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Consequences of Aid Volatility for Macroeconomic Management and Aid Effectiveness

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Summary. — We conclude that individual aid sector volatility matters as well as total aid volatility. Easily, the most important contributor to total volatility is debt aid. The most volatile aid sectors *per se* include debt, industry, and humanitarian, and the least include education and health. In several sectors volatility appears to have peaked around 2006. Within individual countries, sector volatility is often corrected for in the following period, there are also sometimes knock-on effects on other sectors. Finally we examine the impact of sector aid, and aid volatility, on school completion rates, death rates, Internet usage, and mobile phone subscriptions.

Key words — CRS data base, aid volatility, sector aid, school completion rates, Internet users

1. INTRODUCTION

In recent years the impact of aid has been more favorably viewed in the literature. One negative aspect, however, has been aid volatility. Celasun and Walliser (2008) argue that unexpected aid shortfalls can force governments to disproportionately cut investment, including in human capital, while aid windfalls can disproportionately boost government consumption. The issue is relatively new to the literature. Pallage and Robe (2001) observed that aid is highly volatile with an average volatility of about 25% in African recipients and 29.5% in nonAfrican recipients. But perhaps it was the work of Bulíř and Hamann (2003, 2008) which had most early influence. They argued that the volatility of aid is (i) greater than that of government revenue, (ii) increasing over time, and (iii) procyclical (i.e., aid flows are inversely correlated with the level of government expenditures). Others have since built on and modified their conclusions. For example, Hudson and Mosley (2008a) find that volatility as a whole reduces growth given the level of aid, but not in a uniform way, differentiating between upside and downside volatility.

The majority of this work focuses on the totality of aid and its impact on key macroeconomic variables such as growth and government expenditure. Indeed this is also the case with the impact of aid itself. This is problematic. Why should health aid promote growth as equally as infrastructure aid, or vice versa with respect to targets such as infant mortality? Why, too, should volatility in these two sectors have the same impact? In this paper we seek to examine the nature of aid volatility as it relates to specific aid sectors. The database we use is the OECD's Creditor Reporting System (CRS) on the DAC website. This gives detailed information on aid disbursements, and, over a longer time, commitments, by 50 different sectors and subsectors. The data on the former are only available in a reliable form since 2002, but on a panel data basis this is now sufficient to allow meaningful analysis.

We are also interested in analyzing the impact of aid and aid volatility on specific, and in some cases fairly narrow, targets. Much of aid works not so much on the macroeconomy, although there may, for example, be exchange rate effects and policy environment effects for all aid, but rather on individual aspects of the economy. The road built between A and B facilitates trade between those two locations, a new hospital in location C facilitates healthcare in that location. Aid and aid volatility then impact on those projects, and, spillover effects apart, not on others. Now if there is a temporary switch in aid from healthcare to secondary education, this will not show up in the overall aid figures as volatility. The two will cancel each other out. But the healthcare project will have suffered from negative volatility and the education project from positive volatility. Hence a knowledge and understanding of aid sector volatility is important.

The paper proceeds as follows. In the next section, we review the literature, after which we discuss methodological and theoretical issues. Section 4 introduces the data. The empirical analysis follows. In this, we first decompose overall volatility into its constituent, sector parts. We then analyze the extent to which volatility is a dynamic process. Finally we examine the impact of the different aid sectors and associated volatility, on selected "micro targets," i.e., death rates, primary school completion rates, Internet usage, and mobile phone subscriptions. We then conclude the paper.

Table 1 defines some key concepts and the measures of volatility we make use of in this paper. We use several different measures of volatility as is appropriate to the purpose for which it is being used. But, as is clear from the table, they are all based on the same basic variable, the error term from a trend regression.

2. LITERATURE REVIEW

(a) *Measuring aid volatility*

The key initial work in this area is by Bulíř and Hamann (2003, 2008). Their empirical work (ibid. 2008) is based on a

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Table 1. *Key Definitions and Measures of Volatility*

Aid sector	This is the sector, or subsector, at which the aid is identified. Examples include health and program assistance. The term "sector" is the one employed on the CRS database. The different aid sectors we use are defined in the Appendix Table. They are chosen to be a comprehensive summary of total aid and also to reflect important social and productive sectors
Aid target	This is the specific identifiable variable on which the aid is designed to impact. It could be literacy rates, Internet usage, or at a local level, access to safe drinking water in a specific location
Measures of volatility	
Aid volatility (Table 2)	This represents the mean of the square of the error term from regressing aid disbursements on a trend and trend squared for each country. If predicted aid from this regression is negative, then a lower bound of zero is imposed and the error adjusted accordingly.
Mean adjusted CV of aid volatility (Table 2)	Mean adjusted CV (coefficient of variation) divides the standard error of aid volatility, as defined above, in each year by the mean value of aid in all years for each country. In some years, particularly for debt aid, disbursements are low, which would lead to very large CVs as normally calculated
The aid error term (Tables 3 and 4)	In Table 3 we represent the results of an "asymmetric VAR" based on the error term from the trend regression described above. This error term when squared is aid volatility, but is in its original form, more suitable for analysis in a VAR. This is also the basis for the positive and negative error terms used in Table 4 as described in the Table
The volatility measure Figures 1 and 2)	In Figures 1 and 2 the square root of aid volatility, as defined for Table 2, is regressed on a time trend and trend squared to fit trends in volatility. The square root was used as this more closely relates to the error itself and is less affected by outliers

