, results for remittances are not robust anymore, thus casting doubts about the mitigating effects of personal transfers in home country.

Finally in Table 5 we add the ratio of remittances over GDP and its interaction with income volatility in the equation alongside with foreign aid and its relative interaction term. It appears that the results relative to remittances are still not significant, as expected since the literature suggests that the impact of remittances largely differs across countries. However, even with the introduction of remittances in the same regression, we observe that the results for aid remain consistent with our baseline estimations in Tables 3 and 4, although being less significant. Therefore, since no effect from remittances on income distribution is to be observed, we decide for the subsequent sections to focus on the role played by foreign aid and explore in depth its mitigating effect on income volatility.

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Fixed effects estimator | 1 | 2 | 3 | 4 | 5 |
|  |  |  |  |  |  |
| Dependent variables | Gini | Q1 | Q2 | Q1/Q5 | (Q1+Q2)/Q5 |
| (in log) |  |  |  |  |  |
| **GDP per capita volatility** | **0.052\*\*\*** | **-0.079\*\*\*** | **-0.066\*\*\*** | **-0.123\*\*\*** | **-0.116\*\*\*** |
|  | **(0.015)** | **(0.025)** | **(0.013)** | **(0.033)** | **(0.024)** |
| GDP per capita (in log) | 0.514\* | -1.135\*\*\* | -0.573\*\*\* | -1.563\*\*\* | -1.172\*\*\* |
|  | (0.262) | (0.405) | (0.219) | (0.522) | (0.398) |
| GDP per capita squared (in log) | -0.032\*\* | 0.072\*\*\* | 0.035\*\* | 0.100\*\*\* | 0.074\*\*\* |
|  | (0.015) | (0.026) | (0.013) | (0.034) | (0.025) |
| Population growth | -0.011 | 0.018 | 0.014 | 0.023 | 0.021 |
|  | (0.018) | (0.039) | (0.021) | (0.049) | (0.037) |
| Rural population (in log) | -0.023 | 0.080 | 0.018 | 0.091 | 0.048 |
|  | (0.037) | (0.059) | (0.032) | (0.075) | (0.056) |
| Inflation (in log) | 0.010 | -0.017 | 0.001 | -0.020 | -0.007 |
|  | (0.011) | (0.024) | (0.010) | (0.030) | (0.020) |
| Secondary school enrollment (gross, in log) | -0.118\*\* | 0.284\*\*\* | 0.182\*\*\* | 0.395\*\*\* | 0.322\*\*\* |
|  | (0.055) | (0.102) | (0.061) | (0.136) | (0.109) |
| Government expenditures (over GDP, in log) | 0.062 | -0.221\*\* | -0.144\*\*\* | -0.274\*\* | -0.241\*\* |
|  | (0.048) | (0.102) | (0.051) | (0.130) | (0.093) |
| Consumption dummy | -0.029 | 0.064 | 0.031 | 0.078 | 0.049 |
|  | (0.028) | (0.057) | (0.035) | (0.076) | (0.062) |
| Number of observations | 520 | 477 | 475 | 477 | 475 |
| Number of countries | 142 | 140 | 140 | 140 | 140 |

