The macro-micro paradox of aid and volatility

Investigating the macro- and microeconomic effects of aid

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Abstract:

This thesis investigates the efficiency of aid to see whether aid has an effect on the economic performance of a recipient country. Scholars have over the years found that aid flows do not have an effect on a recipient's macroeconomic performance. This research replicates those results.However, this research finds that on the microeconomic level aid flows do have an effect on the death rate and mobile phone and internet subscriptions. There is thus a macro-micro paradox of aid. Furthermore, aid volatility is found to have a negative effect on both macroeconomic and microeconomic performance of a recipient. The effect on the macroeconomic level is dependent on whether a country is aid dependent or not. Geographical location is also determining factor. On the microeconomic level aid volatility has a negative effect, even when volatility is a positive deviation from the aid trend.

Contents

1. Introduction

This research places the aid efficiency debate into a new timeframe: the twenty-first century. This is partly done because of the availability of superior data with regards to not only aid flows but also data on other economic indicators. Furthermore, research has predominately used data of the previous century whereas this research uses only the years 2002-2013 thereby looking at the contemporary effects of aid and volatility.

Donor attitude towards aid has been changing very much over the past 40 years and problems that aid had in the past with regards to efficiency might very well not be relevant in current time. Furthermore, certain trends of aid would not be adequately visible when the last 12 years of aid would not have been the focus. This research finds that total aid flows have been increasing over the last 12 years. Aid as a percentage of GDP, on the other hand, has seen a decreasing trend since the year 2006. This is also the case for aid volatility. These trends were also found by Hudson (2014) and could lead to the assumption that there is a diminishing effect of both aid and its volatility on a recipient's economy. In investigating this relation, it is found that in itself aid and volatility do not significantly affect macroeconomic performance, as measured by the GDP per capita growth rate. Also, following previous research but changing the time period leads to the effects of aid flows and volatility on the GDP per capita growth rate not being statistically significantly anymore. Adding interaction terms of aid volatility and country characteristics changes the outcomes found previously and leads to significant results. With the addition of an interaction term for aid dependency (>10% of GDP as aid flow), volatility of aid disbursements has a negative effect on the GDP per capita growth rate of countries that are not aid dependend. For aid dependend countries this effect is very small and positive which may be a sign of reverse causality. Similar results are found when adding interaction terms for Sub Saharan Africa. For countries in South America, disbursement volatility has a negative effect on GDP per capita growth. The effect of aid predictability, measured by the difference between commitments in *t-1* and disbursements in period t, on macroeconomic performance is also investigated. This measure gives, when significant, a negative coefficient indicating a reverse causality problem. This indicates that the difference between commitments and disbursements in itself is of no importance to recipient countries.

The focus is then shifted towards investigating whether the absence of significant impacts of aid and aid volatility on the entire dataset is due to the macro-micro paradox, indicating that macroeconomic indicators are not affected but microeconomic performance of a recipient is. Following Hudson (2014) this research finds that for all countries in the dataset and for certain microeconomic indicators and aid sectors, aid flows still have significant effects. These effects, depending on the indicator, are both positive and negative. Furthermore, volatility is also important in influencing microeconomic performance of a recipient. It is found that volatility in the form of positive deviations from the trend (positive volatility) can have a negative effect. To conclude, this research thus finds for the macroeconomic level various results with regards to significance, but is able to find negative effects of aid volatility on GDP per capita growth rate. The significance of aid flows at the microeconomic level shows that with regards to just the aid flows there seems to be a micro-macro paradox. With regards to volatility, this seems to be a problem (with negative effects) on both the macro- and microeconomic level.

Section 2 below contains a literature review that briefly discusses literature on the aid effectiveness debate, aid conditionality, aid volatility and aid predictability. Section 3 presents

the methodology and discusses the models used for this research and how volatility and predictability are measured. Section 4 is an elaborate data description that contains information on aid flows and aid volatility and their respective trends. Sections 5 and 6 discuss the results of the models that are shown by section 3 for the macroeconomic and microeconomic analyses respectively. Section 7 contains a summary of the results and ties these together with a conclusion.

2. Literature review

The aid effectiveness debate contains vast amounts of literature spanning over multiple decades. As is the case with most economic literature, findings and opinions change over the years. Below is a summary of the most important and influential literature on the subject.

2.1 Aid-growth efficiency

Earlier research has long focused on only short-term performance of aid. Only relatively recently have scholars taken it upon themselves to test the long-term macroeconomic effects of aid flows for the recipient country. When taken in its simplest form, aid is no more than a government lump-sum transfer. The aid efficiency debate can therefore be traced back to the days of Keynes (1929) who investigated the so-called transfer problem. The transfer problem covered the transfer of capital between two stable economies in a two-country world in the form of unrestricted gifts from one government to another. In the end, these capital transfers impoverished to donor and enriched the recipient of the capital. Terms of trade, however, were affected, giving a possible reason for these capital transfers. Modern-day research done on the transfer problems steps away from the two-country model and adds more countries. This addition of more countries can actually reverse the welfare effects, where welfare increases due to transferring capital to another economy. Welfare in the recipient country is actually decreased, causing the so-called transfer paradox. The transfer-paradox as described by Gale (1974) explains that if a (industrialized) donor country has a very specific demand and strong preference for a certain good, a transfer is able to reduce the worldwide demand and cause excess supply for that good thereby reducing its prices. This then means that for the industrialized donor country the real income rises (which can be seen as a gain in welfare). The reduced prices, on the other hand, cause the income of the recipient country to decrease. The size of the transfer could offset this, but in the long run prices will be lower than before, thereby decreasing welfare. As Gale (1974) argues, when agents scheme together versus the rest of the world, this can cause a welfare decrease for the rest of the world, while both agents (donor and recipient) gain from the transfer due to decreased prices of imports as well as an increase in wealth for the recipient. To summarize, according to literature up to the year 1973 lump-sum transfers can have both negative and positive effects for every agent involved, whether it be the recipient, the donor or even the rest of the world involved in any sort of trade with either agents. This shows that the transfer of capital from one country to another and the effect thereof is, in theory, not without its discussions and contradictions.

When aid is no longer a ‘pure’ transfer in that it is not just a lump-sum transfer but directed aid towards public investment (‘productive’ transfer), it is found that aid will stimulate the steady-state growth of the recipient country, whereas a ‘pure’ transfer will not affect the steady-state growth. However, welfare is increased due to an increase in consumption caused by the transfer (Chatterjee et al., 2003). In the long-run, an increased steady-state growth has a potentially larger positive effect, even though the instantaneous effect on welfare is smaller. However, this steady-state growth is not always given as it depends on

how well the recipient country is endowed with public capital. The positive effects are seen in relatively under-endowed economies, whereas well-endowed economies can even show decreases in growth (Chatterjee et al., 2003). Because developing countries are generally under-endowed when it comes to public capital, it would seem that when aid is 'productive' in that it is aimed towards increasing public capital and public investment, aid should have a positive effect on welfare as well as (steady-state) economic growth.

Empirically, literature on the matter has been far from unanimous, finding both significantly positive and negative effects of aid. Clemens et al. (2004), Mosley (1980) and Hansen & Tarp (2000) identify different phases of literature, covering different time periods and methods on measuring aid effectiveness. Research done by Griffin (1970) investigates the relation between the inflow of foreign capital (more than just aid) and investment levels. He argues there is a possibility that the small positive effect that the inflow of foreign capital has on domestic investment will be countered by the diminishing effect it has on capital-output ratio, causing the growth rate to drop. This is later confirmed by Weisskopf (1972) who finds a negative relation between foreign capital inflows and domestic savings.

The subsequent literature actually looks at aid, instead of general inflows of foreign capital. Because of the distinction between aid and general foreign capital, Panapek (1973) now finds a positive and significant effect of aid on growth. Methods of research however, do not look at causality and do not use instruments. For example, Panapek (1973) is not able to find significant effects of aid on growth when he restricts his data to just North- and South-America. Furthermore, research is mainly done on small 5-year periods, neglecting any long-term effects aid could have on growth.

Mosley (1980) then questions the causality of the previously found relationships between aid and growth. What follows is roughly 15 years of literature that empirically researches the relations of aid and growth by using different countries, periods and instruments. This leads to very contradictory literature. Scholars find significant positive effects (Levy, 1988) as well as no significant effects (Mosley et al. 1987, Singh, 1985). This 'era' of literature finishes with Boone (1996) who uses a large dataset which also controls for country fixed effects. With these country fixed effects he finds zero correlation, whereas without the country fixed effects there is a positive coefficient, albeit only at the 10% significance level. As stated before, research up until this point used small periods of time, only looking at short-term effects of aid. As Clemens et al. (2004) argue, Boone's (1996) research rejects the hypothesis of zero or negative effect at the 5% level when the time-period is extended to 10 years. According to Clemens et al. (2004) it is Boone's research that spurred the last phase of the aid-growth literature. Following Boone, some scholars conclude that there is a macro-micro paradox of aid: aid has positive economic effects on the microeconomic-level which somehow is not observable on the macroeconomic-level. In this next phase, literature is divided in research that addresses this paradox, and research that does not.

As was the case with the previous phase, the most recent literature does not produce unanimous results either. This is also due to the above-mentioned divide in the literature itself. The 'conditional' literature says that on average aid in itself has zero effect on growth. Countries that do seem to get a positive effect of aid on growth have certain characteristics which makes the aid effective. The conditional literature is aimed towards identifying these characteristics. This does not lead to one answer either, and over the years various characteristics have been found that are argued (both theoretically as empirically) to be

necessary for economic growth through aid. Because this part of literature looks at why the typical country that receives aid is not able to turn that aid into something positive, this strand of literature has been very influential in policy-making.

The 'unconditional' literature, on the other hand, still argues that aid in itself has, on average, a positive effect on economic growth. This strand of literature is therefore more aimed towards the investigation of the relation between aid and growth, and whether it is linear or non-linear. This strand of literature also contains research that finds a positive effect of aid, regardless of a non-linear effect.

2.2 Aid conditionality

As mentioned above, literature and aid-donor countries have recently shifted their focus on conditions that a recipient country has to fulfill in order to obtain certain ODA-funds. These conditions originante from the idea that a simple lump-sum transfer has no economic effect if the right conditions are not present in the recipient country. Traditionally donor-countries made commitments of aid-transfers and then, when due, transferred these committed funds to the recipient country in the form of an aid disbursement. Conditions of aid formed when the goals of aid became more specified. Over the years, aid-donors have made multiple agreements on the focus of aid, for example the millennium goals, whose aim was to decrease the amount of people living beneath the poverty line of $1 per day and in hunger to half of the amount in 1990 (Temple, 2010). This is, as is also argued with the macro-micro paradox, not done by simply transferring large funds to problem areas and assuming that poverty and hunger will thereby decrease. Donors therefore have to focus on improving microeconomic mechanisms to be able to affect the economy on the macroeconomic level.

Conditionality of transfers began in the 1980's when the IMF and World Bank started disbursing aid when certain conditions were met by the recipient country with regards to wider policy reforms and macro-economic performance of the recipient (Temple, 2010).This basic conditionality of aid has been widely investigated and discussed and has been generally seen as ineffective and counter-productive in literature (Temple, 2010, Easterly, 2005). The ineffectiveness of aid conditionality can come from multiple mechanisms that exist within a donor-recipient relationship. As is the case with these types of transfers, there exists a principal-agent problem. A donor may have different goals than the recipient country with regards to certain policies other than the main focus of the aid. For example aid can be used to decrease poverty which is the main goal of the aid disbursement. As a secondary goal, the donor can demand of the recipient country to implement other policy reforms that do not necessarily have anything to do with the reduction of poverty. In a way a donor country tries to buy another reform within the recipient country which probably would not have happened without the promise of an aid disbursement. This can then also mean that whenever aid is disbursed the secondary policy reform can be reversed as it is not in the interest of the agent to keep it. Strong conditionality can keep this from happening because reversing reform will mean a reduction in aid disbursements in the following periods. In theory this is an effective way of reforming the policies of an aid-dependent country towards a more sophisticated way of governing. Literature, however, has found that this classic type of conditionality of aid has led to very little improvements of macroeconomic policies in developing countries. Furthermore, countries that are aid-dependent are not among the most stable countries in the world with regards to governments. They vary from dictatorships to countries with high corruption levels and so reforms are very hard to implement in these countries. This then means that a lack of condition enforcement by a donor leads to the

recipient receiving disbursements regardless of policy reform. Furthermore, donor countries may not be influential enough to sway a government towards reforming policies that are not of interest to them. Volatility in aid flows has, due to these conditions, the potential to make aid-commitments lack credibility within the private sectors (Collier et al., 1997).

Because of the absence of positive results due to policy conditionality, donor countries have been developing other ways of choosing where and when to disburse aid. Donors can choose to allocate aid disbursement towards countries in which it is most likely to be effective and successful. This way of allocating aid, called selective aid allocation, comes back to the argument that aid can only be successful when certain conditions are met within a recipient country. Rather than trying to enforce these conditions it is more logical to first help countries in which these conditions are already met. However, the problem of allocating aid this way is that the great unknown is what makes aid effective. Literature with regards to aid flows and aid conditionality have yet to find a uniform answer to whether aid in itself is effective, let alone which conditions make aid effective. Regardless of it not being clear what makes aid effective, it can easily be argued that current aid allocation is far from optimal (Collier and Dollar, 2002). There are many donors, and with unclear allocation optima, disbursements of aid are rather uncoordinated. As Collier and Dollar (2002) argue, coordinated and systematic disbursements of aid by donors can potentially double the amount of people that escape poverty per year.

With regards to reform based conditionality, a more progressive form of conditionality is being implemented by certain donors which entails that instead of a recipient having to meet a certain requirement at a certain date, commitments have no end date on which the reforms will be evaluated (Temple, 2010). This means that whenever a reform is made and thus a condition is met, aid will be disbursed. This directly means that aid can be disbursed before it would have traditionally been, but a recipient country can also delay the disbursement by delaying the reform until a moment that it sees fit. This directly means that predictability of aid for a recipient country can increase due to its control on when the disbursement will happen. On the other hand, aid volatility will increase as disbursement will no longer follow a certain trend.

2.3 Aid volatility

Aid volatility fully entered the aid-efficiency debate when Bulíř & Hamann (2003) investigated the policy implications of uncertain of aid flows. They found that aid flows are more volatile than the domestic revenue of a recipient country. Countries that show higher volatility of revenues also display higher levels of aid volatility. This indicates that both aid flows and domestic revenues could be influenced by the instability of domestic policy. Furthermore, aid is found to be procyclical. This follows from donor-countries being unable to check whether disbursements have been successful, leaving them to tie conditional aid to economic performance. This then means that any shock in economic performance can lead to highly inconsistent and unpredictable aid-flows. Aid dependent countries in themselves are more prone to these shocks in economic performance because of liquidity constraints and bad policy making. In all its effort to help improve economic policy in developing countries, aid and its volatility cause the macroeconomic performance of a developing country to be more unstable. Aid volatility itself can be traced back to both donors and recipients of aid. Donors often make commitments that are higher than the actual disbursements that follow, this is also due to the nature of commitments. Commitments are not obligated to follow the same or next year and are thus not subject to a time-frame. This then means that coupled with aid

conditionality, a commitment could in theory take more than a decade to be fully disbursed. Recipient countries react to these commitments and adjust policy accordingly. Failure of a donor country to donate that amount of aid in a short enough amount of time can thus leave a gap in the recipient's budget. Furthermore, because of the before mentioned aim to improve on a recipient's economic policies, aid has become highly conditional. Even though a commitment is made by a donor, failure to meet the right requirements leads to a lower disbursement for the recipient country. This then also means that when a recipient country is not able to adjust its policies in the right way, the volatility of its aid inflows increases.However, aid dependent countries are often dependent on aid because of their instability and inability to formulate proper economic policy. In their follow up research (Bulíř & Hamann, 2008)did not find any changes compared to five years prior, even though literature seems to have shifted a little more of its attention towards aid volatility. Even though it is now known that aid is volatile, large economic shocks caused by the unstabling effect of aid volatility are not being countered by aid disbursements (Bulíř & Hamann, 2008). This then means that aid policy of donors is still not aimed towards undoing any negative effects of aid volatility. Not through stabilizing aid flows themselves, and not through countering any negative effects that are caused by unstable aid flows.

Following Bulíř and Hamann (2003) literature has set out to investigate the causes of aid volatility and also the effects of aid volatility. As mentioned above, these findings did not lead to any significant policy changes for either donor or recipient. (Arellano, Bulíř, Lane, & Lipschitz, 2009)look at the effect of aid flows on macroeconomic indicators, as well as the effect of aid volatility. Increasing aid flows and permanently higher levels of aid do not lead to increased levels of savings and investments, but do permanently increase levels of consumption. Aid flows are thus largely transformed into consumption and do not affect levels of savings or investment on their own. Aid however does increase the rate of return on capital (Dutch Disease effect) thereby stimulating investment. Increased levels of aid also show increased levels of influence on economic performance. This means that the higher aid inflows are, the more dependent the economic performance of the recipient becomes on the levels of aid, thereby confirming the procyclical nature of aid. Arellano et al. (2009) find a correlation coefficient of aid and GDP of 0.6, when aid is 20% of GDP as compared to the coefficient of 0.2 in the benchmark model, where aid is 6.4% of GDP. Because of the large effect aid has on the consumption, it leads to the conclusion that aid volatility will mainly affect the consumers, when looking at the welfare effects of aid volatility. Aid volatility is thus able to create consumption volatility, which is detrimental to welfare. Arellano et al. (2009) find that when aid flows are stable, aid flows would increase welfare by around 8% of total aid flows. When aid is given in such a way that, through the right policies, it is able to fully counter any volatility of consumption welfare levels will increase by around 64% of total aid flows.

