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The Intensity of Conflict, Growth and Post-Conflict Recovery

by

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Abstract

Growth rates of per capita GDP are depressed by civil conflict to a degree that reflects its severity. Only the more severe conflicts – ones that affect at least half of the country by land area and/or cause more than 1,000 fatalities in at least one year – have a significant negative growth effect. Post-conflict recovery of output is enhanced by aid flows but this finding may be subject to endogeneity bias.

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The Intensity of Conflict, Growth and Post-Conflict Recovery

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1) Introduction

Civil war is bad for growth: it can destroy or displace human and physical capital, and disrupt normal trading relationships (Murdoch and Sandler, 2004). Using different estimators, data periods and country coverage, Barro (1989, 1991), Alesina et al. (1992), Easterly and Levine (1997), and Easterly (2001) all find a permanent negative effect of political violence and instability on long-run development, with estimates in the range of 1.6 – 3 percent slower annual economic growth.

It is natural to think that the more intense and long-lasting a civil conflict, the more harmful to growth it will be. Murdoch and Sandler (2004) investigate duration effects and find only limited evidence of them. We are not aware of any previous study of the impact of the severity of civil war on growth. In this paper we investigate this issue, using data on annual fatalities and the geographical extent of the conflict. We find that growth falls significantly only during the most severe conflicts.

A long-run loss of output from civil wars is not inconsistent with some degree of post-conflict recovery, in the sense that output may grow faster in the immediate post-conflict period than if there had never been a conflict. So long as the recovery is not strong enough to return output to the path that it would have followed in the absence of conflict, there will be a permanent output loss. Chen *et al.* (2008), Collier and Hoeffler (2004) and Elbadawi *et al.* (2008) all find some evidence of post-conflict recovery in growth, although these results are sometimes based on only a limited sample of conflict episodes. The role of aid and other policies after the end of conflict has also been extensively discussed (Collier and Hoeffler, 2004; Demekas et al., 2002; Elbadawi et al., 2008). We re-examine the evidence for post-conflict recovery, and the role of aid in it, taking into account the severity of the preceding conflict.

The paper is organised as follows. The data are discussed in Section 2. Section 3 presents our analysis of conflict severity and its impact on growth. Section 4 discusses post-conflict recovery, and the role of aid in post-conflict recovery is analysed in Section 5. Some robustness tests are reported in Section 6, and Section 7 concludes.

2) The Data

We examine the effect of the severity of civil conflict on real per capita GDP growth over as large a sample of countries as possible over the period 1950-2004. Data on the geographical extent of conflicts and fatalities for each country in each year are provided by the Political Instability Task Force (PITF). The PITF records whether the proportion of a country's surface area affected by conflict in any given year is less than 10%, between 10% and 25%, between 25% and 50%, or greater than 50%. The number of battle-related deaths is categorized as follows: below 1,000, between 1,000 and 10,000, or greater than 10,000. In translating these figures into five-year episodes, we use the maximum annual value of these measures of extent and fatalities. There are other data sets on conflict, and that of the Peace Research Institute, Oslo (PRIO), also contains information on conflict severity. Lacina and Gleditsch (2005) have calculated annual battle deaths for this data set up to 2002, and these data have been used to investigate the severity of conflicts by Lacina (2006) and Lujala (2009). The PRIO data on the geographical extent of conflict are given in terms of a radius around an epicentre rather than a proportion of the country, which is less convenient for present purposes.

Our sample consists of 2013 five-year episodes from 182 countries. Out of these 182 countries there are 70 which experienced at least one civil war. Civil wars tend to start at a local level and then spread to a wider area, so that the number of fatalities and the extent of these civil wars vary over time. Panel A of Table 1 provides some descriptive statistics about the distribution of the extent of civil war in our dataset. There are 74 episodes, in 40 countries, in which a conflict has affected more than half the country by surface area. More than 10,000 annual fatalities were recorded for 40 episodes in 24 countries. In over 86% of episodes no conflict was recorded, but Table 1 shows that if a conflict occurred there was an almost 50% chance that it affected more than a quarter of the country, and a more than 25% chance of more than 1,000 fatalities in any year.

Table 1: Descriptive Statistics for the Extent and Fatalities

Panel A: Extent of Civil War			
Extent of Civil War	Freq	Percent	# Countries
No Conflict	1,745	86.69	182
Less than 25% of the Country	139	6.91	51
Between 25% & 50% of the Country	55	2.73	29
More than 50% of the Country	74	3.68	40
Total	2,013	100.00	
Panel B: Number of Fatalities			
Number of Fatalities	Freq	Percent	# Countries
No Conflict	1,749	86.89	182
Less than 1,000 fatalities	189	9.39	67
Between 1,000 and 10,000 fatalities	35	1.74	22
More than 10,000 fatalities	40	1.99	24
Total	2,013	100.00	

3) Economic Growth and Conflict Severity

The simplest statistical analysis of the relationship between real per capita output growth and civil war is to regress growth on measures of civil conflict, after allowing for fixed country and time effects. These fixed effects may be assumed to capture the fact that some countries have consistently grown faster than others, and that the growth rate of the world economy has varied over time, without modelling explicitly the reasons for this. We show later that replacing fixed country effects with the variables typically used in cross-country growth regressions produces similar results. Growth data are available for 1539 five-year episodes.