sample of 76 countries from 1975 to 2003. They use a Hodrick–Prescott filter [1] to derive aid residuals from a trend. The square of those residuals then measure volatility in a specific year for an individual country. Critical in all this is how one scales aid, particularly when comparing volatilities between different variables. Bulíř and Hamann specify aid in US dollars and government revenue in domestic currency. Both series were transformed into proportions of nominal GDP, PPP GDP, and constant US dollars per capita. This was done in part to remove the impact of scale on variability—clearly a variable with a large mean will tend to have a large variance. But when this is done, the resultant ratio is affected by both the variance of GDP, the variance of the revenue variable, e.g., aid, and the covariance between the two. The normalization process that Hudson and Mosley (2008a) employed involved defining all variables as a proportion of their mean value for the whole estimation period.

In their original paper, Bulíř and Hamann found that volatility was highest in the countries which are most aid-dependent, which are generally the poorest and most vulnerable. However, in their 2008 paper, they found that the pattern to be more complex, and that both those countries that are little dependent on aid and those that are heavily dependent on aid display high aid volatility relative to government revenue. Hudson and Mosley (2008a) in a subsequent paper found no evidence for highly aid dependent countries to have higher volatility. Indeed, they concluded that volatility declines as the aid-revenue ratio increases. But to a large extent they were able to confirm many of the conclusions of Bulíř and Hamann, for example that the ratio of aid to government revenue volatility was in excess of one for almost all countries. The volatility of overseas aid was also noted to be severe, in relation to the volatility of domestic revenue, and increasing over time.

(b) *The causes and the macroeconomic impact of aid volatility*

Relatively little work has been done in analyzing the causes of volatility and how to reduce it. However, in a work which parallels that of Fielding and Mavrotas (2005), Hudson and Mosley (2008a) examined the link between volatility and donor concentration. There was a tendency for countries with high two-donor concentration ratios, i.e., the share of aid provided by the two biggest donors, to have relatively high volatility. They also found that in part, volatility was in response to recipient need, e.g., the famines in Ethiopia, but in part it was impacted on by donor coordination. Eifert and Gelb (2008) argued that the costs of aid volatility can be dramatically reduced by a flexible pre-commitment rule which adjusts aid flows in response to improvements or deteriorations in country performance ratings. They also suggested that a buffer stock of annual aid-financed spending might enable a corrective feedback loop, with the buffer depending on the size and variability of aid flows. Turning to self-insurance by recipient countries, Agenor and Aizenman (2010) studied the impact of aid volatility in a two-period model, with a first-period contingency fund financed through taxation. Unsurprisingly, an increase in aid volatility is shown to raise the optimal contingency fund. But if future aid also depends on the size of the contingency fund, the optimal recipient policy may entail no self-insurance.

Much more work has focused on the impact of volatility on the macroeconomy. For example, Lensink and Morrissey (2000) concluded that volatility damages the macroeconomic effectiveness of aid. Arellano, Bulíř, Lane, and Lipschitz (2009) examined the effects of aid and its volatility on consumption, investment, and the structure of production in the context of an inter-temporal, two-sector general equilibrium model. They argued that a permanent flow of aid mainly finances consumption rather than investment and that aid volatility results in substantial welfare losses to consumers, equivalent to 8% of the aid budget. Hudson and Mosley (2008b) analyzed the impact of aid volatility on GDP/GNP shares of expenditure. Negative volatility reduces investment and government expenditure shares and also the import share. This may be because of the type of aid which is subject to volatility, or because consumers are better able to absorb shocks by drawing on savings and/or borrowing than other agents. The results also suggest a limited ability of governments to rearrange revenue flows to reduce the impact of volatility upon their expenditure priorities. Positive volatility also reduces investment and government expenditure shares, as well as increasing consumers' expenditure share. These results suggest that absorptive capacity constraints particularly limit aid's effectiveness with respect to both investment and government spending. Rodrik (1990) also analyzed the problems revenue volatility can cause developing countries, while Mosley and Suleiman (2007) showed that the ability of the recipient coun-

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