Hudson and Mosley (2008) are the first ones to divide aid volatility in positive and negative aid volatility. They argue that both have different effects on the shares of GDP to domestic expenditure. Governments of aid-dependent countries seem to be unable to counter the negative effects that negative aid volatility has on the revenue flows and expenditure priorities. Aid volatility thus has a negative effect on investment and even import when it is negative. Positive aid volatility seems to increase consumption expenditure while also decreasing the investments and expenditure of governments. This means that governments lack the absorptive capacity of increased amounts of aid when these increased amounts are

not expected. The increase in consumer expenditure shows that consumers are likely to be better at absorbing both negative and positive shocks through their levels of consumption and saving (Hudson, 2014). Hudson and Mosley do find that some of the negative impact positive aid volatility has is later reversed, indicating that the absorptive capacity problems mentioned before could be short-term only.

Using the Creditor Reporting System (CRS) database, Neanidis & Vervarigos (2009) and Hudson (2014) look at the impact of aid (volatility) on economic performance divided over different aid-sectors of purpose (sectors are as defined by the OECD). The first article divides the sectors over the type of aid, namely pure aid and productive aid. Pure aid is given in the form of food aid and monetary aid, where it is purely used to be a short term solution to bad periods (such as bad harvest or flooding). Productive aid on the other hand is divided over 2 different categories; aid aimed towards improving public services and the physical infrastructure and aid aimed towards social infrastructure of the economy. Productive aid is therefore seen as aid that should be effective on the long-run rather than as the short-term solutions of current pure aid flows. Neanidis and Vervarigos (2009) conclude that productive aid has a positive impact on economic growth. Volatility of this type of aid, however, has a negative impact. On the other hand, pure aid transfers do not show positive economic effects on their own. When pure aid flows are volatile they do seem to have a positive effect on growth. This contradicts previous findings regarding aid volatility as described above and therefore indicates there is good reason to distinguish between the different types of aid (with regards to purpose) to fully capture the effects of aid volatility. Hudson (2014) adds to this by differentiation aid itself over positive volatility and negative volatility. He finds that increases in aid volatility, be it negative or positive, are often compensated for in the following period(s) by fluctuations of volatility in the opposing direction. Furthermore, this compensation in sector aid volatility seems to cross over to other sectors, mainly governmental aid. The impact between sectors is mainly negative.

Besides the effects of aid volatility, the causes of aid volatility also differ between total aid and sector aid. Fielding et al. (2008) find that the volatility of aid is caused by both recipient and donor countries. Macroeconomic stability of a recipient country is important for total aid volatility; low inflation decreases total volatility. Conditionality of aid, a much given example being certain IMF conditions, on the other hand increases total aid volatility. Both these characteristics, however, have no significant effect on sector aid volatility. Political institutions significantly influence both total and sector aid volatility. With regards to aid donors only recipients that receive a high share of aid coming from Arab donors experience higher volatility.

2.4 Aid predictability

The difference between the aid commitments and aid disbursements of donors can be called aid predictability (Bullir and Hamann, 2008 & 2003). Aid predictability is, as is argued above, important for the aid recipient as aid commitments are given some time before the actual disbursements. With the volatility of the aid itself and the tendency of disbursements to be lower than commitments, predictability of the amount of disbursements based on commitments can potentially give a recipient country the chance to fill in the expected deficit using its own funding. However, aid receiving countries often have crippling liquidity constraints and will therefore probably not be able to do this on short notice. Failure to predict aid can thus lead to ineffective allocations of government funds of which there are already relatively little, which is not desirable. On the other hand, being able to effectively

predict aid, not only can a recipient country anticipate budget constraints, it can also anticipate conditional funds coming in and allocate the incoming disbursements in the most efficient manner.

Aid predictability is different from aid volatility in that aid volatility, although it is a deviation from a trend, can be very predictable. Aid commitments can come from large projects taken on by a donor and can cause a certain influx of aid flows into a recipient country that significantly deviate from the normal trend in disbursements. This is seen as a positive volatility. However, since this commitment was already made, in theory it is also predictable. Aid inflows due to natural disasters or famine are also deviations from that trend, but are on the other hand not very predictable. The lack of aid predictability can come from either donors not sticking to their commitments or recipients not sticking to their conditional requirements.

Celasun and Walliser (2007) investigate the effects of aid predictability and look at whether the inability of donors to stick to their commitments has any significant effect on a recipient's economy. They find that the stigma that donors do not live up to their commitments is actually not true in that they find that actual disbursements are both lower and higher than the commitments that were made. This also leads to another conclusion that, when aid predictability is caused by both positive and negative deviations from the commitments made, most countries will suffer from unpredictable aid. Especially budget aid is shown to have a negative effect when it is unpredictable. If budget aid falls short with more than 1% of GDP, recipient government have to fill in this gap by accumulating more debt and reducing capital spending (Celasun and Walliser, 2007). Most destructive of this mechanism is that these losses in capital spending are not reversed when the shortfall in budget aid is over, leading the effects of this shortfall to be a permanent one.

2.5 Relevance of this research

Aid volatility research has focused on the aid volatility of the actual aid disbursements, which makes sense because that is how the actual aid flows are measured. This, however, ignores the fact that donor countries make commitments towards recipients some time (this can vary) before sending out the actual aid. It is reasonable to think and often expected that recipient countries will respond to this through various mechanisms such as political policies. This research therefore also looks at the difference between the effect of the aid disbursements and aid commitments. Thus, this research expands on existing literature by looking at both commitments and disbursements, shifting the period of interest towards more recent years and by adding aid predictability to aid volatility analysis. Shifting the period of interest gives an opportunity to see whether trends found by Hudson (2014) in aid volatility have continued and whether these trends have any influence on the effect of aid volatility. Furthermore, the focus is also narrowed from country-level data to 'aid sector'-level data and thereby follows Hudson (2014) in investigating the macro-micro paradox of aid flows and volatility. Lastly, the effectiveness debate is shifted from all aid receiving countries towards looking at the effects of aid with regards to certain recipient characteristics. This is done by looking at country characteristics based on aid dependency (when aid is a certain percentage of GDP) and region.

3. Methodology

3.1 Model specifications

The empirical part of his research is divided over two different sections, with one focusing on the macroeconomic effects of aid and its volatility (section 5) and the other on the microeconomic effects of aid and volatility (section 6). The focus on the macroeconomic effects means that country level data of aid volatility is used instead of aid sector specific data for aid flows and aid volatility. Furthermore, section 5 looks at macroeconomic specific dependent and independent variables and thus looks at a more generalized effect. The section regarding the microeconomic focus uses data on the specific sectors of aid and their corresponding characteristics as control variables. As these differ between the different sectors, the dependent variables can also change according to the sector of interest.

This research is based on multiple existing papers. This means that a goal of this research is to recreate the same models as those papers and if and when possible expand on them.

First, the effects of the independent variables on the dependent variable are tested without the addition of any other variables in the model. Then, the models that are estimated are based on existing literature. After that, in the case of the macroeconomic level, an improvement on that model is used. The models used in this research are as follows:

The most general macroeconomic model:

$$GDPgrowth_{it} = \beta_{0+}\beta_1 X_{it} + \beta_2 Year\ Dummies + \varepsilon_{it}$$

Where the vector X can be described as the various independent variables that are of interest in the aid effectiveness literature. These independent variables are the aid flows themselves, as commitments and disbursements. Also included are the multiple variables for aid volatility based on both commitments and disbursements. Lastly, the variable of aid predictability, as described below.

Then, the model used by Hudson and Mosley (2008) is estimated with the addition of year dummy variables to control for year fixed effects. This model then looks like the following:

$$\begin{aligned} GDPgrowth_{it} = {} & \beta_0 + \beta_1 Volatility_{it} + \beta_2 Positive\ Volatility_{it-1} + \beta_3 Negative\ volatility_{it-1} \\ & + \beta_4 Aid\ flow_{it} + \beta_5 GDP\ per\ capita_{it} + \beta_6 World\ growth_t + \beta_7 Inflation_{it-1} \\ & + \beta_8 Disaster_{it} + \beta_9 SSA_i + \beta_{10} Asia_i + \beta_{11} South\ America_i + \beta_{12} Trend \\ & + \beta_{13} Year\ Dummies + \eta_{it} \end{aligned}$$

The dependent variable, GDP growth, is a measure for economic performance and is the annual growth rate of GDP per capita in percentages. Descriptions of the independent variables of interest that involve aid flows are as described in the next section. The variable GDP per capita is lagged for two periods, as is used by Hudson and Mosley (2008) and expressed as a logarithm. World growth is the annual growth rate, in percentages, of the OECD as a total and represents the most important donors of aid and their performance. Inflation is the lagged value of inflation and thus represents inflation of the previous period. Inflation is also in percentages and is used as an indicator for government and policy performance. The disaster variable is a dummy variable which has a value of 1 when the recipient country is involved in a disaster or famine which affects more than 5% of population. This data is taken from the EM-DAT database for disasters. Lastly dummy

variables are used for different regions. When using fixed effects, however, these dummy variables are excluded.

Finally, the goal of this research is to go beyond the models described above to see whether other mechanisms are also at play with regards to aid effectiveness. As mentioned before, this is done by adding aid predictability and country characteristics to the model. The macroeconomic model then becomes as follows:

$$\begin{aligned} GDPgrowth_{it} = {} & \beta_0 + \beta_1 Volatility_{it} + \beta_2 Positive\ Volatility_{it-1} + \beta_3 Negative\ volatility_{it-1} \\ & + \beta_4 Aid\ flow_{it} + \beta_5 Volatility_{it} * InteractionDummy + \beta_6 GDP\ per\ capita_{it} \\ & + \beta_7 World\ growth_t + \beta_8 Inflation_{it-1} + \beta_9 Disaster_{it} + \beta_{10} SSA_i + \beta_{11} Asia_i \\ & + \beta_{12} South\ America_i + \beta_{13} Trend + \beta_{14} Year\ Dummies + \mu_{it} \end{aligned}$$

Furthermore, another model is estimated with the addition of aid predictability for every country and every time period.

The most general microeconomic model is similar to its macroeconomic counterpart:

$$Y_{it} = \gamma_0 + \gamma_1 Z_{it} + \gamma_2 Year\ Dummies + \zeta_{it}$$

Where the dependent variables are in this case represented by vector Y, which consists of different dependent variables based on the aid sector of interest. Vector Y includes for example death rate, school completion rate and mobile telephone subscriptions. Vector Z, as did vector X in the macroeconomic model, represents all the different aid variables.

Following Hudson (2014), the final microeconomic models are as follows:

$$\begin{aligned} Y_{it} = {} & \gamma_0 + \gamma_1 Aidflow_{sit} + \gamma_2 Positive\ volatility_{sit} + \gamma_3 Negative\ volatility_{sit} \\ & + \gamma_4 Total\ aidflows_{it} + \gamma_5 Baseyear\ value\ dependent\ variable_{si} \\ & + \gamma_6 Year\ Dummies + \theta_{sit} \end{aligned}$$

Where total aid flows are the total aid commitments or disbursements. Baseyear value of dependent variable is the value of the dependent variables used in the year 2002, which is the starting year for this research.

A summary of the different variables mentioned above and their source are as indicated by the following table 1:

Table 1: All variables used and their sources

Variable	**Description**	**Source**
GDP per capita growth rate (%)	GDP per capita growth rate as a percentage	WorldBank World Development Indicators
Aid disbursements	Aid disbursements (used as percentage of recipient GDP)	OECD CRS database
Aid commitments	Aid commitments (used as percentage of recipient GDP)	OECD CRS database
GDP per capita	Logged value of GDP per capita	WorldBank World Development Indicators
World Growth	Total GDP of OECD	OECD CRS database

	donor countries	
Inflation	Inflation as a percentage	WorldBank World Development Indicators
Disaster	Dummy variable indicating disaster in period for that country	EM-DAT disaster database
Death rate	Death rate used as log	WorldBank World Development Indicators
Secondary school completion	School completion rate used as log	WorldBank World Development Indicators
Mobile phone subscriptions	Mobile phone subscriptions used as log	WorldBank World Development Indicators
Internet subscriptions	Internet subscriptions used as log	WorldBank World Development Indicators
Manufacturing value added	Value added due to manufacturing as a percentage of GDP	WorldBank World Development Indicators
CO2 emissions	CO2 emissions as log	WorldBank World Development Indicators

3.2 Measuring volatility

Measurement of aid volatility has not been uniform over the years and there can therefore be different choices which all have been proven to give significant results. Most recently Hudson (2014) has used a self-computed volatility instead of using a Hodrick-Prescott filter (as argued by Bulíř and Hamann, 2003 and 2008, different measures should give similar results) and thus this is a logical method to follow for this research. This method of computing aid volatility entails the regression of aid of a sector on a time trend and its square and then taking the (squared) deviations from this trend. This leaves, according to Hudson (2014) room for the aid flows to be both positive and negative, whereas the squared values indicate the absolute volatility. Volatility is measured for both aid commitments and aid disbursements over all the relevant sectors. This is done separately for every country, as every country will have different trends in aid flows. To be able to compare countries and results, aid flows are taken as a share of recipient GDP. Official development assistance is used for aid flows, this research thus excludes privately funded aid projects.

3.3 Measuring aid predictability

With regards to aid predictability an assumption has to be made in order to calculate its value. Aid commitments are not necessarily disbursed in to following period, and can be made with a longer term. To be able to capture predictability, however, the assumption is made that an aid commitment is normally set to be disbursed the following year. This then means that when a commitment is fully disbursed, aid disbursements in period t should equal aid commitments in period t-1. What follows is that a measure of aid predictability is simply disbursements in period t, minus the lagged value for commitments.

3.4 Estimation methods

This research uses a panel dataset and thus is able to utilize panel model estimation methods. For completeness, non-panel estimations, random effects estimations and fixed effects estimations can be found in the appendix for most models. A Hausmann test is used to see whether fixed effects estimation is a better fit than the random effects estimation. Depending on these results, the conclusions applicable to that particular model are based on the best fitting model. This thus means that using fixed or random effects is based on econometric testing rather than on economic theory. Furthermore, year dummies are added into the models when they are jointly significant and therefore an improvement on the models. This is thus also done on the basis of the results of statistical tests.

4. Data description

4.1 Dataset

The dataset used for this research revolves around the Creditor Reporting System (CRS) of the OECD. The CRS is a system for which donors themselves deliver the data for the database using elaborate questionnaires. These questionnaires regard both disbursement and commitments of aid divided over the different 'aid sectors'. These so called aid sectors are as distinguished by the OECD, which uses the term sector to identify the specific use for an aid flow. Total aid is thus divided over 10 different sectors which each have their own respective subsectors. This research focuses only on the 10 largest sectors which will be described below. Additional data regarding the countries of interest are as provided by the World Bank organization in their World Development Indicators database as well as the World Bank's Worldwide Governance Indicators and the EM-DAT disaster database.

Countries in the dataset are selected on the availability of data with regards to aid flows in the CRS database. This means that, at least for total aid flows, every country in the dataset has a minimum of 2 observations. With regards to additional variables, there is a large absence of data for certain variables. This vastly decreases the number of countries that are used in the regressions, depending on which variables are used. The CRS database contains sufficient data for 147 countries over the twelve year period 2002 to 2013. Combining this with data available on GDP, which is used to measure aid flows (as a percentage of GDP) results in data useable data on aid flows for 143 different countries over 12 years. The years chosen for this research are based on availability of data on disbursements. The CRS database only has reliable data on disbursements starting 2002. Like Hudson (2014) this is not a large amount of years, but compared to Hudson (2014) this is already an addition of 4 years also adding to relevance of this research.

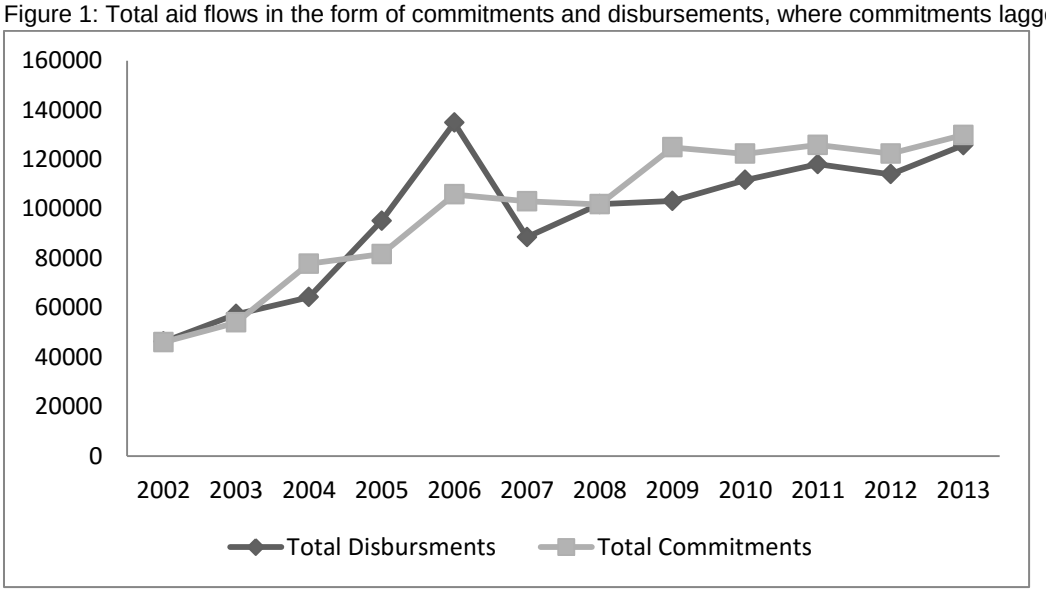
4.2 Total aid flows

For this research, aid flows include both aid commitments and aid disbursements. Aid commitments are commitments made by a donor that are backed up by necessary funding and are often coupled with certain conditions that have to be met by the recipient in order to receive the aid commitment in the form of an aid disbursement. And so an aid disbursement is the actual aid flow that goes from donor to recipient in that year. This means that aid disbursements can be seen as the actual aid flows.