Table 2 shows a two-way fixed effects regression of per capita growth on the geographical extent of civil conflict (Model 1) and fatalities (Model 2), using dummy variables in each case for the three categories. The two-way fixed effects model allows the intercept to differ for each country and time period, so it measures the effect of conflict severity relative to the country and period average. It can be seen that the estimated negative effect on growth increases monotonically with the degree of severity, whether severity is measured by extent or fatalities. At the lowest level of severity the negative effect of conflict is not statistically significant, but it is significant both statistically and economically at the highest level of severity.

Table 2: Conflict Severity and Growth

	Dependent Variable: GDP per Capita Growth (% per annum)	
	Model 1	Model 2
Estimation Method:	FE	FE
Extent < 25%	-0.00342	
	(-0.65)	
25% < Extent < 50%	-0.0128**	
	(-2.16)	
Extent > 50%	-0.0367***	
	(-3.19)	
Fatalities < 1,000		-0.00756
		(-1.56)
1,000 < Fatalities < 10,000		-0.0193*
		(-1.92)
Fatalities > 10,000		-0.0503***
		(-2.98)
Constant	0.0202***	0.0204***
	(7.24)	(7.30)
Time Dummies	Yes	Yes
Observations	1539	1539
Countries	182	182
R-squared	0.12	0.13

Robust t statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In Table 3 we show that the picture is much the same if we include a variety of explanatory variables that have considerable cross-country variation in place of the country fixed effects: per capita GDP in the previous five-year period, population growth, the ratios of investment, international trade and government consumption to GDP, and dummies for Africa and Asia. Data on these are from Penn World Tables 6.3. Because the results are similar to Table 2, we use the more parsimonious two-way fixed effects model in the rest of the paper.

It is not clear from the results so far whether geographical extent and fatalities are pure substitutes as measures of the effect of the severity of civil conflict on growth, or whether they measure different dimensions of severity, each of which has separate growth effects. Table 4 is a cross-tabulation of fatalities and extent. It may be seen that the correlation between these two alternative measures of severity is not terribly close. There are 74 country-quinquennium episodes where more than half the country is affected but, in 30 of these, fatalities do not exceed 1,000 annually and, in a further 20, fatalities do not exceed

10,000 annually. Of the 40 episodes where fatalities exceed 10,000, in eleven the extent is below 25% and in a further five extent is below 50%. Thus, of the 90 episodes where *either* extent or fatalities is in the highest category, *both* are in the highest category in only 24 cases, and both are in one of the two highest categories in 51 cases.

In Table 5 we address the issue of whether the fit is improved by including both fatalities and extent together rather than separately in the regression. In Model 1 we include them in the following way: Extent is counted as two if it is greater than 50%, as one if it is between 25% and 50%, and as zero otherwise; Fatalities are counted as two if they exceed 10,000, as one if they are between 1,000 and 10,000, and as zero otherwise. This formulation reflects the size of the estimated coefficients in Table 2, together with the insignificance of the lowest categories in that regression. In this model both Extent and Fatalities measured in this way are significant at the 5% level, so each adds something as an explanation of the growth-depressing effects of civil conflict.

In Model 2 of Table 5 the dummies for each of the two highest categories of Extent and Fatalities are included separately. The highest category of each has a significant negative coefficient, but the dummy for the second highest category, although still negative, is not significant for either Extent or Fatalities. This suggests that the growth effects of civil conflict are largely confined to those cases where 50% of the country is affected, and/or there are more than 10,000 fatalities in a year. It seems that both Extent and Fatalities are important in determining the growth effects of conflict. To test this in another way, we construct a dummy for a severe conflict (*SEVERE*) which takes the value of one only if Extent or Fatalities is in the highest category (i.e. if the observation falls in either the last column or last row of Table 4), and zero otherwise. Model 3 of Table 5 just includes this new dummy, which is significant at the 1% level with an estimated coefficient of –0.031. When a dummy for the incidence of conflict is added together with *SEVERE*, as in Model 4 of Table 5, it is insignificant.