Notes: Robust standard errors in parentheses, + 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 and Income share quintiles), volatility, aid and remittances, panel fixed effects, 1973-2012, 5-year periods.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Fixed effects estimator | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  |  |  |  |  |  |  |  |  |  |  |
| Dependent variables | Gini | Q1 | Q2 | Q1/Q5 | (Q1+Q2)/Q5 | Gini | Q1 | Q2 | Q1/Q5 | (Q1+Q2)/Q5 |
| (in log) |  |  |  |  |  |  |  |  |  |  |
| **GDP per capita volatility** | 0.062\*\*\* | -0.106\*\*\* | -0.077\*\*\* | -0.160\*\*\* | -0.144\*\*\* | 0.084\*\*\* | -0.183\*\*\* | -0.125\*\*\* | -0.275\*\*\* | -0.241\*\*\* |
|  | (0.017) | (0.033) | (0.016) | (0.043) | (0.032) | (0.030) | (0.060) | (0.034) | (0.080) | (0.063) |
| 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) |  |  |  |  |  |
| **Remittances (over GDP, in log)** |  |  |  |  |  | 0.015+ | -0.061\*\*\* | -0.033\*\*\* | -0.081\*\*\* | -0.062\*\*\* |
|  |  |  |  |  |  | (0.010) | (0.017) | (0.010) | (0.022) | (0.018) |
| **Volatility x Remittances** |  |  |  |  |  | -0.024+ | 0.057\* | 0.035\*\* | 0.084\*\* | 0.072\*\* |
|  |  |  |  |  |  | (0.016) | (0.029) | (0.018) | (0.041) | (0.033) |
| GDP per capita (in log) | 0.512\* | -1.294\*\*\* | -0.581\*\* | -1.738\*\*\* | -1.242\*\*\* | 0.544\* | -1.217\*\* | -0.656\*\*\* | -1.707\*\*\* | -1.314\*\*\* |
|  | (0.263) | (0.414) | (0.226) | (0.537) | (0.410) | (0.307) | (0.525) | (0.250) | (0.652) | (0.472) |
| GDP per capita squared (in log) | -0.032\*\* | 0.081\*\*\* | 0.034\*\* | 0.108\*\*\* | 0.076\*\*\* | -0.034\* | 0.075\*\* | 0.040\*\* | 0.107\*\* | 0.082\*\*\* |
|  | (0.015) | (0.027) | (0.014) | (0.035) | (0.026) | (0.018) | (0.036) | (0.016) | (0.044) | (0.031) |
| Population growth | -0.008 | 0.020 | 0.015 | 0.025 | 0.022 | -0.020 | 0.017 | 0.012 | 0.020 | 0.017 |
|  | (0.018) | (0.040) | (0.022) | (0.051) | (0.039) | (0.019) | (0.042) | (0.021) | (0.052) | (0.038) |
| Rural population (in log) | -0.022 | 0.090\* | 0.022 | 0.106+ | 0.059 | -0.016 | 0.092 | 0.043 | 0.128 | 0.086 |
|  | (0.038) | (0.054) | (0.032) | (0.069) | (0.055) | (0.076) | (0.126) | (0.052) | (0.145) | (0.098) |
| Inflation (in log) | 0.012 | -0.013 | 0.002 | -0.016 | -0.006 | 0.008 | -0.014 | 0.001 | -0.013 | -0.002 |
|  | (0.012) | (0.023) | (0.010) | (0.029) | (0.021) | (0.009) | (0.022) | (0.009) | (0.027) | (0.018) |
| Secondary school enrollment (gross, in log) | -0.112\*\* | 0.265\*\* | 0.175\*\*\* | 0.372\*\*\* | 0.307\*\*\* | -0.098+ | 0.275\*\* | 0.199\*\*\* | 0.393\*\*\* | 0.338\*\*\* |
|  | (0.056) | (0.102) | (0.062) | (0.136) | (0.109) | (0.061) | (0.110) | (0.069) | (0.145) | (0.119) |
| Government expenditures (over GDP, in log) | 0.069 | -0.198\* | -0.139\*\*\* | -0.250\* | -0.232\*\* | 0.075+ | -0.305\*\*\* | -0.175\*\*\* | -0.379\*\*\* | -0.310\*\*\* |
|  | (0.050) | (0.100) | (0.051) | (0.128) | (0.093) | (0.050) | (0.091) | (0.046) | (0.116) | (0.084) |
| Consumption dummy | -0.032 | 0.069 | 0.033 | 0.085 | 0.054 | -0.024 | 0.072 | 0.031 | 0.092 | 0.058 |
|  | (0.028) | (0.058) | (0.036) | (0.078) | (0.063) | (0.028) | (0.055) | (0.033) | (0.072) | (0.057) |
| Number of observations | 514 | 471 | 469 | 471 | 469 | 470 | 435 | 433 | 435 | 433 |
| Number of countries | 142 | 140 | 140 | 140 | 140 | 136 | 135 | 135 | 135 | 135 |

Notes: Robust standard errors in parentheses, + 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 4: Income inequality (Gini and Income share quintiles), volatility, aid and remittances, Sys-GMM, 1973-2012, 5-year periods