Looking at total aid flows it is clear that disbursements do not simply follow commitments made in the previous period. Aid flows have, since 2002, shown a clear upward trend with both types of aid flows. For disbursements there is a large peak in 2006 which is caused by a

large increase in aid targeted at debt relief and focused on certain African countries. This peak is not present for aid commitments, indicating that the large increase in disbursements was not previously anticipated. Total aid flows over the period 2002-2013 are as depicted in figure 1 below, where the graph for commitments is lagged so that in 2002, the value for commitments made in 2001 is shown. Total aid commitments are lower than the following disbursements for only three of the twelve periods, being higher in the rest. This indicates that when it comes to total aid flows commitments are not a good indicator for what is going to be disbursed, meaning that aid is highly unpredictable.

Figure 1: Total aid flows in the form of commitments and disbursements, where commitments lagged.



Within this dataset, both commitments and disbursements are expressed as a percentage of the recipients GDP at the time of the actual commitment/disbursement. Table 2 shows a short summary of the country-level aid flows and shows that even though the minimum and mean value for commitments are higher, the maximum value of aid disbursements is the highest with almost 185% of total GDP. This already shows that, with regards to aid predictability, aid disbursements can be higher than the promised aid that was supposed to be disbursed. This confirms the finding by Celasun and Walliser (2007) that is not only the case that donor countries do not live up to the commitments but actually also disburse more than promised. Lagged commitments and disbursements as shares of GDP have a correlation coefficient of 0.78, indicating that they are indeed closely related but still have a rather large difference between them.

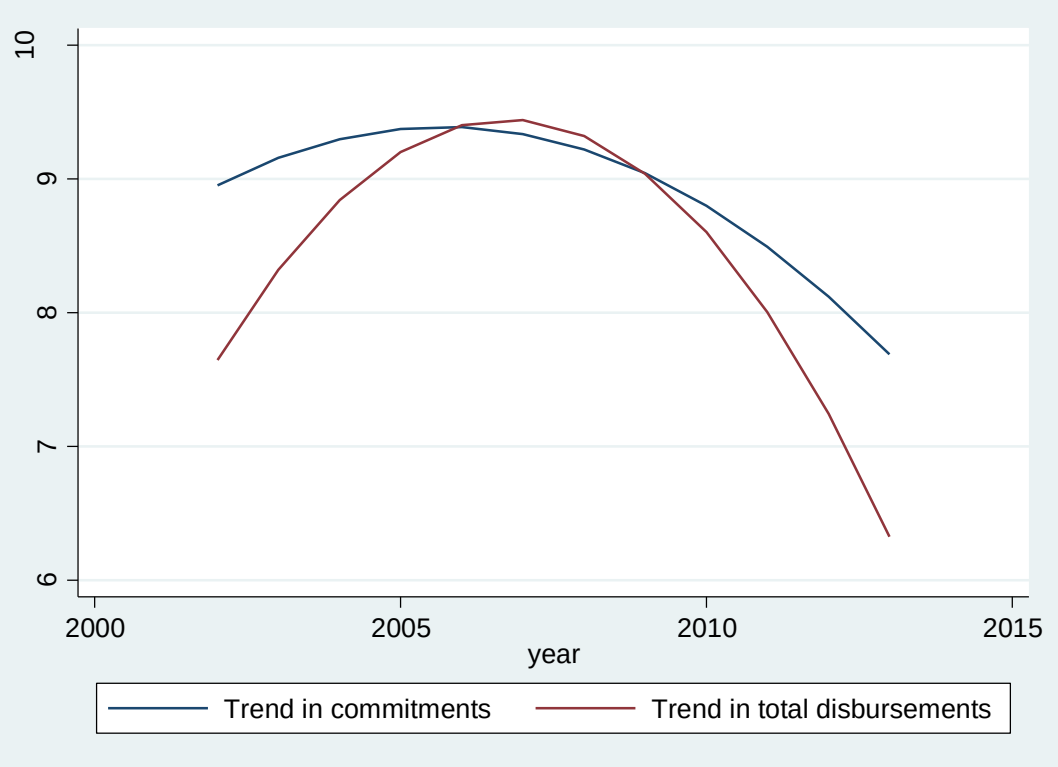
Table 2: Summary of aid flows

Variable	Number of observations	Mean	Min	Max
Disbursements (as a % of GDP)	1652	8.462	.001	184.911
Commitments (as a % of GDP)	1652	8.913	.001	173.557

Table 1 in the appendix shows the results from seperately regressing commitments and disbursements on a trend and a squared trend to make a non-linear trend of aid-flows. The regression results, graphically shown in figure 2 below, show that, when using fixed effects

panel regression to allow for systematic country differences, there is an increasing trend with regard to both commitments and disbursements up until around the year 2005 for commitments and 2006 for disbursements. After that, aid flows (as a percentage of GDP) sharply decrease and follow a negative trend. This decreasing trend is as indicated by the negative coefficient for the squared time trend. Please note that the coefficients of aid commitments are not statistically significant at the 5% level, this then means that with regards to commitments it is not certain that there is a trend within countries.

Figure 2: Trends in total aid commitments and disbursements.



Note: Trends calculated through predicted values of trend model of table 1 in the appendix

4.3 Sector aid flows

Aid sector is a term coined by the OECD and indicates the sector of an economy that the aid flow is supposed to help. For example, social infrastructure aid is aimed towards helping infrastructure within the recipient country, which can be in the form of internet connections or other forms of communication. What follows from this is that the aid flows that are as specifically directed can possible be shown to have an effect on the microeconomic performance of a country. Thus analysis can be used to investigate the relationship between sector specific aid flows and more specified economic indicators. Table 2 in the appendix shows an overview of the 10 major sectors that are of interest for this research and explain their contents by stating some subsectors and a short description.

The dataset is compiled by looking at the availability of total aid flows. The sector specific aid flows are not as well documented, or are not always present. This leaves this part of data with quite a few holes, which is shown by the number of observations. Furthermore, sector aid flows as a percentage of GDP are often times very small, this is because there are ten sectors over which aid is divided, and not every sector gets an equal amount of aid flows at any given time. The summary of sector specific aid flows is given by table 3. As shown by the

mean of both disbursements and commitments, most aid goes towards social infrastructure and service aid. Not coincidentally, this is also the sector that has the most available data and therefore a sector that is always of interest to donors. For debt aid and aid aimed towards helping refugees in donor countries there is the least data available. This is due to then this type of aid not often being used and thus there are relatively few observations. Debt aid, however, does have the highest maxima as a percentage of GDP for both disbursements and commitments. When it comes to aid aimed at economic infrastructure the maximum value for commitments is more than doubled by the maximum amount of disbursements. This can mean that aid aimed at this sector is often highly conditional and is not often paid out, which is also shown by a higher mean.

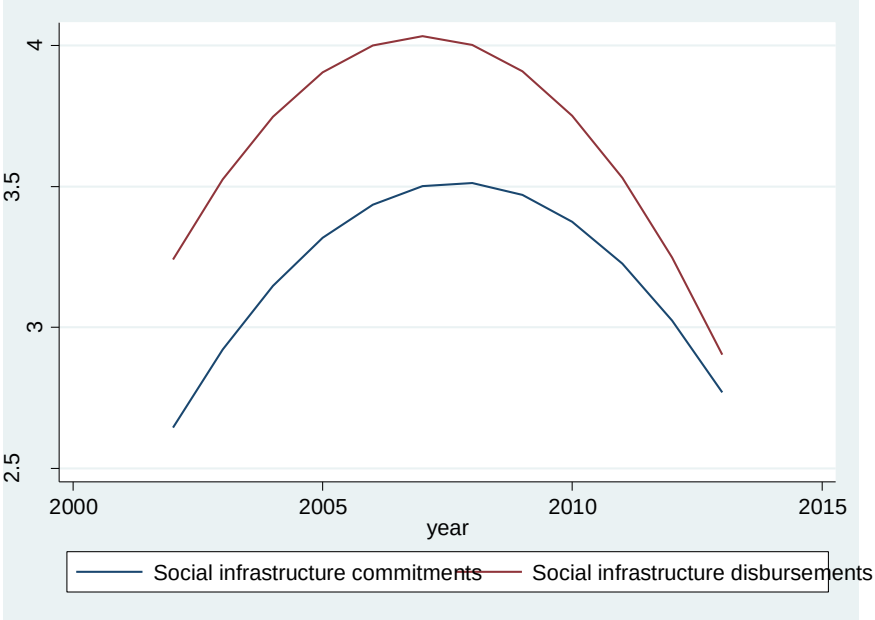
Table 3: Summary of sector aid flows

Flow type	Disbursements				Commitments			
Sector	Number of observations	Mean	Min	Max	Number of observations	Mean	Min	Max
Social infrastructure	1652	3.654	0.001	78.240	1652	3.198	0.00061	64.700
Economic infrastructure	1622	1.419	1.81E-06	71.660	1633	0.946	-0.02372	29.770
Production sectors	1638	0.618	3.67E-06	9.842	1646	0.493	0.00003	23.181
Multi-sector	1643	0.901	0.0000278	58.376	1640	0.717	0.00003	44.276
Commodity aid	1176	1.297	1.85E-09	42.856	1241	1.176	5.65E-08	44.790
Debt aid	830	1.137	2.77E-06	86.774	875	2.549	-0.0081	140.418
Humanitarian	1510	0.657	2.25E-06	33.980	1531	0.579	-0.0114	31.859
Admin costs of donors	1425	0.028	1.81E-07	0.745	1475	0.034	1.81E-07	5.535
Refugees in donor countries	834	0.036	1.51E-07	2.252	853	0.036	8.89E-08	2.256
Unspecified	1559	0.066	5.11E-08	2.883	1614	0.164	-0.1984	5.281

As was the case with total aid flows, the majority of trends found in the sector aid flows are at first positive but decreasing thereafter, indicating that as a percentage of GDP aid flows are steadily decreasing. This decreasing trend can come from either total aid flows (not as a percentage of GDP) also showing a decreasing trend or the GDP of recipient countries rising faster than the aid flows, indicating a higher trend in GDP. Commitments of sector aid show 4 out of 10 significant trends at the 5% confidence level, of which 4 start positive become decreasing trends. For the commitments of unspecified aid, however, it is reverse. There is a negative trend that is becoming positive. Disbursements share the same trend for social infrastructure and services and multi-sector aid with commitments. Disbursements however also has a significant trend in the sector called administration costs of donor, where commitments show no significant trend. There is no significant negative or positive trend in either unspecified sector aid or debt aid for disbursements, even though these are present

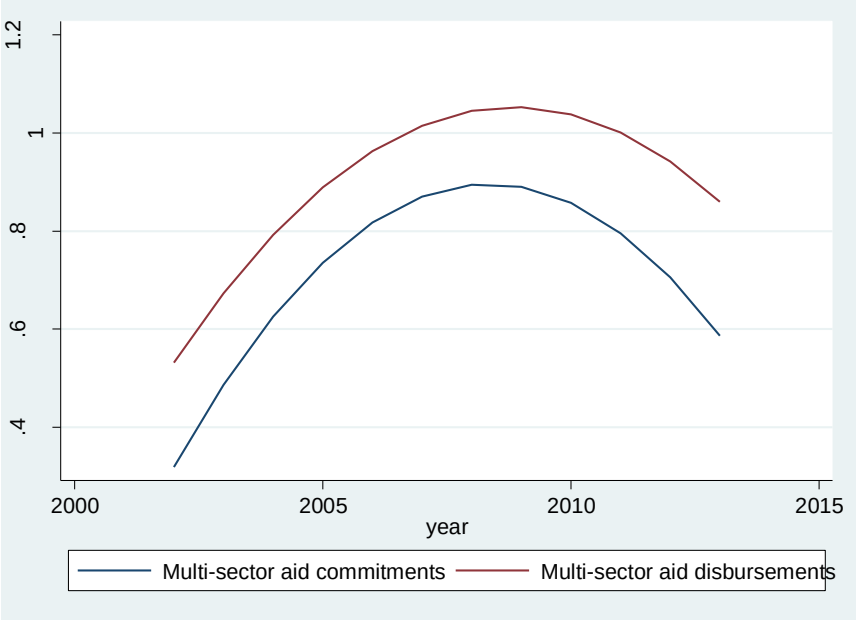
within commitments. The difference in trends reinforces the conclusion that commitments are not a good way to predict disbursements and expands that conclusion to sector specific aid. The regression results corresponding to these trends are as shown by both table 2 and 3 in the appendix, the former containing trends of commitments and the latter containing disbursements. Figures 3 to 6 graphically show the trends in aid flows for those trends that were statistically significant at the 5% confidence level.

Figure 3: trends for both social infrastructure commitments and disbursements



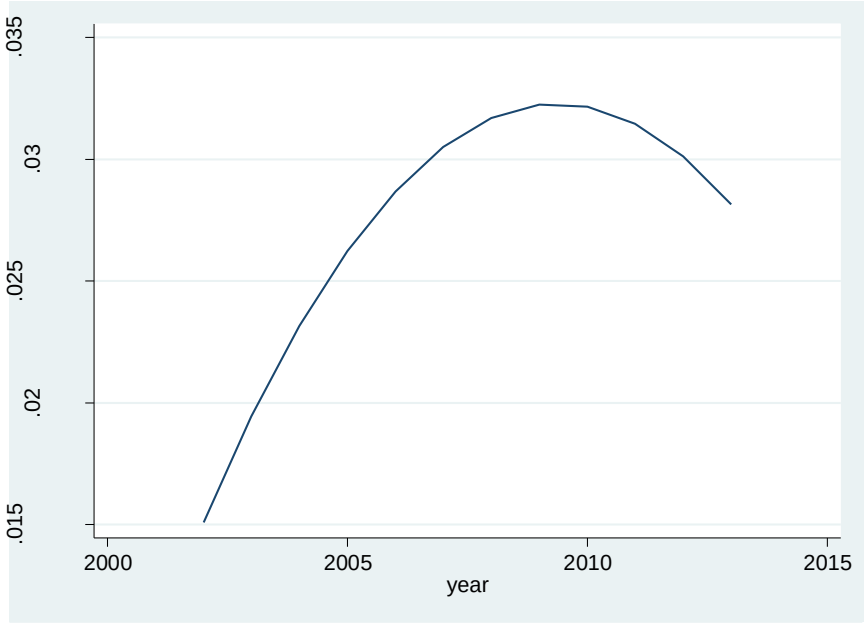
Note: Trend lines are calculated by predicted values of trend models found in table 3 and 4 in the appendix

Figure 4: trend for both commitments and disbursements for multi-sector aid



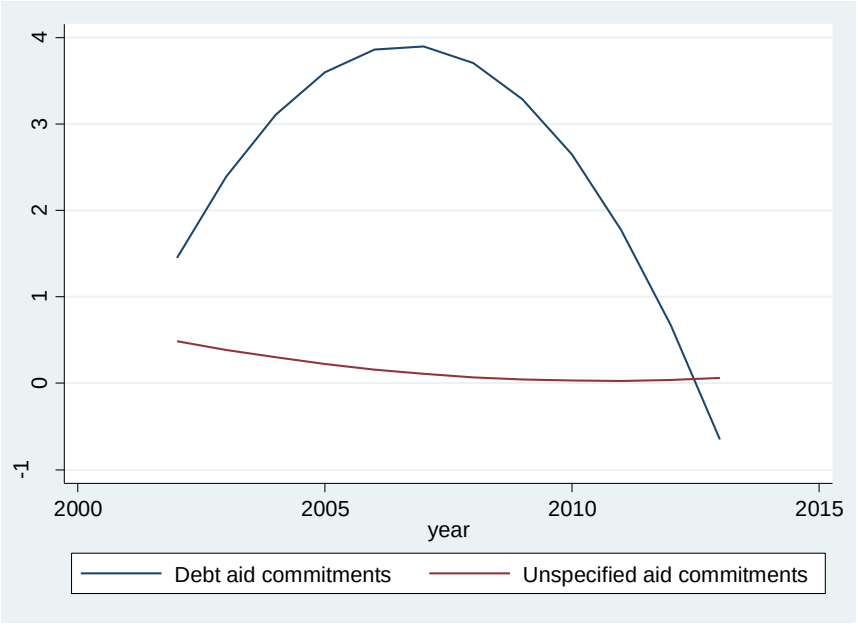
Note: Trend lines are calculated by predicted values of trend models found in table 3 and 4 in the appendix

Figure 5: the trend of disbursements of administration costs of donors



Note: Trend lines are calculated by predicted values of trend models found in table 3 and 4 in the appendix

Figure 6: trends for the commitments of debt aid and of unspecified aid



Note: Trend lines are calculated by predicted values of trend models found in table 3 and 4 in the appendix

As shown by the images above the periods in which the trends change their sign differ from sector to sector. Social infrastructure aid follows total aid flows with a decreasing trend starting at around 2006. Multi-sector aid starts decreasing at around 2009 as does the disbursements of administration cost aid. Debt aid too follows total aid flows with a decrease in aid flows as a percentage of GDP starting around 2006. Unspecified aid commitments are the only sector to start with a negative trend, which seems to become positive at around 2011.

4.4 Aid volatility

Measuring aid volatility follows from the previous sections in which the trends of aid flows are calculated. Deviations from this trend, calculated per country, are considered aid volatility and can either be positive or negative depending on the deviation from the trend. Squaring these residuals gives the absolute positive value of aid volatility. Positive and negative volatility, however, are also of interest; literature has found a significantly different effect between the two. This way of measuring aid volatility, by calculating a trend over the years of interest, assumes that the trend that starts at 2002 for this dataset is known by the recipient country and has not been necessarily different in the period before. Because aid volatility is measured using aid flows as a share of GDP, the residuals that represent volatility are as percentage of GDP deviations from the aid flow trend. Using the squared residuals, as is done by Hudson (2014) and in this research, makes the coefficient a little harder to interpret, but the sign and significance of volatility are the main interest. Using the positive and negative values for volatility makes it possible to interpret the results in the form of percentage of GDP deviations.