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  |  |  |  |  |  |  |  |  |  |  |
| Dependent variables | Gini | Q1 | Q2 | Q1/Q5 | (Q1+Q2)/Q5 | Gini | Q1 | Q2 | Q1/Q5 | (Q1+Q2)/Q5 |
| (in log) |  |  |  |  |  |  |  |  |  |  |
| Lagged dependent | 0.509\*\*\* | 0.311\*\* | 0.380\*\*\* | 0.293\*\* | 0.369\*\*\* | 0.475\*\*\* | 0.492\*\*\* | 0.468\*\*\* | 0.517\*\*\* | 0.558\*\*\* |
|  | (0.105) | (0.127) | (0.125) | (0.126) | (0.107) | (0.116) | (0.106) | (0.155) | (0.111) | (0.126) |
| **GDP per capita volatility** | 0.059\*\* | -0.086 | -0.057+ | -0.114+ | -0.095\* | 0.094 | -0.084 | -0.137+ | -0.073 | -0.148 |
|  | (0.027) | (0.068) | (0.039) | (0.069) | (0.055) | (0.079) | (0.226) | (0.090) | (0.272) | (0.184) |
| Net ODA (over GDP, in log) | 0.019\* | 0.001 | 0.002 | -0.007 | 0.006 |  |  |  |  |  |
|  | (0.010) | (0.025) | (0.016) | (0.030) | (0.025) |  |  |  |  |  |
| No ODA dummy | 0.208\* | 0.262 | 0.119 | 0.208 | 0.241 |  |  |  |  |  |
|  | (0.121) | (0.292) | (0.200) | (0.360) | (0.321) |  |  |  |  |  |
| **Volatility x ODA** | **-0.015\*** | 0.030 | **0.019+** | **0.041\*** | **0.033\*** |  |  |  |  |  |
|  | **(0.009)** | (0.021) | **(0.012)** | **(0.022)** | **(0.018)** |  |  |  |  |  |
| Remittances (over GDP, in log) |  |  |  |  |  | 0.008 | 0.020 | -0.016 | 0.030 | -0.006 |
|  |  |  |  |  |  | (0.016) | (0.035) | (0.016) | (0.043) | (0.033) |
| Volatility x Remittances |  |  |  |  |  | -0.008 | -0.100 | 0.032 | -0.126 | -0.010 |
|  |  |  |  |  |  | (0.028) | (0.108) | (0.046) | (0.150) | (0.097) |
| GDP per capita (in log) | 0.390\*\*\* | -0.423\*\* | -0.296\*\*\* | -0.799\*\* | -0.579\*\*\* | 0.370\*\*\* | -0.475\*\* | -0.303\*\* | -0.594\*\* | -0.429\* |
|  | (0.085) | (0.211) | (0.104) | (0.320) | (0.204) | (0.111) | (0.222) | (0.134) | (0.286) | (0.228) |
| GDP per capita squared (in log) | -0.023\*\*\* | 0.023\* | 0.018\*\*\* | 0.045\*\* | 0.034\*\*\* | -0.021\*\*\* | 0.027\*\* | 0.018\*\* | 0.035\*\* | 0.025\* |
|  | (0.005) | (0.012) | (0.006) | (0.019) | (0.012) | (0.007) | (0.012) | (0.008) | (0.016) | (0.013) |
| Population growth | 0.051\*\*\* | -0.056\* | -0.058\*\*\* | -0.097\*\* | -0.089\*\* | 0.049\*\*\* | -0.046\*\* | -0.045\*\*\* | -0.063\* | -0.062\*\* |
|  | (0.011) | (0.029) | (0.020) | (0.046) | (0.035) | (0.017) | (0.020) | (0.017) | (0.033) | (0.029) |
| Rural population (in log) | 0.009 | -0.021 | 0.004 | -0.029 | -0.008 | 0.010 | 0.011 | 0.008 | 0.017 | 0.014 |
|  | (0.018) | (0.031) | (0.021) | (0.045) | (0.034) | (0.021) | (0.034) | (0.018) | (0.045) | (0.032) |
| Inflation (in log) | 0.010 | -0.028 | -0.012 | -0.039 | -0.032 | 0.010 | -0.042+ | -0.006 | -0.057\* | -0.030 |
|  | (0.011) | (0.026) | (0.012) | (0.034) | (0.026) | (0.011) | (0.026) | (0.013) | (0.031) | (0.028) |
| Secondary school enrollment (gross, in log) | 0.014 | 0.004 | 0.003 | 0.038 | 0.025 | -0.016 | 0.020 | 0.005 | 0.020 | 0.006 |
|  | (0.035) | (0.079) | (0.038) | (0.105) | (0.077) | (0.046) | (0.064) | (0.040) | (0.079) | (0.072) |
| Government expenditures (over GDP, in log) | -0.109\*\*\* | 0.094\* | 0.059+ | 0.162\*\* | 0.127\* | -0.080\*\*\* | 0.137\*\* | 0.073\* | 0.188\*\*\* | 0.145\*\* |
|  | (0.031) | (0.056) | (0.039) | (0.077) | (0.066) | (0.028) | (0.054) | (0.040) | (0.069) | (0.065) |
| Consumption dummy | -0.057\*\*\* | 0.105\*\* | 0.055\* | 0.115+ | 0.073 | -0.031 | 0.086 | 0.065+ | 0.099 | 0.098 |
|  | (0.022) | (0.051) | (0.030) | (0.072) | (0.058) | (0.028) | (0.065) | (0.043) | (0.085) | (0.084) |
| Number of observations | 415 | 354 | 351 | 354 | 351 | 387 | 335 | 332 | 335 | 332 |
| Number of countries | 122 | 116 | 115 | 116 | 115 | 117 | 111 | 110 | 111 | 110 |
| AR1 (p-value) | 0.000 | 0.055 | 0.003 | 0.046 | 0.005 | 0.001 | 0.049 | 0.004 | 0.026 | 0.004 |
| AR2 (p-value) | 0.430 | 0.837 | 0.471 | 0.965 | 0.886 | 0.774 | 0.487 | 0.445 | 0.576 | 0.570 |
| Hansen test (p-value) | 0.687 | 0.586 | 0.563 | 0.523 | 0.621 | 0.439 | 0.617 | 0.564 | 0.463 | 0.352 |