The measures for positive and negative volatility are calculated with an upper bound of zero for negative, and a lower bound of zero for positive aid volatility. This means that, for example, when in period t in country j there is no observation for positive volatility (because there is negative volatility), positive volatility gets an observation equal to zero. Imposing these bounds makes it possible to include both variables in a model at the same time to investigate their joint effect. Table 6 summarizes the volatility measures of total aid flows for both commitments (upper three rows) and disbursements (lower three rows). Disbursements show higher volatility than commitments in all three measures and indicate that there is a predictability issue with aid volatility. It is therefore relevant to study both disbursements and commitments, as they are both significantly different and can potentially influence recipient's differently.

Table 4: summary of total aid flow volatility

Variable	Number of observations	Mean	Min	Max
Squared commitment volatility	1642	26.493	4.37E-27	7507.299
Negative commitment volatility	1642	-1.041	-39.933	0
Positive commitment volatility	1642	1.041	0	86.645
Squared disbursement volatility	1651	48.468	7.44E-24	12363.29
Negative disbursement volatility	1651	-1.207	-52.101	0
Positive disbursement volatility	1651	1.207	0	111.190

Table 5 summarizes the three volatility measures for the different aid sectors. As is the case with aid flows, total volatility is divided over the different sectors. The last three sectors (Admin costs of donors, refugees in donor countries and unspecified aid) portray the lowest volatility in aid flows, as can be seen from the minimum and maximum values for respectively the negative and positive measures for volatility. Aid flows that are directed at debt have, as seen in the previous section, the highest maximum and minimum values of all the different

aid sectors. This can also be seen in the measures for volatility; both the lowest negative volatility and the highest positive volatility are seen in debt aid for commitments. The highest positive volatility of disbursements is of economic infrastructure aid, the lowest is again debt aid. The highly positive volatility of economic infrastructure specific aid disbursements is also shown by the large difference in maximum commitments and disbursements of aid flows for that sector. As argued before this shows that this type of aid is very unpredictable. The same is the case for volatility.

Table 5: Summary of sector specific volatility measures

Flow type		Disbursements				Commitments			
Sector	Volatility measure	Obs	Mean	Min	Max	Obs	Mean	Min	Max
Social infrastructure	Squared	1652	4.590	1.21E-24	1834.256	1652	2.650	1.42E-24	1354.685
	Positive	1652	0.441	0	42.828	1652	0.267	0	36.806
	Negative	1652	-0.441	-15.189	0.000	1652	-0.267	-13.479	0.000
Economic infrastructure	Squared	1622	6.333	1.92E-33	2290.632	1633	0.717	5.03E-26	300.613
	Positive	1622	0.420	0	47.861	1633	0.151	0	17.338
	Negative	1622	-0.420	-28.590	0.000	1633	-0.151	-10.259	0.000
Production sectors	Squared	1638	0.369	6.97E-23	40.492	1646	0.220	1.96E-34	92.560
	Positive	1638	0.155	0	6.363	1646	0.084	0	9.621
	Negative	1638	-0.155	-3.010	0.000	1646	-0.084	-8.144	0.000
Multi-sector	Squared	1643	2.713	1.94E-25	1231.013	1640	1.474	1.25E-26	580.377
	Positive	1643	0.209	0	35.086	1640	0.119	0	24.091
	Negative	1643	-0.209	-16.128	0.000	1640	-0.119	-13.106	0.000
Commodity aid	Squared	1176	2.204	6.61E-39	1036.221	1241	1.833	7.35E-36	1148.054
	Positive	1176	0.297	0	32.190	1241	0.225	0	33.883
	Negative	1176	-0.297	-8.235	0.000	1241	-0.225	-8.296	0.000
Debt aid	Squared	830	12.964	2.22E-35	2073.595	875	64.169	1.96E-38	12329.880
	Positive	830	0.518	0	45.537	875	1.505	0	111.040
	Negative	830	-0.518	-39.325	0.000	875	-1.505	-50.174	0.000
Humanitarian aid	Squared	1509	1.741	3.60E-38	485.599	1531	1.191	8.45E-33	415.974
	Positive	1509	0.165	0	22.036	1531	0.133	0	20.395
	Negative	1509	-0.165	-17.346	0.000	1531	-0.133	-10.038	0.000
Admin costs of donors	Squared	1425	0.001	9.22E-36	0.087	1475	0.007	9.22E-36	5.592
	Positive	1425	0.004	0	0.295	1475	0.006	0	2.365
	Negative	1425	-0.004	-0.220	0.000	1475	-0.006	-1.773	0.000
Refugees in donors	Squared	832	0.014	1.49E-38	3.445	850	0.012	1.84E-38	3.455
	Positive	832	0.017	0	1.856	850	0.015	0	1.859
	Negative	832	-0.017	-0.850	0.000	850	-0.015	-0.738	0.000
Unspecified	Squared	1559	0.010	2.70E-34	4.560	1614	0.042	6.49E-25	6.460
	Positive	1559	0.016	0	2.136	1614	0.043	0	2.542
	Negative	1559	-0.016	-0.705	0.000	1614	-0.043	-1.208	0.000

As mentioned before, total volatility is caused by the individual volatility of the different aid sectors. As is done by Hudson (2014) the sum of the means of sector volatilities should come close to the value of total volatility. If this is a perfect match, it would mean that total volatility is caused only by volatility in the separate sectors. A difference between the two indicates there is a covariance of the sectors and thus means that there is also interaction within the sectors affecting total volatility. Table 6 shows the results of summing the mean values of the different volatilities as they are depicted by table 4 and 5.

Table 6. Total aid flow volatility in a fixed effects model on sector specific aid flow volatilities

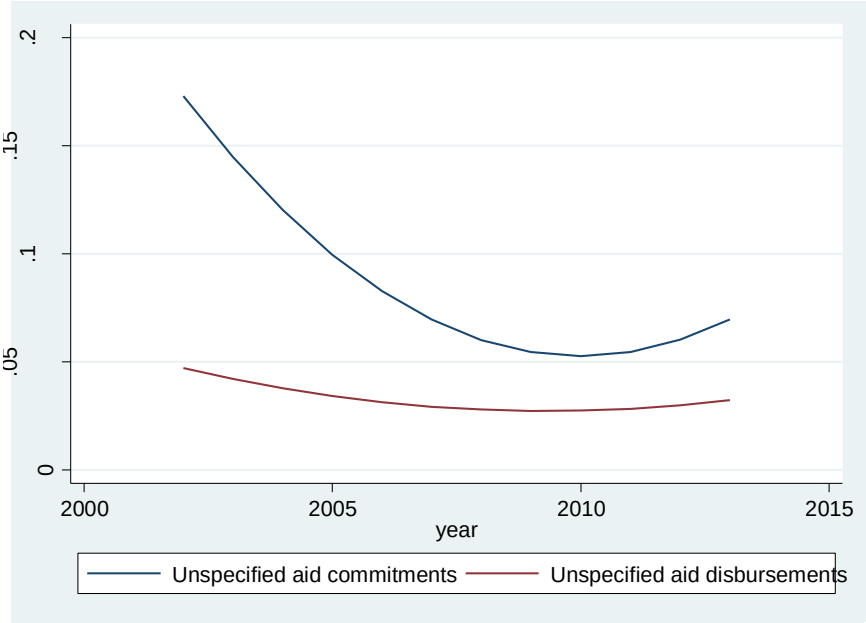
	Disbursements			Commitments		
	Squared	Positive	Negative	Squared	Positive	Negative
Social infrastructure	4.590	0.441	-0.441	2.650	0.267	-0.267
Economic infrastructure	6.333	0.420	-0.420	0.717	0.151	-0.151
Production sectors	0.369	0.155	-0.155	0.220	0.084	-0.084
Multi-sector	2.713	0.209	-0.209	1.474	0.119	-0.119
Commodity aid	2.204	0.297	-0.297	1.833	0.225	-0.225
Debt aid	12.964	0.518	-0.518	64.169	1.505	-1.505
Humanitarian aid	1.741	0.165	-0.165	1.191	0.133	-0.133
Admin costs of donors	0.001	0.004	-0.004	0.007	0.006	-0.006
Refugees in donors	0.014	0.017	-0.017	0.012	0.015	-0.015
Unspecified	0.010	0.016	-0.016	0.042	0.043	-0.043
Sum of sectors	30.938	2.244	-2.244	72.316	2.547	-2.547
Total volatility	48.468	-1.207	1.207	26.493	-1.041	1.041

For both disbursements and commitments it is the case that the sum of mean sector volatilities is lower than the mean of total volatility. This thus, as argued above, indicates that there is a covariance between the separate sectors that influences the value of total volatility.

4.5 Trends in aid volatility

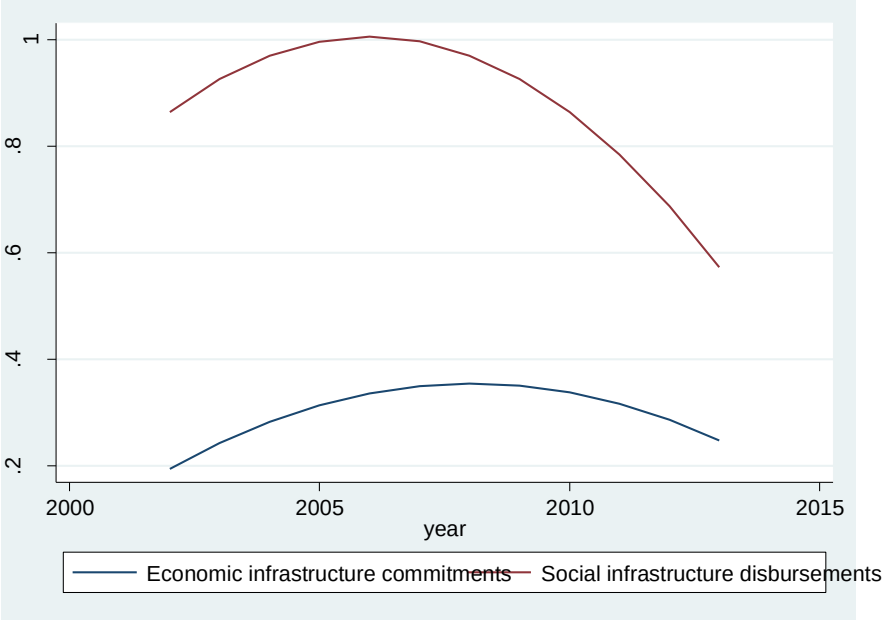
Lastly, trends in volatility are investigated. Since research on the effects of aid volatility is relatively new, Bulíř and Hamann (2008) found no decrease in volatility following their research of 2003. Hudson (2014) also investigated this problem and found that, as is the case with aid flows in this research, aid volatility had a significant non-linear trend that increases up until around 2006 after which it sharply decreases. This research uses the same database as Hudson (2014), albeit upgraded to around half more years of observations, so the trends found by Hudson (2014) should still apply here. As done in the previous sections, measures of aid volatilities are regressed on a time trend and its square using a fixed effects panel model to control for country fixed characteristics. The coefficients coming from these regressions are then used to graphically indicate the trend of volatility. Following Hudson (2014), instead of using the squared measure for volatility the square root of this value is used. This is done because the square measure is more influenced by outliers and therefore prone to influence the trend. Regression results are as indicated in table4 through 6 in the appendix. The trends of volatilities that were significant at the 5% confidence level are presented in figures 7 to 10.

Figure 7: Trends in volatility of both commitments and disbursements for unspecified sector aid



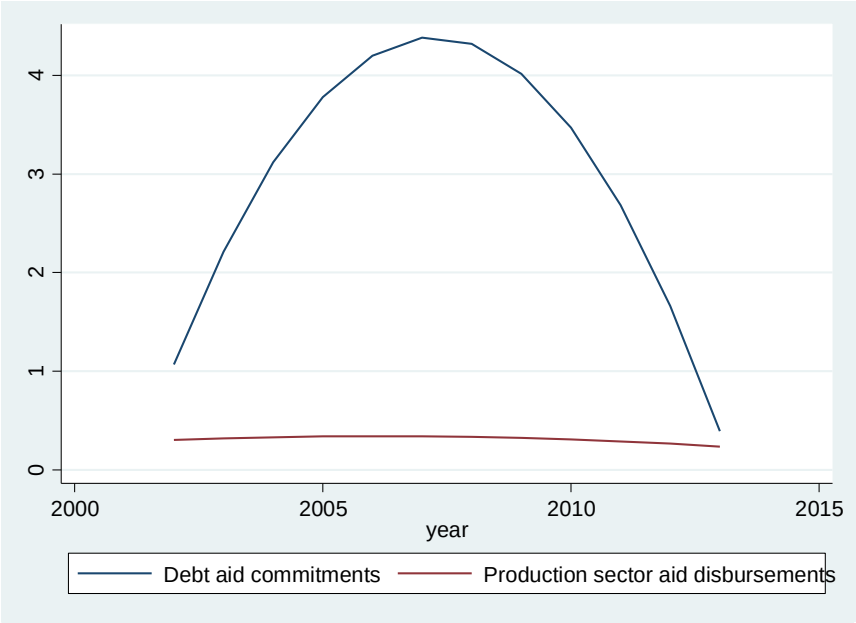
Note: Trend lines are calculated by predicted values of trend models found in table 5 and 6 in the appendix

Figure 8: Trends in Economic infrastructure commitment volatility and social infrastructure disbursement volatility



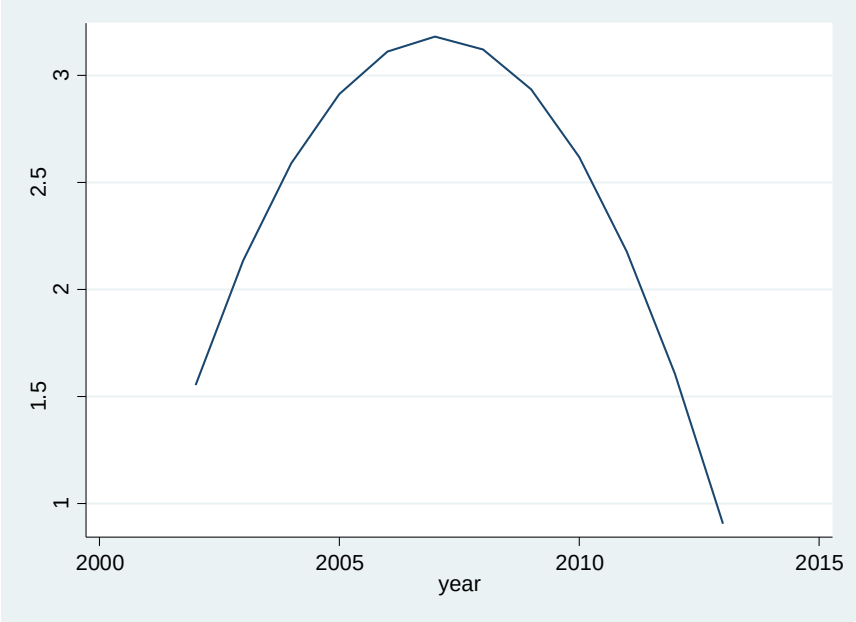
Note: Trend lines are calculated by predicted values of trend models found in table 5 and 6 in the appendix

Figure 9: Trends in volatility of debt aid commitments and production sector aid disbursements



Note: Trend lines are calculated by predicted values of trend models found in table 5 and 6 in the appendix

Figure 10: Trend in the volatility of total aid disbursements



Note: Trend lines are calculated by predicted values of trend models found in table 7 in the appendix

As shown in figures 7 to 10, trends of aid volatilities closely follow the trends of the aid flows themselves although significance of these trends differs between the two. Corresponding to the findings of Hudson (2014), volatility of total aid disbursements has an increasing trend up until the year 2006 where the trend becomes negative and volatility decreases. This type of trend is also visible for the different aid sectors with statistically significant trends (at the 5% confidence level). Only unspecified sector aid has a trend for both disbursements and commitments, with the commitments showing more exaggerated trends (more negative slope

at the start, more positive slope at the end). The trend reversal for this sector is, as was the case for normal aid flows, a few years later than the change of trend for the other sectors. As mentioned before, the year 2006 has a massive peak in total aid flows due to a sharp increase in disbursements of debt aid.

5. Empirical macroeconomic analysis and results

This section analyzes the effects of aid flows, aid volatility and aid predictability on the macroeconomic performance of the countries that are included in the dataset. Macroeconomic performance is represented as GDP per capita growth because GDP per capita is a widely used indicator for welfare and thus its growth rate indicates changes in welfare. Annual GDP per capita growth is used for all analyses in this section as the dependent variable. Research on this topic is not new and has been investigated in almost every study regarding this topic. However, most of these other studies use different datasets with data coming from different databases. This research uses the CRS database, which is arguably the most reliable database to date with regards to aid flows. Furthermore, the measure of volatility used for this research is not the Hodrick-Prescott filter and thus differs from existing literature analyzing country-level mechanisms of aid volatility.

5.1 First look at aid, volatility and predictability

Starting with the most general estimations, the results of regressing GDP growth on aid flows, aid volatility and aid predictability are shown in table 7. All regressions use fixed effects to control for country-specific characteristics. Furthermore dummies are added for the years, as indicated by the testparm application in Stata, to control for time-fixed effects. As indicated by a modified Wald test, there is heteroskedasticity so robust and clustered standard errors are also used. With no control variables present, total aid flows and aid volatilities do not have a statistically significant effect on GDP growth. Interestingly aid predictability does. Aid predictability is the difference between disbursements in period t minus the commitments in period t-1. This then means that when aid is fully predictable its value should be equal to zero. Any change in predictability thus makes it less predictable. The significant negative effect of the predictability measure on the GDP per capita growth rate indicates a possible reverse causality as this negative coefficient would mean that giving less disbursements than commitments would actually benefit a country. This is not logical and therefore leads to the assumption that the sign of this coefficient is most probably caused by increases in disbursements compared to commitments that follow from a decrease in GDP per capita growth rate. As stated, these results are all of country-fixed effects. For completeness, results for both normal OLS (non-panel) and random effect panel estimations are presented in tables 8 and 9 in the appendix.