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 and 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) |
| **Volatility x remittances** | **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.

**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 6 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 (2010), 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 (2010) finds that aid benefits disproportionately to the 20% highest income elite. In Table 7 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.

Table 6: Income inequality (Gini and 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.

Table 7: Income inequality (Gini and 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.

**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, while remittances do not. 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 (Agénor, 2002). 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 enrolment rates and output volatility. Figure 1 shows that high output volatility is associated with lower education outcomes,[[7]](#footnote-7) 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).[[8]](#footnote-8)

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



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



Figure 3. Enrolment 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,[[9]](#footnote-9) 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).

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:

*VOLYi,(t,t-5)* = *VOLYi, (t-5,t-10)* + *Xi,(t,t-5) +* *Xi,(t,t-5).VOLXi,(t,t-5) +* *X i, (t,t-5).VOLXi,(t,t-5) .AIDi,(t,t-5)*

+ *AIDi,(t,t-5)* + *AIDi,(t,t-5)* x *VOLAi,(t,t-5)* + *Xi,(t,t-5)* + *i* + *t* + *i,(t,t-5)*  (3)

where *Xi,(t,t-5)* stands for exports of goods and services over GDP, averaged over *t* and *t*-5, and *VOLXi,(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 8 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 8: 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**

As income growth is a major factor in poverty reduction income volatility hurts the poor through its negative effect on income growth. If macroeconomic volatility generates inequality and if aid or remittances have a stabilizing impact, it should be expected that due to this impact they contribute 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 and remittances may dampen the adverse effects of macroeconomic volatility on income inequality. We find that volatility has a robust and positive impact on inequality and that aid tends to reduce volatility and simultaneously to dampen its positive impact on inequality (or negative impact on the poor). The effect of remittances is more uncertain as their mitigating action seems to occur only when volatility is high. We address the endogeneity of aid, remittances and volatility by implementing System-GMM estimators, where results for aid are robust to the use of internal instruments, at the opposite of remittances. Our results are also robust to estimations on reduced samples, as well as to specification tests. We also examine the way political institutions affect the inequality-aid-volatility relationship, which do not seem to be corroborated by the data. We suggest two main reasons for the mitigating effect of aid: increasing of public expenditures in favour of the poor and counter-cyclical aid flows.

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**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 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 A0: Sample of countries

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   Laurent Wagner: Ferdi [↑](#footnote-ref-1)
2. e.g. nutritional status (Dercon and Krishnan, 2000, for Ethiopia), or removing children from school (Thomas et al., 2004, for Indonesia) [↑](#footnote-ref-2)
3. See for instance [Stark](http://www.sciencedirect.com/science/article/pii/0304387888900028) ,Harvard University, Cambridge, MA 02138, USA

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   * [Yitzhaki](http://www.sciencedirect.com/science/article/pii/0304387888900028) (1988);  [Taylor](http://www.sciencedirect.com/science/article/pii/016189389290008Z) (1992); [Barham](http://www.sciencedirect.com/science/article/pii/S0304387898900384) and[Boucher](http://www.sciencedirect.com/science/article/pii/S0304387898900384) (1998); Adams and Page (2005); Le Goff (2010).

   [↑](#footnote-ref-3)
4. 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. [↑](#footnote-ref-4)
5. Measures based on consumption data reflect more accurately income distribution, but would restrict our sample too much. [↑](#footnote-ref-5)
6. 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. [↑](#footnote-ref-6)
7. The same pattern appears when education is purged from the effect of income per capita. [↑](#footnote-ref-7)
8. 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. [↑](#footnote-ref-8)
9. 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. [↑](#footnote-ref-9)