So, with regards to their effects in the most general models, variables pertaining aid flows as used by most research seem to be of no significance in affecting the annual GDP per capita growth rates of the countries included in this research for the 2002-2013 period. This can have several reasons, most importantly the small size of the model which captures a too small variation in such a large macroeconomic indicator as GDP per capita growth. The next section eliminates this problem by estimating a full model as given by Hudson and Mosley (2008).

Table 7: General regressions of aid flows, aid volatility and aid predictability

Variables	Annual GDP per capita growth rate				
Disbursements	0.005				
	(0.01)				
Commitments (lagged)		0.056			
		(0.04)			
Disbursement volatility			-4.76e-05		
			(0.0003)		
Commitment volatility(lagged)				0.001	
				(0.001)	
Predictability					-0.025**
					(0.01)
Constant	1.837***	1.964***	1.908***	2.406***	2.436***
	(0.39)	(0.59)	(0.40)	(0.42)	(0.41)
Observations	1,639	1,505	1,638	1,496	1,498
R-squared	0.055	0.061	0.058	0.057	0.057
Number of countries	143	143	143	142	143

Note: Robust and clustered standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is GDP per capita growth rate, estimations are fixed effects

5.2 Following Hudson and Mosley

Following these basic results of different aid flows is replicating the results as found by Hudson and Mosley (2008). Their paper follows up Bulíř and Hamann (2003, 2008) and expands on it by using measures for positive and negative volatility and increasing the size of the dataset. This research follows in that it uses the same variables and model. The important difference is that the time period is different from their research, as well as this research includes a larger number of countries. This automatically means that recreating their model should not necessarily give similar results. It is, however, interesting to see whether their results and conclusions are still applicable in this time period.

Tables 10 and 11 of the appendix show the results for the estimated models based on Hudson and Mosley (2008). Table 10 indicates aid flows in the form of commitments and table 11 contain the disbursements. Control variables are similar for both models and are as described above. The second columns are the regular OLS results, added for completeness. A Breusch-Pagan langragian multiplier test is done to see whether using random effects panel estimations are superior to OLS, and this is confirmed. Hausmann tests are used to see whether the fixed effects models of the fourth columns are a better fit than random effects estimations. This results in a test statistic probability of 0.0005 for disbursements and 0.000 for commitments, indicating fixed effects is the best fit. Furthermore, this dataset consists of time-series data and thus autocorrelation can be a problem within the data, this is however largely countered by using robust and clustered standard errors. The fifth and sixth columns show the results for the AR(1) estimations of both the fixed and random effects estimations, this means that for both these estimated models the lagged dependent variable is added into the model. This is, however, only done for completeness sake.

The fixed effects models estimated (column 4 in both table 10 and 11) show little similarity to the results found by Hudson and Mosley (2008). This is due to the difference in data but can

also be explained by differences in estimation methods: this research uses clustered standard errors to control for autocorrelation and has the addition of year dummies. As shown, for both commitments and disbursements, none of the measures of aid are of statistical significance: aid flows themselves do not seem to have any effect on GDP per capita growth. Furthermore, none of the measures of aid volatility are significant. With regards to the control variables used, only the twice lagged logged value for GDP per capita and inflation are significant and negative. The models that have excluded the year dummies to further simulate Hudson and Mosley (2008) are added in the appendix in table 13 and 14.

To conclude, following the previous section there seems to not be a significant effect of aid on GDP growth. This is the case for both the pure aid flows and the volatility of aid and for both aid disbursements and aid commitments.

5.3 The effects of aid based on recipient characteristics

The goal of this research is to go beyond existing literature and to be able to draw new and relevant conclusions. The previous sections found that aid does not seem to have a significant effect on the GDP per capita growth rate when aid is measured as both commitments and disbursements. Furthermore, the deviations from the trend of these aid flows, as indicated by aid volatility, also have no significant effect while previous research all found a significant and negative effect on growth. As was mentioned in the data description section, the trends of aid volatility and aid flows themselves have become negative over the last few years. This then means that there is a chance that aid volatility in itself is, for the entire dataset of 143 countries, no longer a relevant negative factor.However, one cannot conclude that aid volatility is thus no longer a relevant topic of research. This section looks at whether aid volatility is still very much a relevant and significant factor that (negatively) affects GDP per capita growth. As mentioned in the methodology section this is done by using interaction terms that combine dummy variables that represent certain characteristics of countries with the measures of aid volatility. These country characteristics represent both aid dependency and geographical region. Aid dependency is measured by the amount of aid as a percentage of GDP and a country is said to be aid dependent when this measure is above a certain percentage. The percentage used is 10% of GDP which is above the mean and in the 75 percentile of disbursements. A country gets for this variable a zero when aid is above 10% of its GDP and zero if its below. This means that a country can have both values for this variable depending on the period. Geographical region is as was already added as dummy variables in the previous models: Sub Saharan Africa, Asia and South America.

Like in the previous section, Hausman tests are done to see whether random effects or country fixed effects are a better fit for the models estimated. In all cases the test indicated that fixed effects were superior. Adding interaction terms into the model means that the coefficients should be interpreted a little different than before: if a country has a certain country characteristic its value for the dummy variable is 1. This then means that both coefficients for aid volatility and the interaction term are in effect and should be added up for the total effect (only if statistically significant)of aid volatility on the GDP per cpaita growth rate of that country. If a country does not have that particular characteristic, only the coefficient belonging to aid volatility is of interest.

Table 8 below shows the results of the country fixed effects estimated model used by Hudson and Mosley in 2008 with added interaction terms and year dummies to control for year fixed effects.

Table 8: Regressions results of the models including interaction terms

	Disbursements				Commitments			
VARIABLES	Aid >10% GDP	SSA	Asia	South America	Aid >10% GDP	SSA	Asia	South America
Trend	0.243	0.0905	0.0624	0.107	0.301	0.340	0.166	0.322
	(1.48)	(1.48)	(1.48)	(1.48)	(1.45)	(1.43)	(1.43)	(1.44)
Disaster	-0.406	-0.411	-0.396	-0.334	-0.384	-0.360	-0.394	-0.391
	(0.28)	(0.28)	(0.28)	(0.26)	(0.28)	(0.28)	(0.28)	(0.28)
Aid flow	-0.0241	-0.00569	-0.0134	-0.00935	0.0340	0.0212	0.0290	0.0309
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)
Inflation (t-1)	-0.0748**	-0.0745**	-0.0734**	-0.0728**	-0.0841**	-0.0814**	-0.0797**	-0.0842**
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Volatility	-0.0298***	-0.00734***	-1.35e-05	-7.10e-05	0.0121	0.00985**	-0.000216	-0.000246
	(0.01)	(0.002)	(0.0003)	(0.0003)	(0.02)	(0.004)	(0.001)	(0.001)
Volatility*Dummy	0.0299***	0.00726***	-0.00905	-0.0420***	-0.0124	-0.0100***	0.0355	0.00511
	(0.01)	(0.002)	(0.01)	(0.01)	(0.02)	(0.004)	(0.02)	(0.01)
Positive volatility	0.0287	0.0244	0.0256	0.0262	-0.00433	0.00151	-0.00282	-0.00456
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Negative volatility	-0.0716*	-0.0534	-0.0604	-0.0589	0.109	0.0996	0.113	0.109
	(0.04)	(0.04)	(0.04)	(0.04)	(0.09)	(0.09)	(0.09)	(0.09)
World growth	-0.0959	-0.792	-0.929	-0.772	0.304	0.466	-0.370	0.400
	(7.21)	(7.22)	(7.21)	(7.20)	(7.05)	(6.97)	(6.99)	(7.05)
log GDPPC	-5.088***	-5.001**	-5.006**	-5.104***	-4.834**	-4.908**	-4.812**	-4.862**
	(1.93)	(1.93)	(1.93)	(1.92)	(1.99)	(1.98)	(1.98)	(1.98)
Constant	39.99	41.97	42.57	42.54	36.51	36.42	38.93	36.37
	(30.54)	(30.68)	(30.66)	(30.57)	(30.24)	(30.03)	(30.20)	(30.28)
Observations	1,228	1,228	1,228	1,228	1,222	1,222	1,222	1,222
R-squared	0.099	0.099	0.097	0.101	0.099	0.101	0.101	0.099
Countries	132	132	132	132	131	131	131	131
Hausman prob>Chi:	0.000	0.000	0.0007	0.0007	0.000	0.000	0.0014	0.000

Note: Clustered and robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is GDP per capita growth rate, estimations are fixed effects as indicated by Hausman statistics

For commitments, only when the interactionterm of Sub Saharan Africa is added, is there any relevant variable significant: volatility is positive, the interaction term is negative. This thus means that for the countries that are not in Sub Saharan Africa, aid volatility of commitments has a positive and significant effect on GDP per capita growth. This positive effect is counterintuitive and indicates a possible reverse causality present in this estimation. Countries that are situated in Sub Saharan Africa, on the other hand, have a significant but negative effect (albeit a very small one). The latter is also found when looking at aid disbursements. On the other hand, for all other countries it is the other way around: aid volatility has a negative effect on the GDP per capita growth rate. For aid disbursements, when the interaction term pertains aid dependency it is found that for countries that have aid disbursements below 10% of their GDP, aid volatility has a significant negative effect. When countries are aid dependend, this effect becomes positive but very small (almost zero). The interaction term of aid volatility and countries in South America is also significant for disbursements: it has a negative effect on the GDP per capita growth rate. Adding this interaction term gives for disbursements the highest value of the R-squared, even though aid volatility in itself (so for all other countries) is not statistically significant. The Hausman probability statistics are given in the last row and indicate that for every model fixed effects is the best estimation method.

5.4 The effect of aid predictability

Results of this research indicate mostly that there is a difference in the effects that both disbursements and commitments have on GDP per capita growth. What follows is the idea that recipient countries react to commitments when they are made and to disbursements when they are received. Aid predictability can therefore be of interest with regards to aid efficiency. Section 5.1 showed that by looking at the effects of aid variables in a model without control variables, aid predictability had a negative effect on GDP per capita growth. As argued there, this is an indication of reverse causality. This section of the research adds that variable to the models of Hudson and Mosley (2008) to see whether predictability has any effects on the GDP per capita growth rate, and if so if this is still an indication of the reverse causality found in section 5.1 or whether there seems to be a mechanism in place where recipient countries react to aid commitments in a way that lower disbursements would have an effect on the economy. The results of the addition of predictability are shown in table 9. These results are also included in the appendix in table 17, which also included random effects estimations.

Opposed to when no control variables are added into the model, predictability does not have a significant effect on GDP per capita growth when it is added to the model on itself. The introduction of an interaction term that represents aid dependency makes predictability significant and again negative. The interaction term is significant and positive, with a smaller absolute value than the coefficient for predictability. This indicates that for countries that are not aid dependend and for countries that are, aid predicitability has a negative effect on the GDP per capita growth rate. For the latter countries this effect is smaller. Again, as was the case in section 5.1, this is an indication of reverse causality as a negative value for this variables means that a recipient country getting less aid disbursed than was commited would increase its GDP per capita growth rate. It is therefore highly probable that the effect shown is due to decreases in the GDP per capita growth rate followed by an increase in disbursements relative to commitments.

Table 9: Modelof Hudson and Mosley (2008) with the addition of predictability and an interaction term.

VARIABLES	No interaction	Aid > 10% GDP
Trend	0.0790	-0.0229
	(1.476)	(1.504)
Diaster	-0.397	-0.396
	(0.275)	(0.284)
Aid flows	-0.000672	-0.000855
	(0.0296)	(0.0278)
Inflation (t-1)	-0.0741**	-0.0702**
	(0.0350)	(0.0350)
Volatility	-1.04e-05	-0.000147
	(0.0003)	(0.0003)
Predictability	-0.0163	-0.191**
	(0.0324)	(0.0951)
Predictability*Aid dependency		0.187**
		(0.0944)
Positive volatility (t-1)	0.0170	0.0199
	(0.0160)	(0.0154)
Negative volatility (t-1)	-0.0671	-0.0610
	(0.0502)	(0.0476)
World growth	-0.825	-1.372
	(7.200)	(7.340)
log GDPPC	-4.926**	-4.887**
	(1.957)	(1.947)
Constant	41.50	43.10
	(30.76)	(31.22)
Observations	1,228	1,228
R-squared	0.098	0.101
Countries	132	132

Note: Clustered and robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is GDP per capita growth rate, estimates are fixed effects.

5.5 Statistical problems with models

Dalgaard, Hansen and Tarp (2004) argue that when using annual data for aid flows, aid may not have an endogeneity problem. Hudson and Mosley further investigate this and conclude that indeed aid is not endogenous. They do however still estimate their model using instruments for aid, which does not give any different results from their models not using instruments. It logically follows that aid is probably endogenous and that instrumental values should be added to the models. However, the difficult part is in finding good instruments that can be argued to fully capture this endogeneity. This has not been done before in research and is beyond the scope of this research. The above models therefore follow the aforementioned researches and assume that aid is not endogenous. It should therefore be noted that the results found in this section are indications of what effects aid flows, aid volatility and aid predictability can possibly have on the macroeconomic performance of a recipient country. With regards to causality there is a similar problem. However, the signs of the coefficients belonging to aid flows indicate that causality is indeed as is argued in the

theory above in that, when a statistically significant relation is found, aid influences macroeconomic performance and not the other way around.

5.6 Summary

Replicating Hudson and Mosley's (2008) model finds no significant results for either aid flows and measures of aid volatility. This is most probably due to the data used rather than the estimation methods. This difference in found significance of the variables for aid and volatility can be caused by the decreasing trends for both these variables found in section 4. The effect of aid in itself has always been subject of discussion and this research finds no effect for aid flows at the macroeconomic level. The next step is therefore to investigate whether there is a macro-micro paradox in that aid flows influence a recipient's economy through microeconomic performance rather than macroeconomic performance such as GDP per capita growth. When expanding on the models of Hudson and Mosley (2008) by using country characteristics it is found that aid volatility can have significant effects on countries, in most cases negative. The positive effect of total volatility found for aid dependent countries is counterintuitive and is possibly a sign of reverse causality. Models containing aid predictability show reverse causality and indicate that the difference between commitments and disbursements do not affect the recipients economic performance (at least not at the macroeconomic level).

6. Empirical microeconomic analysis and results

This section investigates the effects of the sector-level aid flows and aid volatility on microeconomic indicators that correspond to that sector. In table 2 of the appendix a summary of all the sectors and their corresponding subsectors is given. Microeconomic performance indicators are derived from these subsectors. Social infrastructure, for example, can possibly be seen in government expenditure on health but also on death rates. Death rates are as used by Hudson (2014), government expenditure on healthcare (public health expenditure) are as suggested by van de Sijpe (2010). It should be noted that when looking at these microeconomic indicators it is not necessarily the case that only the aid aimed at that sector influences that specific indicator. As Hudson (2014) argues, not only aid aimed towards helping healthcare decreases the death rates, but better education can also promote healthier lifestyles. Furthermore it can be the case that a general better level of welfare increases the average living standards of the recipient.

6.1 General models

Like the previous section, this section starts with the most generalized models of sector aid. Not all sectors are included in this analysis due to not every sector having a suitable microeconomic indicator that corresponds to it.

For the first estimations the focus is on the largest sector, social infrastructure and services, with dependent variables corresponding to indicators that represent the effectiveness of aid for this sector. This model therefore follows Hudson (2014) in using death rates and secondary school completion rates. Regression results of random effects estimations are given in table 18 in the appendix, country-fixed effects are given in table 19.

For death rates (log), estimations using a random effects panel model, which is the best fit according to the Hausman tests, shows a significant and negative coefficient for negative volatility of aid disbursements. Commitments, on the other hand, have only a significant

positive volatility, which has positive sign. The latter coincides with results previously found in research.

For school completion, country fixed effects estimations are the best fit. However, these estimations do not give any significant results when the aid flows are disbursements. For commitments all three measures are significant, with aid commitments having a negative effect. Both variables for volatility are positive. The negative effect of aid commitments is a sign of reverse causality, an increase in aid would logically not be followed by a decrease in school completion.

The second sector of interest is economic infrastructure. Mobile phones are used instead of fixed telephone subscriptions because mobile phones have become more important over the years and therefore fixed telephone subscriptions are likely to have been decreasing, which is not being caused by the effects of aid but rather by an increase in technology. The number of mobile phone subscriptions is logged to represent growth within the indicator. The results corresponding to random effects estimations are given in table 20 in the appendix, country fixed effects in table 21. None of the estimations are significant. Last for this sector is the number of internet connections per 100 people to indicate the performance in communications of the recipient country. This variable is used as a logged value. Table 20 and 21 also include these estimations. None of the estimations contain significant results.

Up until this point the analysis of sector-level effects of aid and volatility followed Hudson in using the same indicators representing the sectors. This research now expands on Hudson by including more, different sectors. Table 22 and 23 in the appendix contain the regression results of the aid and volatility measures of the production sector aid on value added by manufacturing, of multi-sector aid on CO2 emissions and finally of humanitarian aid on the death rate for both random (table 24) and fixed effects (table 23) models. The latter regression is added because humanitarian aid is a large and important sector of aid; however there is no good indicator to represent what is done in this sector. Humanitarian aid is aimed towards helping people after disasters, during wars or during famine. Humanitarian aid can therefore arguably be represented by a decrease in death rate.

The aid flow variables do not influence the value added by the manufacturing sector, whereas negative volatility has a negative effect. For CO2 emissions and multi-sector aid there are no significant results at all. This is most probably due to CO2 emission not being the best indicator representing this sector. However, no better were available. Humanitarian aid disbursements seem to significantly influence the death rates. However, the actual disbursements seem to have the wrong sign. This is due to reversed causality where an increase in the death rate is followed by an increase in humanitarian aid. Volatility measures of disbursements both have significant negative coefficients indicating that an increase in volatility decreases the death rate.

6.2 Following Hudson

Due to the causality issues mentioned above, the focus is again shifted to the sectors and indicators used by Hudson (2014). Recreating these models and extending the time period to 2013 instead of 2007 gives the results as presented in tables 24 (random effects) and 25 (fixed effects) of the appendix. The relevant results with regards to best fitting models and results are given in table 10. The bottom row of table 10 contains the Prob>chi statistic of the Hausman test to show why either RE or FE are used.

Table 10: Best fitted models following Hudson (2014).

	Social Infrastructure aid				Economic infrastructure aid			
VARIABLES	Death rate (log)		School completion (log)		Mobile Phone (log)		Internet (log)	
Disbursements	-0.00241**		0.00424		0.0646**		0.0789**	
	(0.00112)		(0.00327)		(0.0305)		(0.0335)	
Disbursement volatility (+)	0.00447***		-0.0128**		-0.0700*		-0.109**	
	(0.00135)		(0.00597)		(0.0361)		(0.0428)	
Disbursement volatility (-)	-0.00223*		0.00142		-0.0351		0.00834	
	(0.00129)		(0.0118)		(0.0247)		(0.0333)	
Aid commitments (t-1)		-0.00716***		-0.000825		0.0634		0.0832
		(0.00196)		(0.00226)		(0.0425)		(0.0603)
Commitment volatility (t-1, +)		0.00902***		-0.0215		-0.145***		-0.143**
		(0.00218)		(0.0198)		(0.0544)		(0.0654)
Commitment volatility (t-1, -)		0.00378*		0.0186		0.0399		0.0483
		(0.00212)		(0.0193)		(0.0813)		(0.0532)
Total Aid Disbursements	0.000161		-0.00213*		-0.00145		-0.00264	
	(0.000227)		(0.00117)		(0.00211)		(0.00192)	
Total Aid commitments (t-1)		0.000617*		0.000851		-0.000162		-0.00289
		(0.000331)		(0.000588)		(0.00213)		(0.00214)
Base value of dependent variable	0.918***	0.918***	0.770***	0.748***	0.842***	0.816***	0.734***	0.696***
	(0.0163)	(0.0176)	(0.0274)	(0.0283)	(0.0370)	(0.0417)	(0.0402)	(0.0463)
Constant	0.181***	0.177***	0.907***	1.055***	1.916***	2.782***	0.0868	0.432***
	(0.0348)	(0.0373)	(0.112)	(0.123)	(0.488)	(0.562)	(0.0613)	(0.0738)
Observations	1,608	1,477	699	627	1,504	1,389	1,528	1,413
Number of country	141	140	78	78	133	133	136	136
Estimation Method	RE	RE	RE	RE	RE	RE	RE	RE
Hausman Prob>chi	0.13	0.93	0.11	0.062	x	0.99	0.081	0.92

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
For FE estimations, standard errors are clustered and robust. Year dummies are excluded from the table due to size.

As shown in the second to last row, all models use random effects, as supported by the Hausman tests of which the probabilities are in the last row. For mobile phone subscriptions, the Hausman test was inconclusive for the aid disbursements. Random effects is used because of the better fit of random effects for aid commitments.

Both disbursements and commitments have a significant and negative effect on the death rate, indicating an increase in aid flows leads to a decrease in the death rate (or change therein, as indicated by the log). Positive volatility has, for both measures of aid flows, also a significant effect. This effect is positive, indicating volatility leads to increases in the rate of

deaths, even if this volatility is in the form of positive deviations from the trend. Negative volatility has the opposite sign for both disbursements and commitments. This variable, however, is only significant at the 10% level. Hudson (2014) also uses random effects for these estimations and finds similar results.

Different from Hudson (2014), school completion is not divided over females and males. This is done due to data availability. Aid commitments do not give any significant results. Disbursements on the other hand give for positive volatility a significant and negative sign. This means that a positive deviation from the trend of aid disbursements leads to a decrease in school completion. Hudson (2014) found a significant and positive effect of aid disbursements on school completions, which this research is unable to replicate. This is also the case when, like Hudson (2014), a worse fitting fixed effects estimation is used.

Economic infrastructure aid disbursements lead to an increase in both mobile phone and internet subscriptions. Positive volatility decreases both, but only the effect on internet subscriptions is significant at the 5% level (mobile phone subscriptions at the 10% level). For aid commitments, positive volatility has a negative and significant effect: when aid commitments positively deviate from their trend, there is a decreases in the growth of mobile phone and internet subscriptions.

Hudson uses for both these estimations random effects. Also, instead of aid aimed at economic infrastructure and services as a whole, he uses subsectors. His conclusion at the end of his research states that there is a possible spillover bewtween sectors and subsectors. Effects found in the more specified subsectors can therefore arguably be found when using data of the larger sectors. Results of this research are almost similar to the results found by Hudson: Hudson finds significant positive effects of disbursements on both internet subscriptions and mobile phone subscriptions. Positive volatility of disbursements has for both researches a significant effect on internet subscriptions. There is a difference in the other measures: Hudson finds a significant and positive effect of negative aid volatility on internet use, opposed to no significance at all. For mobile phone subscriptions positive volatility has a negative effect in Hudson's research, this research again finds no effect that is significant at at least the 5% level (it is however significant at the 10% level).

6.3 Macro-micro paradox

To summarize, section 6.2 recreates the results found by Hudson (2014) to see whether there is a significant effect of volatility on microeconomic indicators. As found by both Hudson (2014) and this research, volatility has had a decreasing trend since the year 2006, which continued for the entire time period used in this dataset. This is the case for total volatility and for volatility of the different sectors. This research looks at whether these negative trends have made volatility an insignificant inconsistency of aid flows. This is not the case and aid volatility in both negative and positive form significantly affect microeconomic indicators. Furthermore, aid flows affect these indicators. Section 5 found that aid flows, both disbursements and commitments, do not have any significant effect on macroeconomic performance. The combination of these results mean that there is likely to be a macro-micro paradox: aid flows do not affect macroeconomic performance but recipient countries do benefit from them in the form of microeconomic performance. Aid volatility has an effect on both the macroeconomic and microeconomic level.

7. Conclusion and discussion

The goal of this research was to investigate the effects of aid flows, aid flow volatily, aid flow predictability on macro- and microeconomic performance and to see whether it was still the case that volatility has a negative effect on both economic performances. In short: to see whether aid flows are effective. This research sets itself apart from other existing literature by using both disbursements and commitments to investigate the effects of aid. Furthermore, the CRS database is used which has only recently become available and has not been used often. Research on both the macroeconomic and microeconomic level also gives the opportunity to investigate the macro-micro paradox.

Despite recent literature stating aid is not effective and not efficient, total aid flows have had a positive trend over the last 14 years, commitments closely following aid disbursements. When aid flows are expressed as a percentage of the recipient's GDP this positive trend was present up until around 2006. After 2006 this trend turns negative and aid flows as a percentage of GDP seem to decrease. Coupled with the increasing trend of total aid flows this leads to believe that, on average for this dataset, recipient countries have a faster growing GDP than that there is an increase in aid flows. Aid recipient countries are by definition not the most developed countries and part of this increase in GDP might be contributable to aid.

Hudson(2014) investigated the trend of aid volatility and found that, although positive before, in 2006 the trend of aid volatility has become negative. This research duplicates those results and expands the number of years investigated from 2002-2007 to 2002-2013, thereby confirming that the negative trend has continued. This negative trend could indicate a diminishing effect of volatility, as volatility becomes smaller.

What follows is a country-level analysis of the effect of aid and volatility that is modeled after previous research, most significantly Hudson and Mosley (2008), by recreating the models used in that research and by changing the time period to 2002-2013 (due to the new database used for data pertaining aid flows). These models, contrary to Hudson and Mosley (2008), show no significant effect of aid or aid volatility on the GDP per capita growth rate of a recipient country. These results were also already found by looking at the most general effects of these measures on GDP per capita growth. The difference in outcome between the two researches is most likely due to the difference in the time period.

Introducing interaction terms between volatility and terms that involve certain recipient characteristics (aid dependency and whether countries are located in Sub Sahara Africa, Asia or South America) changes the estimated coefficients of volatility with regards to the significance. When an interaction term for aid dependency is added it is found that for countries that receive less than 10% of their GDP in aid disbursements, volatility has a negative effect on the GDP per capita growth rate. When countries receive more than 10% of their GDP in disbursements, this effect is positive, but very small. A positive effect of total volatility is not previously found in literature and counterintuitive, indicating a possible reverse causality for this coefficient. These results show that aid volatility, despite its recent negative trend, is still negatively influencing GDP per capita growth. This effect is found for countries that are not aid dependent (aid disbursements of less than 10% of GDP) and countries that are situated in South America. This effect is also found for the model that uses Sub Saharan Africa as characteristic, countries that are situated in Sub Saharan Africa have a smaller negative effect than countries that are outside of Sub Saharan Africa. Both are significant.

These results are only for disbursements. This indicates that aid volatility still has an effect on the macroeconomic performance of an aid receiving country. This effect is negative, as found by previous research.

Aid flows are still not significant and do not seem to influence macroeconomic performance of a recipient in the form of GDP per capita growth. This is the case for all models estimated.

Lastly, on the macroeconomic level, predictability looks at how well disbursements follow commitments. An increase in the variable for predictability would thus indicate a decrease in how predictable aid is, regardless of whether it is positive or negative. Predictability has a significant negative effect on GDP per capita growth when an interaction term regarding aid dependency is added to the model. This negative effect is an indication of reverse causality. This finding leads to the conclusion that the difference between commitments made and disbursements received do not influence the recipients economy and indicates that recipient countries do not seem to react to aid commitments in a way that lower aid disbursements would negatively influence the economy.

On the microceconomic level, the estimated models show almost identical results to Hudson (2014). Aid volatility affects different microeconomic indicators, such as the death rate, school completion and subscriptions for mobile phones and internet, and thereby the microeconomic performance of a recipient country. Furthermore, aid flows significantly affect the death rate and mobile phone and internet subscriptions, indicating that aid is efficient when it comes to these indicators. This supports the argument that aid flows are beneficial for recipient countries even though this is not always visible on the macroeconomic level. This confirms the argument for the existence of the macro-micro paradox.

To summarize, aid disbursements and aid commitments have a significant effect on microeconomic performance. Volatility of aid flows can affect both the macroeconomic performance and the microeconomic performance of a recipient country. To maximize their efficiency, aid donors should aim to increase a recipient's microeconomic performance.This will ultimately lead to better macroeconomic performance. This means that donor countries should keep enforcing the conditionality of aid with regards to microeconomic goals and make sure that aid flows are used to reinforce these conditions. Recipient countries, on the other hand, should aim towards following these conditions as good and fast as possible to be able to make aid as effective as possible. In doing this, deviations from the trend of aidflows are kept as small as possible thereby decreasing aid volatility and thus the negative effects volatility can have on both the macroeconomic and microeconomic level.

Following the results of this research, future research should investigate the implications of the negative trend in aid volatility. The number of aidsectors investigated is also rather limited in this research and should be expanded on in the future, when more data becomes available in the CRS database. More data also means that microeconomic analysis can be further specified with regards to subsectors and geographical regions. Furthermore, this research finds for several models a reverse causality. This leads to the question whether other results are also subject to this reverse causality. This is a problem that is present in this kind of research, this subject of research in particular. Instrumental variable estimations can be used to control for this reverse causality and endogeneity. However, scholars have yet to find good instruments. Future research should therefore also aim towards finding these instruments.

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Appendix

Table 1: Trend regressions of aid disbursements and commitments.

	Disbursements (as a % of GDP)	Commitments (as a % of GDP)
Trend	320.6***	128.1*
	(83.44)	(71.87)
Trend^2	-0.0799***	-0.0319*
	(0.0208)	(0.0179)
Constant	-321,702***	-128,429*
	(-83,748)	(-72,14)
Observations	1,652	1,652
R-squared	0.012	0.005
Number of country	143	143

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2: Aid sectors and their subsectors

Sector	Subsectors
Social infrastructure and services	Education, health, population policy, water supply and sanitation, government and civil society
Economic infrastructure and services	Transport, communications, energy, banking and business
Production sector	Agriculture, foresting fishing, industry and trade policies
Multi-sector	Environment protection and others
Commodity / program assistance	General budget support
Debt aid	Debt relief and forgiveness
Humanitarian	Emergency response and reconstruction
Administration costs of donors	No subsectors
Refugees in donor countries	No subsectors
Unspecified	No subsectors

Table 3: regression results of sector specific aid commitments as a percentage of GDP on a time trend and its square

	Commitments									
VARIABLES	Social infrastructure	Economic infrastructure	Production sectors	Multi sector	Commodity	Debt	Humanitarian	Admin costs of donors	Refugees in donors	Unspecified
Trend	107.1***	-4.720	-10.67	57.48***	-29.62	455.7***	25.28*	1.488	-1.769	-25.25***
	(22.38)	(11.52)	(6.523)	(16.29)	(26.68)	(121.4)	(14.23)	(1.123)	(1.814)	(2.898)
Trend^2	-0.0267***	0.00119	0.00265	-0.0143***	0.00737	-0.114***	-0.00630*	-0.000370	0.000439	0.00628***
	(0.00558)	(0.00287)	(0.00162)	(0.00406)	(0.00665)	(0.0302)	(0.00354)	(0.000280)	(0.000452)	(0.000722)
Constant	-107,546***	4,701	10,718	-57,718***	29,767	-457,231***	-25,356*	-1,495	1,784	25,386***
	(22,468)	(11,562)	(6,547)	(16,347)	(26,782)	(121,890)	(14,287)	(1,127)	(1,820)	(2,908)
Observations	1,652	1,633	1,646	1,640	1,241	875	1,531	1,475	853	1,614
R-squared	0.015	0.012	0.004	0.011	0.003	0.022	0.004	0.003	0.048	0.207
Number of countries	143	143	143	143	129	98	141	139	115	143

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Regression results of sector specific aid disbursements as a percentage of GDP on a time trend and its square

	Disbursements									
VARIABLES	Social infrastructure	Economic infrastructure	Production sectors	Multi sector	Commodity	Debt	Humanitarian	Admin costs of donors	Refugees in donors	Unspecified
Trend	126.5***	-21.25	-0.677	44.71**	-26.03	68.99	11.21	1.269***	-0.0805	-0.244
	(28.07)	(28.69)	(7.014)	(20.16)	(27.32)	(61.32)	(17.92)	(0.388)	(1.906)	(1.282)
Trend^2	-0.0315***	0.00531	0.000168	-0.0111**	0.00647	-0.0172	-0.00280	-0.000316***	1.82e-05	5.96e-05
	(0.00699)	(0.00715)	(0.00175)	(0.00502)	(0.00680)	(0.0153)	(0.00446)	(9.66e-05)	(0.000475)	(0.000319)
Constant	-126,947***	21,261	682.4	-44,911**	26,177	-69,061	-11,206	-1,275***	88.58	248.8
	(28,170)	(28,797)	(7,040)	(20,238)	(27,420)	(61,550)	(17,985)	(389.3)	(1,914)	(1,287)
Observations	1,652	1,622	1,638	1,643	1,176	830	1,510	1,425	834	1,559
R-squared	0.015	0.006	0.000	0.006	0.006	0.020	0.007	0.018	0.037	0.012
Number of countries	143	143	142	143	123	93	141	137	114	143

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: trend estimations of volatility sector specific aid commitments by regressing volatility on a trend and its square

	Commitments									
VARIABLES	Social infrastructure	Economic infrastructure	Production sectors	Multi sector	Commodity	Debt	Humanitarian	Admin costs of donors	Refugees in donors	Unspecified
Trend	16.36	17.54***	0.0926	5.645	20.79*	484.9***	4.191	0.824*	2.016*	-7.565***
	(10.81)	(5.572)	(3.053)	(7.490)	(11.33)	(78.58)	(7.776)	(0.466)	(1.110)	(1.312)
Trend^2	-0.00408	-0.00437***	-2.47e-05	-0.00140	-0.00518*	-0.121***	-0.00104	-0.000205*	-0.000503*	0.00188***
	(0.00269)	(0.00139)	(0.000760)	(0.00187)	(0.00282)	(0.0196)	(0.00194)	(0.000116)	(0.000276)	(0.000327)
Constant	-16,416	-17,611***	-86.02	-5,682	-20,871*	-486,671***	-4,202	-827.1*	-2,020*	7,602***
	(10,852)	(5,593)	(3,065)	(7,518)	(11,377)	(78,874)	(7,806)	(467.5)	(1,114)	(1,317)
Observations	1,652	1,633	1,646	1,640	1,241	875	1,531	1,475	850	1,614
R-squared	0.002	0.007	0.005	0.006	0.003	0.048	0.001	0.003	0.030	0.076
Number of countries	143	143	143	143	129	98	141	139	114	143

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 6: trend estimations of volatility sector specific aid disbursements by regressing volatility on a trend and its square

	Disbursements									
VARIABLES	Social infrastructure	Economic infrastructure	Production sectors	Multi sector	Commodity	Debt	Humanitarian	Admin costs of donors	Refugees in donors	Unspecified
Trend	35.45**	13.66	8.860**	5.837	21.13*	62.63*	6.713	0.0585	0.431	-1.478**
	(14.04)	(16.28)	(3.769)	(10.74)	(12.51)	(33.23)	(9.305)	(0.154)	(1.186)	(0.690)
Trend^2	-0.00884**	-0.00340	-0.00221**	-0.00145	-0.00527*	-0.0156*	-0.00167	-1.47e-05	-0.000109	0.000368**
	(0.00350)	(0.00405)	(0.000939)	(0.00267)	(0.00312)	(0.00828)	(0.00232)	(3.83e-05)	(0.000295)	(0.000172)
Constant	-35,552**	-13,739	-8,887**	-5,877	-21,196*	-62,744*	-6,726	-58.15	-427.6	1,485**
	(14,095)	(16,336)	(3,783)	(10,776)	(12,559)	(33,353)	(9,341)	(154.5)	(1,190)	(692.2)
Observations	1,652	1,622	1,638	1,643	1,176	830	1,509	1,425	832	1,559
R-squared	0.008	0.003	0.007	0.004	0.005	0.029	0.002	0.017	0.040	0.008
Number of countries	143	143	142	143	123	93	141	137	113	143

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7: Non-linear trend estimations of the volatility of total aid disbursements and aid commitments

	Disbursements (as a % of GDP)	Commitments (as a % of GDP)
Trend	257.1***	44.75
	(48.96)	(32.41)
Trend^2	-0.0640***	-0.0112
	(0.0122)	(0.00807)
Constant	-257,974***	-44,861
	(49,141)	(32,528)
Observations	1,652	1,642
R-squared	0.019	0.004
Number of country	143	142

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8: Model of section 5.1 using random effects

Variables	Annual GDP per capita growth rate				
Disbursements	-0.0139				
	(0.0108)				
Commitments (lagged)		0.00230			
		(0.0192)			
Disbursement Volatility			-0.000107		
			(0.000313)		
Commitments Volatility (lagged)				0.000412	
				(0.000859)	
Predictability					-0.0291**
					(0.0121)
Constant	1.930***	2.401***	1.852***	2.408***	2.433***
	(0.444)	(0.558)	(0.458)	(0.470)	(0.458)
Observations	1,639	1,505	1,638	1,496	1,498
Number of countries	143	143	143	142	143

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is GDP per capita growth rate. Year dummies excluded from table due to size

Table 9:Model of section 5.1 using OLS

Variables	Annual GDP per capita growth rate				
Disbursements	-0.0223**				
	(0.00926)				
Commitments (lagged)		-0.0124			
		(0.0104)			
Disbursement Volatility			-0.000159		
			(0.000225)		
Commitments Volatility (lagged)				7.98e-05	
				(0.000537)	
Predictability					-0.0317**
					(0.0135)
Constant	1.984***	2.539***	1.819***	2.435***	2.446***
	(0.463)	(0.465)	(0.460)	(0.459)	(0.456)
Observations	1,639	1,505	1,638	1,496	1,498
R-squared	0.050	0.047	0.050	0.047	0.049

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is GDP per capita growth rate. Year dummies excluded from table due to size

Table 10: Model by Hudson and Mosley (2008) of section 5.2, commitments.

VARIABLES	OLS	RE	FE	RE AR(1)	FE AR(1)
Trend	-1.355	-1.057	0.323	-0.114*	0.000311
	(1.60)	(1.54)	(1.44)	(0.07)	(0.16)
Disaster	-0.0842	-0.147	-0.393	-0.167	-0.537
	(0.26)	(0.30)	(0.28)	(0.38)	(0.47)
Aid/GDP percentage (t-1)	0.0248	0.0236	0.0310	0.0233	0.0326
	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)
Inflation (t-1)	-0.00950	-0.0228	-0.0842**	-0.00850	-0.0589
	(0.03)	(0.03)	(0.04)	(0.03)	(0.04)
Volatility (t-1)	0.000391	0.000330	-0.000247	0.000233	-0.000204
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Positive Volatility (t-2)	0.000602	0.00191	-0.00464	0.000396	-0.0149
	(0.02)	(0.03)	(0.03)	(0.04)	(0.06)
Negative Volatility (t-2)	0.138*	0.132	0.109	0.129*	0.144
	(0.07)	(0.10)	(0.09)	(0.07)	(0.10)
World Growth	-5.693	-4.214	0.404	0.532***	0.533***
	(7.94)	(7.61)	(7.05)	(0.09)	(0.09)
SSA	0.0698	0.0162		0.0646	
	(0.38)	(0.44)		(0.52)	
Asia	2.129***	2.101***		2.104***	
	(0.40)	(0.50)		(0.51)	
South America	0.860*	0.881*		0.851	
	(0.45)	(0.49)		(0.72)	
log (GDP per capita t-2)	-0.191	-0.259	-4.864**	-0.197	-1.987
	(0.20)	(0.20)	(1.98)	(0.23)	(1.30)
Constant	27.48	22.42	36.37	4.045**	12.75*
	(30.55)	(29.27)	(30.27)	(1.92)	(7.41)
Observations	1,222	1,222	1,222	1,222	1,091
R-squared	0.089		0.099		
Number of country		131	131	131	131

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is GDP per capita growth rate. Year dummies excluded from table due to size. Standard errors are clustered and robust for FE.

Table 11: Model by Hudson and Mosley (2008) of section 5.2, disbursements

VARIABLES	OLS	RE	FE	RE AR(1)	FE AR(1)
Trend	-1.425	-1.192	0.0786	-0.114*	0.0290
	(1.62)	(1.56)	(1.47)	(0.07)	(0.16)
Disaster	-0.147	-0.189	-0.396	-0.230	-0.569
	(0.26)	(0.30)	(0.27)	(0.37)	(0.47)
Aid/GDP percentage	-0.0113	-0.0137	-0.0136	-0.0118	-0.00213
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Inflation (t-1)	-0.00717	-0.0182	-0.0735**	-0.00477	-0.0515
	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
Volatility	4.59e-05	6.10e-05	-1.05e-05	-6.32e-05	-0.000351
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Positive Volatility (t-1)	0.0175	0.0200	0.0258	0.0214	0.0248
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Negative Volatility (t-1)	-0.0154	-0.0233	-0.0611	-0.0271	-0.0280
	(0.05)	(0.06)	(0.04)	(0.06)	(0.08)
World Growth	-6.013	-4.860	-0.850	0.533***	0.530***
	(8.02)	(7.71)	(7.19)	(0.08)	(0.09)
SSA	-0.0177	-0.0736		-0.0354	
	(0.39)	(0.44)		(0.52)	
Asia	2.108***	2.086***		2.093***	
	(0.39)	(0.49)		(0.51)	
South America	0.759*	0.772		0.756	
	(0.46)	(0.50)		(0.72)	
log (GDP per capita t-2)	-0.273	-0.332	-5.004**	-0.268	-2.243*
	(0.21)	(0.21)	(1.93)	(0.23)	(1.30)
Constant	29.51	25.61	42.25	4.730**	13.90*
	(30.90)	(29.76)	(30.54)	(1.89)	(7.29)
Observations	1.228	1.228	1.228	1.228	1.096
R-squared	0.086		0.097		
Number of country		132	132	132	131

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is GDP per capita growth rate. Year dummies excluded from table due to size. Standard errors are clustered and robust for FE

Table 12: Model of section 5.2 without year dummies, commitments.

VARIABLES	OLS	RE	FE	RE AR(1)	FE AR(1)
Trend	-0.113*	-0.112**	0.321*	-0.114*	-0.00327
	(0.0595)	(0.0556)	(0.169)	(0.0683)	(0.156)
Disaster	-0.0665	-0.118	-0.347	-0.166	-0.542
	(0.261)	(0.303)	(0.273)	(0.376)	(0.471)
Aid/GDP percentage (t-1)	0.0213	0.0200	0.0274	0.0225	0.0310
	(0.0200)	(0.0152)	(0.0209)	(0.0229)	(0.0396)
Inflation (t-1)	0.00533	-0.00339	-0.0484	-0.00873	-0.0596
	(0.0274)	(0.0314)	(0.0341)	(0.0271)	(0.0393)
Volatility (t-1)	0.000373	0.000326	-0.000266	0.000243	5.11e-05
	(0.000715)	(0.000570)	(0.000554)	(0.000825)	(0.00169)
Positive Volatility (t-2)	0.00727	0.00931	0.0147	0.00486	0.0116
	(0.0114)	(0.00952)	(0.0119)	(0.0252)	(0.0281)
Negative Volatility (t-2)	0.125*	0.119	0.0862	0.126*	0.116
	(0.0728)	(0.0914)	(0.0778)	(0.0704)	(0.0856)
World Growth	0.521***	0.521***	0.481***	0.533***	0.536***
	(0.0729)	(0.0718)	(0.0696)	(0.0853)	(0.0887)
SSA	0.0271	-0.0256		0.0580	
	(0.385)	(0.439)		(0.518)	
Asia	2.096***	2.068***		2.107***	
	(0.403)	(0.502)		(0.511)	
South America	0.819*	0.828*		0.850	
	(0.448)	(0.492)		(0.715)	
log (GDP per capita t-2)	-0.195	-0.252	-4.650***	-0.195	-1.935
	(0.197)	(0.197)	(1.738)	(0.228)	(1.303)
Constant	3.942**	4.468***	34.93***	4.034**	12.45*
	(1.592)	(1.632)	(11.75)	(1.921)	(7.392)
Observations	1,222	1,222	1,222	1,222	1,091
R-squared	0.077		0.083		
Number of country		131	131	131	131

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is GDP per capita growth rate. Standard errors are clustered and robust for FE

Table 13: Model of section 5.2 without year dummies, disbursements.

VARIABLES	OLS	RE	FE	RE AR(1)	FE AR(1)
Trend	-0.111*	-0.110**	0.346**	-0.114*	0.0290
	(0.0593)	(0.0557)	(0.166)	(0.0681)	(0.158)
Disaster	-0.141	-0.178	-0.372	-0.230	-0.569
	(0.260)	(0.308)	(0.272)	(0.374)	(0.472)
Aid/GDP percentage	-0.0130	-0.0152	-0.0146	-0.0118	-0.00213
	(0.0206)	(0.0172)	(0.0190)	(0.0222)	(0.0319)
Inflation (t-1)	0.00606	-0.00147	-0.0441	-0.00477	-0.0515
	(0.0263)	(0.0306)	(0.0316)	(0.0264)	(0.0385)
Volatility	9.94e-05	0.000116	4.75e-05	-6.32e-05	-0.000351
	(0.000441)	(0.000327)	(0.000324)	(0.000501)	(0.000617)
Positive Volatility (t-1)	0.0227	0.0251	0.0372*	0.0214	0.0248
	(0.0189)	(0.0209)	(0.0195)	(0.0257)	(0.0326)
Negative Volatility (t-1)	-0.0150	-0.0224	-0.0804**	-0.0271	-0.0280
	(0.0465)	(0.0546)	(0.0341)	(0.0585)	(0.0756)
World Growth	0.524***	0.524***	0.487***	0.533***	0.530***
	(0.0747)	(0.0727)	(0.0698)	(0.0849)	(0.0881)
SSA	-0.0529	-0.106		-0.0354	
	(0.389)	(0.440)		(0.522)	
Asia	2.079***	2.056***		2.093***	
	(0.395)	(0.491)		(0.511)	
South America	0.723	0.729		0.756	
	(0.449)	(0.493)		(0.717)	
log (GDP per capita t-2)	-0.274	-0.325	-4.845***	-0.268	-2.243*
	(0.201)	(0.202)	-1688	(0.225)	-1296
Constant	4.707***	5.168***	36.28***	4.730**	13.90*
	-1636	-1674	(11.39)	-1889	-7290
Observations	1,228	1,228	1,228	1,228	1,096
R-squared	0.075		0.084		
Number of country		132	132	132	131

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is GDP per capita growth rate. Standard errors are clustered and robust for FE

Table 14: Model of section 5.3 using OLS as estimation method.

	Disbursements				Commitments			
VARIABLES	Aid >10% GDP	SSA	Asia	South America	Aid >10% GDP	SSA	Asia	South America
Trend	-1.115	-1.412	-1.417	-1.467	-1.313	-1.364	-1.468	-1.359
	(1.627)	(1.619)	(1.614)	(1.616)	(1.602)	(1.595)	(1.581)	(1.599)
Disaster	-0.182	-0.146	-0.143	-0.106	-0.108	-0.0775	-0.0541	-0.0884
	(0.259)	(0.258)	(0.258)	(0.258)	(0.263)	(0.261)	(0.261)	(0.260)
Aid flow	-0.0214	-0.00349	-0.0125	-0.00915	0.0223	0.0225	0.0158	0.0248
	(0.0213)	(0.0204)	(0.0210)	(0.0205)	(0.0216)	(0.0212)	(0.0208)	(0.0211)
Inflation (t-1)	-0.00969	-0.00660	-0.00726	-0.00740	-0.0104	-0.00922	-0.00695	-0.00958
	(0.0268)	(0.0268)	(0.0268)	(0.0268)	(0.0281)	(0.0281)	(0.0281)	(0.0281)
Volatility	-0.0418***	-0.00929***	6.46e-05	1.19e-05	-0.0194	0.00322	0.000601	0.000387
	(0.0113)	(0.00194)	(0.000456)	(0.000443)	(0.0160)	(0.00265)	(0.000724)	(0.000706)
Volatility*Dummy	0.0420***	0.00927***	0.00927	-0.0366***	0.0199	-0.00281	0.0289**	-0.0137
	(0.0114)	(0.00186)	(0.0471)	(0.0121)	(0.0161)	(0.00257)	(0.0135)	(0.0193)
Positive volatility	0.0222	0.0158	0.0179	0.0183	0.00164	0.00194	0.00455	0.000944
	(0.0201)	(0.0206)	(0.0207)	(0.0206)	(0.0246)	(0.0247)	(0.0245)	(0.0246)
Negative volatility	-0.0321	-0.00566	-0.0166	-0.0142	0.136*	0.136*	0.136*	0.138*
	(0.0467)	(0.0446)	(0.0470)	(0.0460)	(0.0750)	(0.0753)	(0.0762)	(0.0749)
World growth	-4.542	-5.954	-5.976	-6.230	-5.488	-5.738	-6.275	-5.710
	(8.075)	(8.041)	(8.016)	(8.027)	(7.953)	(7.922)	(7.850)	(7.943)
Sub Saharan Africa	0.0567	-0.132	-0.0143	-0.0469	0.0756	0.107	0.104	0.0642
	(0.391)	(0.389)	(0.387)	(0.388)	(0.380)	(0.390)	(0.380)	(0.380)
Asia	2.046***	2.045***	2.092***	2.085***	2.113***	2.140***	1.986***	2.126***
	(0.388)	(0.389)	(0.393)	(0.390)	(0.399)	(0.400)	(0.400)	(0.398)
South America	0.794*	0.768*	0.757*	0.968**	0.876*	0.865*	0.845*	0.908**
	(0.457)	(0.451)	(0.456)	(0.454)	(0.452)	(0.452)	(0.450)	(0.459)
log GDPPC	-0.355*	-0.283	-0.273	-0.278	-0.216	-0.188	-0.196	-0.194
	(0.211)	(0.206)	(0.206)	(0.206)	(0.206)	(0.202)	(0.202)	(0.202)
Constant	24.47	29.37	29.36	30.34	26.93	27.62	29.76	27.58
	(31.08)	(30.97)	(30.87)	(30.92)	(30.58)	(30.48)	(30.18)	(30.56)
Observations	1,228	1,228	1,228	1,228	1,222	1,222	1,222	1,222
R-squared	0.090	0.089	0.086	0.088	0.089	0.089	0.091	0.089

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is GDP per capita growth rate, year dummies are excluded from table due to size. Positive and negative volatility are lagged once for disbursements, twice for commitments. All other aid variables are lagged once for commitments.

Table 15: Model of section 5.3 using Random effects estimations.

	Disbursements				Commitments			
VARIABLES	Aid >10% GDP	SSA	Asia	South America	Aid >10% GDP	SSA	Asia	South America
Trend	-0.917	-1.179	-1.179	-1.211	-1.029	-1.059	-1.191	-1.053
	(1.563)	(1.566)	(1.562)	(1.561)	(1.540)	(1.531)	(1.515)	(1.539)
Disaster	-0.220	-0.191	-0.188	-0.147	-0.161	-0.137	-0.117	-0.151
	(0.306)	(0.302)	(0.303)	(0.296)	(0.299)	(0.297)	(0.299)	(0.297)
Aid flow	-0.0237	-0.00597	-0.0145	-0.0114	0.0219	0.0201	0.0151	0.0237
	(0.0175)	(0.0162)	(0.0166)	(0.0161)	(0.0164)	(0.0166)	(0.0171)	(0.0162)
Inflation (t-1)	-0.0204	-0.0180	-0.0187	-0.0190	-0.0235	-0.0226	-0.0193	-0.0232
	(0.0320)	(0.0321)	(0.0321)	(0.0321)	(0.0331)	(0.0331)	(0.0331)	(0.0331)
Volatility	-0.0397***	-0.00884***	7.29e-05	2.60e-05	-0.0125	0.00460	0.000527	0.000326
	(0.00994)	(0.00176)	(0.000328)	(0.000318)	(0.0168)	(0.00346)	(0.000582)	(0.000558)
Volatility * Dummy	0.0399***	0.00884***	0.00627	-0.0367***	0.0129	-0.00424	0.0299**	-0.0108
	(0.0100)	(0.00172)	(0.0100)	(0.00983)	(0.0168)	(0.00341)	(0.0123)	(0.00931)
Positive Volatility	0.0244	0.0183	0.0203	0.0208	0.00247	0.00416	0.00532	0.00212
	(0.0223)	(0.0234)	(0.0232)	(0.0232)	(0.0251)	(0.0251)	(0.0255)	(0.0252)
Negative volatility	-0.0389	-0.0139	-0.0243	-0.0222	0.131	0.129	0.131	0.132
	(0.0518)	(0.0559)	(0.0558)	(0.0552)	(0.0985)	(0.0976)	(0.102)	(0.0986)
World growth	-3.561	-4.798	-4.793	-4.963	-4.079	-4.225	-4.899	-4.190
	(7.719)	(7.734)	(7.710)	(7.705)	(7.609)	(7.565)	(7.488)	(7.602)
Sub Saharan Africa	-0.00219	-0.182	-0.0732	-0.107	0.0193	0.0702	0.0574	0.0103
	(0.442)	(0.439)	(0.445)	(0.447)	(0.443)	(0.451)	(0.439)	(0.444)
Asia	2.027***	2.028***	2.075***	2.062***	2.089***	2.116***	1.956***	2.097***
	(0.489)	(0.484)	(0.498)	(0.492)	(0.502)	(0.503)	(0.516)	(0.501)
South America	0.805*	0.782	0.771	0.981**	0.891*	0.889*	0.865*	0.919*
	(0.482)	(0.485)	(0.496)	(0.491)	(0.490)	(0.499)	(0.487)	(0.511)
log GDPPC	-0.410**	-0.340*	-0.334	-0.339*	-0.276	-0.257	-0.257	-0.263
	(0.206)	(0.203)	(0.205)	(0.205)	(0.207)	(0.204)	(0.202)	(0.203)
Constant	21.21	25.45	25.37	26.03	22.06	22.42	25.03	22.37
	(29.79)	(29.83)	(29.76)	(29.73)	(29.27)	(29.11)	(28.80)	(29.24)
Observations	1,228	1,228	1,228	1,228	1,222	1,222	1,222	1,222
Countries	132	132	132	132	131	131	131	131

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is GDP per capita growth rate, year dummies are excluded from table due to size. Positive and negative volatility are lagged once for disbursements, twice for commitments. All other aid variables are lagged once for commitments.

Table 16: Model of section 5.3 using fixed effects estimations

	Disbursements				Commitments			
VARIABLES	Aid >10% GDP	SSA	Asia	South America	Aid >10% GDP	SSA	Asia	South America
Trend	0.243	0.0905	0.0624	0.107	0.301	0.340	0.166	0.322
	(1.479)	(1.479)	(1.478)	(1.478)	(1.445)	(1.425)	(1.427)	(1.444)
Disaster	-0.406	-0.411	-0.396	-0.334	-0.384	-0.360	-0.394	-0.391
	(0.275)	(0.276)	(0.275)	(0.258)	(0.278)	(0.275)	(0.276)	(0.277)
Aid flow	-0.0241	-0.00569	-0.0134	-0.00935	0.0340	0.0212	0.0290	0.0309
	(0.0199)	(0.0192)	(0.0189)	(0.0181)	(0.0250)	(0.0245)	(0.0240)	(0.0242)
Inflation (t-1)	-0.0748**	-0.0745**	-0.0734**	-0.0728**	-0.0841**	-0.0814**	-0.0797**	-0.0842**
	(0.0347)	(0.0349)	(0.0348)	(0.0346)	(0.0370)	(0.0370)	(0.0368)	(0.0370)
Volatility	-0.0298***	-0.00734***	-1.35e-05	-7.10e-05	0.0121	0.00985**	-0.000216	-0.000246
	(0.00922)	(0.00195)	(0.000306)	(0.000295)	(0.0178)	(0.00382)	(0.000553)	(0.000577)
Volatility*Dummy	0.0299***	0.00726***	-0.00905	-0.0420***	-0.0124	-0.0100***	0.0355	0.00511
	(0.00931)	(0.00191)	(0.00992)	(0.0119)	(0.0179)	(0.00383)	(0.0221)	(0.00983)
Positive volatility	0.0287	0.0244	0.0256	0.0262	-0.00433	0.00151	-0.00282	-0.00456
	(0.0219)	(0.0226)	(0.0225)	(0.0224)	(0.0278)	(0.0275)	(0.0287)	(0.0277)
Negative volatility	-0.0716*	-0.0534	-0.0604	-0.0589	0.109	0.0996	0.113	0.109
	(0.0383)	(0.0380)	(0.0395)	(0.0383)	(0.0900)	(0.0871)	(0.0925)	(0.0905)
World growth	-0.0959	-0.792	-0.929	-0.772	0.304	0.466	-0.370	0.400
	(7.210)	(7.221)	(7.212)	(7.207)	(7.053)	(6.970)	(6.988)	(7.054)
log GDPPC	-5.088***	-5.001**	-5.006**	-5.104***	-4.834**	-4.908**	-4.812**	-4.862**
	(1.928)	(1.929)	(1.927)	(1.919)	(1.994)	(1.976)	(1.978)	(1.984)
Constant	39.99	41.97	42.57	42.54	36.51	36.42	38.93	36.37
	(30.54)	(30.68)	(30.66)	(30.57)	(30.24)	(30.03)	(30.20)	(30.28)
Observations	1,228	1,228	1,228	1,228	1,222	1,222	1,222	1,222
R-squared	0.099	0.099	0.097	0.101	0.099	0.101	0.101	0.099
Countries	132	132	132	132	131	131	131	131

Note: Robust and clustered standard errors in parentheses, *** p<0.01, ** p<0.05,
* p<0.1

Dependent variable is GDP per capita growth rate, year dummies are excluded from table due to size. Positive and negative volatility are lagged once for disbursements, twice for commitments. All other aid variables are lagged once for commitments.

Table 17: Estimations of model of section 5.4

	Random Effects		Fixed effects	
VARIABLES	No interaction	Aid > 10% GDP	No interaction	Aid > 10% GDP
Trend	-1.210	-1.319	0.0790	-0.0229
	(1.578)	(1.601)	(1.476)	(1.504)
Diaster	-0.148	-0.125	-0.397	-0.396
	(0.308)	(0.311)	(0.275)	(0.284)
Aid flows	-0.00420	0.000487	-0.000672	-0.000855
	(0.0180)	(0.0182)	(0.0296)	(0.0278)
Inflation (t-1)	-0.0159	-0.0132	-0.0741**	-0.0702**
	(0.0321)	(0.0318)	(0.0350)	(0.0350)
Volatility	0.000265	0.000105	-1.04e-05	-0.000147
	(0.000332)	(0.000346)	(0.000290)	(0.000315)
Predictability	-0.0316	-0.202**	-0.0163	-0.191**
	(0.0210)	(0.0892)	(0.0324)	(0.0951)
Predictability*Aid dependency		0.180**		0.187**
		(0.0909)		(0.0944)
Positive volatility (t-1)	-0.00212	0.00159	0.0170	0.0199
	(0.0198)	(0.0192)	(0.0160)	(0.0154)
Negative volatility (t-1)	-0.0200	-0.0219	-0.0671	-0.0610
	(0.0597)	(0.0570)	(0.0502)	(0.0476)
World growth	-4.941	-5.514	-0.825	-1.372
	(7.791)	(7.897)	(7.200)	(7.340)
Sub Sahara Africa	-0.0189	0.00296		
	(0.443)	(0.436)		
Asia	2.088***	2.061***		
	(0.492)	(0.490)		
South America	0.798	0.801		
	(0.499)	(0.508)		
log GDPPC	-0.273	-0.203	-4.926**	-4.887**
	(0.213)	(0.214)	(1.957)	(1.947)
Constant	25.35	26.80	41.50	43.10
	(30.09)	(30.47)	(30.76)	(31.22)
Observations	1,228	1,228	1,228	1,228
R-squared			0.098	0.101
Countries	132	132	132	132

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Dependent variable is GDP per capita growth rate. Year dummies excluded from table due to size.
Standard errors are clustered and robust for fixed effects.

Table 18: Social infrastructure and services aid and its effect on death rate and school completion, random effects. Section 6.1

VARIABLES	Death rate		School completion	
Disbursement	0.000157		-0.0185**	
	(0.00196)		(0.00752)	
Positive volatility	0.00191		0.0117	
	(0.00190)		(0.00871)	
Negative volatility	-0.00452**		0.0257**	
	(0.00209)		(0.0122)	
Commitment (t-1)		-0.00435*		-0.0288***
		(0.00242)		(0.0103)
Positive volatility (t-1)		0.00689***		0.0255**
		(0.00230)		(0.0108)
Negative volatility (t-1)		0.00111		0.0350**
		(0.00276)		(0.0145)
Constant	2.130***	2.130***	3.897***	3.987***
	(0.0388)	(0.0393)	(0.0651)	(0.0639)
Observations	1,609	1,478	950	877
Countries	142	141	130	129

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Year dummies are excluded in the table because of size

Table 19: Social infrastructure and services aid and its effect on death rate and school completion, country fixed effects. Section 6.1

VARIABLES	Death rate		School completion	
Disbursement	-3.38e-05		-0.0132*	
	(0.00196)		(0.00690)	
Positive volatility	0.00213		0.00683	
	(0.00190)		(0.00802)	
Negative volatility	-0.00446**		0.0207*	
	(0.00210)		(0.0118)	
Commitment (t-1)		-0.00467*		-0.0241**
		(0.00249)		(0.0112)
Positive volatility (t-1)		0.00729***		0.0198*
		(0.00239)		(0.0117)
Negative volatility (t-1)		0.00122		0.0327**
		(0.00280)		(0.0152)
Constant	2.145***	2.145***	3.896***	3.977***
	(0.0103)	(0.00924)	(0.0273)	(0.0332)
Observations	1,609	1,478	950	877
R-squared	0.313	0.314	0.341	0.304
Countries	142	141	130	129

Note: Clustered and robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Year dummies are excluded in the table because of size

Table 20: Economic infrastructure and services aid and its effect on mobile phone subscriptions and internet subscriptions, random effects. Section 6.1

VARIABLES	Mobile phone		Internet	
Disbursement	0.00300		0.0392	
	(0.0281)		(0.0278)	
Positive volatility	-0.00366		-0.0604	
	(0.0330)		(0.0370)	
Negative volatility	0.0240		-0.00475	
	(0.0300)		(0.0207)	
Commitment (t-1)		-0.00327		0.0501
		(0.0532)		(0.0532)
Positive volatility (t-1)		-0.0257		-0.0913
		(0.0814)		(0.0620)
Negative volatility (t-1)		0.0319		0.0333
		(0.0530)		(0.0546)
Constant	12.18***	12.66***	0.503***	0.821***
	(0.225)	(0.217)	(0.150)	(0.147)
Observations	1,588	1,474	1,569	1,456
Countries	142	142	141	141

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Year dummies are excluded in the table because of size

Table 21: Economic infrastructure and services aid and its effect on mobile phone subscriptions and internet subscriptions, country fixed effects. Section 6.1

VARIABLES	Mobile phone		Internet	
Disbursement	0.0131		0.0481	
	(0.0283)		(0.0307)	
Positive volatility	-0.00784		-0.0701*	
	(0.0339)		(0.0394)	
Negative volatility	0.00250		-0.0128	
	(0.0289)		(0.0230)	
Commitment (t-1)		0.0180		0.0677
		(0.0501)		(0.0581)
Positive volatility (t-1)		-0.0392		-0.108
		(0.0739)		(0.0650)
Negative volatility (t-1)		-0.00652		0.0127
		(0.0533)		(0.0580)
Constant	12.26***	12.71***	0.438***	0.762***
	(0.0877)	(0.0823)	(0.0722)	(0.0748)
Observations	1,588	1,474	1,569	1,456
R-squared	0.808	0.794	0.779	0.766
Countries	142	142	141	141

Note: Clustered and robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Year dummies are excluded in the table because of size

Table 22: Models using different aid sectors and their effects on relevant microeconomic indicators, random effects estimations. Section 6.1

	Production sector		Multi-sector		Humanitarian	
VARIABLES	Manufacturing value added (%of GDP)		CO2 emissions (log)		Death rate (log)	
Disbursements	0.616		-0.000299		0.00929***	
	(0.538)		(0.00709)		(0.00241)	
Disbursement volatility (t-1, +)	-0.655		-0.00737		-0.00772**	
	(0.683)		(0.0158)		(0.00307)	
Disbursement volatility (t-1, -)	-0.546*		0.00888		-0.0109***	
	(0.322)		(0.0191)		(0.00386)	
Commitments (t-1)		0.0462		-0.000370		0.00600
		(0.206)		(0.00778)		(0.00479)
Commitment volatility (t-1, +)		-0.192		-0.00350		-0.00223
		(0.389)		(0.0191)		(0.00529)
Commitment volatility (t-1, -)		0.0581		-0.00126		-0.0111*
		(0.149)		(0.00907)		(0.00631)
Constant	12.61***	12.99***	-0.463***	-0.450***	2.148***	2.140***
	(0.656)	(0.653)	(0.0761)	(0.0753)	(0.0383)	(0.0377)
Observations	1,424	1,303	1,207	1,069	1,486	1,375
Number of country	133	132	140	140	139	139

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Year dummies are excluded in the table because of size

Table 23: Models using different aid sectors and their effects on relevant microeconomic indicators, country fixed effects estimations. Section 6.1

	Production sector		Multi-sector		Humanitarian	
VARIABLES	Manufacturing value added (% of GDP)		CO2 emmisions		Death rate	
Disbursements	0.694		9.00e-05		0.00908***	
	(0.542)		(0.00714)		(0.00245)	
Disbursement volatility (+)	-0.707		-0.00732		-0.00749**	
	(0.685)		(0.0157)		(0.00308)	
Disbursement volatility (-)	-0.675**		0.00812		-0.0107***	
	(0.329)		(0.0189)		(0.00388)	
Commitments (t-1)		0.0845		0.000387		0.00558
		(0.217)		(0.00786)		(0.00485)
Commitment volatility (t-1, +)		-0.232		-0.00160		-0.00175
		(0.402)		(0.0195)		(0.00534)
Commitment volatility (t-1, -)		0.0220		-0.00206		-0.0108*
		(0.165)		(0.00877)		(0.00633)
Constant	12.83***	13.20***	-0.470***	-0.458***	2.163***	2.153***
	(0.272)	(0.193)	(0.0161)	(0.0152)	(0.00942)	(0.00884)
Observations	1,424	1,303	1,207	1,069	1,486	1,375
R-squared	0.164	0.149	0.033	0.035	0.358	0.338
Number of countries	133	132	140	140	139	139

Note: Clustered and robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Year dummies are excluded in the table because of size

Table 24: Model following Hudson (2014) with the expansion of the time period. Random effects estimations. Section 6.2

	Social Infrastructure aid				Economic infrastructure aid			
VARIABLES	Death rate (log)		School completion (log)		Mobile Phone (log)		Internet (log)	
Disbursements	-0.00241**		0.00424		0.0646**		0.0789**	
	(0.00112)		(0.00327)		(0.0305)		(0.0335)	
Disbursement volatility (+)	0.00447***		-0.0128**		-0.0700*		-0.109**	
	(0.00135)		(0.00597)		(0.0361)		(0.0428)	
Disbursement volatility (-)	-0.00223*		0.00142		-0.0351		0.00834	
	(0.00129)		(0.0118)		(0.0247)		(0.0333)	
Aid commitments (t-1)		-0.00716***		-0.000825		0.0634		0.0832
		(0.00196)		(0.00226)		(0.0425)		(0.0603)
Commitment volatility (t-1, +)		0.00902***		-0.0215		-0.145***		-0.143**
		(0.00218)		(0.0198)		(0.0544)		(0.0654)
Commitment volatility (t-1, -)		0.00378*		0.0186		0.0399		0.0483
		(0.00212)		(0.0193)		(0.0813)		(0.0532)
Total Aid Disbursements	0.000161		-0.00213*		-0.00145		-0.00264	
	(0.000227)		(0.00117)		(0.00211)		(0.00192)	
Total Aid commitments (t-1)		0.000617*		0.000851		-0.000162		-0.00289
		(0.000331)		(0.000588)		(0.00213)		(0.00214)
Base value of dependent variable	0.918***	0.918***	0.770***	0.748***	0.842***	0.816***	0.734***	0.696***
	(0.0163)	(0.0176)	(0.0274)	(0.0283)	(0.0370)	(0.0417)	(0.0402)	(0.0463)
Constant	0.181***	0.177***	0.907***	1.055***	1.916***	2.782***	0.0868	0.432***
	(0.0348)	(0.0373)	(0.112)	(0.123)	(0.488)	(0.562)	(0.0613)	(0.0738)
Observations	1,608	1,477	699	627	1,504	1,389	1,528	1,413
Number of country	141	140	78	78	133	133	136	136

Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Year dummies are excluded in the table because of size

Table 25: Model following Hudson (2014) with the expansion of the time period. Country fixed effects estimations. Section 6.2

	Social Infrastructure aid				Economic infrastructure aid			
VARIABLES	Death rate (log)		School completion (log)		Mobile Phone (log)		Internet (log)	
Disbursements	-0.000412		-0.00344		0.0552*		0.0766**	
	(0.00173)		(0.00717)		(0.0309)		(0.0336)	
Disbursement volatility (+)	0.00247		-0.00269		-0.0556		-0.102**	
	(0.00174)		(0.00689)		(0.0359)		(0.0411)	
Disbursement volatility (-)	-0.00427**		0.00875		-0.0405		-0.00148	
	(0.00200)		(0.0146)		(0.0278)		(0.0382)	
Aid commitments (t-1)		-0.00614**		-0.0211*		0.0544		0.0836
		(0.00247)		(0.0116)		(0.0434)		(0.0607)
Commitment volatility (t-1, +)		0.00779***		0.00359		-0.130**		-0.136**
		(0.00248)		(0.0163)		(0.0549)		(0.0650)
Commitment volatility (t-1, -)		0.00285		0.0426		0.0417		0.0358
		(0.00282)		(0.0265)		(0.0880)		(0.0615)
Total Aid Disbursements	0.000208		-0.00336***		-0.00194		-0.00205	
	(0.000262)		(0.00120)		(0.00208)		(0.00196)	
Total Aid commitments (t-1)		0.000680*		0.000270		-0.000898		-0.00280
		(0.000353)		(0.000674)		(0.00214)		(0.00219)
Base value of dependent variable	-	-	-	-	-	-	-	-
Constant	2.145***	2.144***	3.941***	4.025***	12.38***	12.92***	0.433***	0.772***
	(0.0106)	(0.00988)	(0.0238)	(0.0308)	(0.0896)	(0.0767)	(0.0765)	(0.0768)
Observations	1,608	1,477	699	627	1,504	1,389	1,528	1,413
R-squared	0.314	0.318	0.348	0.281	0.816	0.803	0.783	0.770
Number of country	141	140	78	78	133	133	136	136

Note: Clustered and robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Year dummies are excluded in the table because of size