Table 3: Conflict Severity and Growth without Country Fixed Effects

	Dependent Variable: GDP per Capita Growth (% per annum)	
	Model 1	Model 2
Estimation Method: OLS		
Log GDP pc (t – 1)	-0.00682***	-0.00647***
	(-4.47)	(-4.20)
Log Investment/GDP	0.0157***	0.0155***
	(6.05)	(5.89)
Population Growth	-0.310*	-0.337**
	(-1.93)	(-2.19)
Log (1 + Trade/GDP)	0.000868	0.00102
	(0.56)	(0.66)
Log (1+ Government Consumption/GDP)	-0.00731***	-0.00656***
	(-3.26)	(-2.89)
Asia Dummy	0.0123***	0.0129***
	(3.87)	(4.06)
Africa Dummy	-0.00308	-0.00256
	(-0.79)	(-0.66)
Extent < 25%	-0.00159	
	(-0.43)	
25% < Extent < 50%	-0.00958	
	(-1.56)	
Extent > 50%	-0.0350***	
	(-3.30)	
Fatalities < 1,000		-0.00342
		(-0.98)
1,000 < Fatalities < 10,000		-0.0213**
		(-2.11)
Fatalities > 10,000		-0.0490***
		(-2.88)
Constant	0.0513***	0.0474***
	(3.10)	(2.79)
Time Dummies	Yes	Yes
Observations	1365	1365
Countries	182	182
R-squared	0.21	0.22

Robust t statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Cross-Correlation of Extent and Fatalities

			Number of Fatalities		
Extent of Conflict	No Conflict	Fatalities < 1,000	1,000< Fatal<10,000	Fatalities > 10,000	Total
No Conflict	1,745	0	0	0	1,745
Extent < ¼	0	118	10	11	139
¼ <Extent< ½	0	45	5	5	55
Extent > ½	0	30	20	24	74
	1745	193	35	40	2013

Table 5: Including Fatalities and Extent Simultaneously

Dependent Variable: GDP per Capita Growth (% per annum)				
	Model 1	Model 2	Model 3	Model 4
Estimation Method: FE				
Extent of Civil War (0 – 2) Scale	-0.0111**			
	(-2.35)			
Number of Fatalities (0 – 2) Scale	-0.0155**			
	(-2.19)			
25% < Extent of War < 50%		-0.00836		
		(-1.42)		
Extent of War > 50%		-0.0245**		
		(-2.26)		
1000 < Number of Fatalities < 10000		-0.00466		
		(-0.42)		
Number of Fatalities > 10000		-0.0335**		
		(-2.21)		
Severe Conflict			-0.0313***	-0.0280***
			(-3.31)	(-2.96)
Incidence of Civil War				-0.00497
				(-1.08)
Constant	0.0206***	0.0207***	0.0204***	0.0203***
	(7.35)	(7.40)	(7.27)	(7.26)
Time Dummies	Yes	Yes	Yes	Yes
Observations	1539	1539	1539	1539
Countries	182	182	182	182
R-squared	0.13	0.13	0.12	0.12

Robust t statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4) Post-Conflict Recovery

There is some evidence, from relatively small samples, that economies experience supra-normal growth immediately after the end of a civil war. Collier and Hoeffler (2004, Table 1), using data from 34 post-conflict episodes between 1974 and 1997, find that a dummy for the first two post-conflict four-year periods has a positive coefficient in a growth regression, but it is significant only at the 10% level. Chen *et al*. (2008, Table 4) find positive post-conflict growth effects that are significant at the 5% level relative to a regional control group in a smaller sample of 24 post-conflict episodes. Elbadawi *et al*. (2008, Table 5), using a sample

of 39 post-conflict episodes, report significant additional growth of 2.0 % p.a. in the first five-year period after the end of a conflict, but significantly *lower* growth (by 2.8% p.a.) in the subsequent five-year period.[1]

In order to test whether growth exceeds normal peacetime rates once the conflict ends, we construct three post-conflict dummies. The first dummy (Post-Conflict1) is equal to one in the first five-year period in which there is no conflict, and zero otherwise; the second dummy (Post-Conflict2) is equal to one in the subsequent five-year period, and zero otherwise; and finally the third dummy (Post-Conflict3) is equal to one for the third five-year episode without conflict, and zero otherwise. In total we have 64 observations for Post-Conflict1, 38 observations for Post-Conflict2, and 23 observations for Post-Conflict3.

Table 6 presents a two-way fixed effects model of post-conflict effects on growth. In Model 1 the post-conflict effects are not statistically significant, but the point estimates are arguably economically significant, with estimated additional growth of +0.9% p.a. in each of the first two post-conflict periods. The small sample of post-conflict periods means that additional growth of about 1.5% p.a. is required for statistical significance, which is a relatively high threshold.

A possible criticism of this model is that, according to our previous results, unless the conflict was severe, there is nothing to recover from. In Model 2 of Table 6 we construct a dummy for Post-Severe-Conflict periods. This dummy takes the value of one only if the matching Post-Conflict dummy is one *and* the conflict was severe, as previously defined, during either of the last two five-year episodes of the conflict. The number of Post-Severe-Conflict episodes is 31, 15 and 9 for the first, second and third five-year periods following the end of the conflict. The results for Model 2 in Table 6 show a larger recovery after severe conflicts (+1.0% p.a. in the first period, +1.6% in the second and + 1.5% in the third), but these figures are still not statistically significant, because the reduced sample implies that an effect of +2.0% p.a. or more is required for statistical significance.

[1] In these studies no dummies for conflict periods are included, and it is not always clear that the sample excludes conflict periods. If conflict periods are included in the sample, then the estimated post-conflict effect, relative to peacetime, is exaggerated because it is estimated relative to a mixture of peace and conflict periods.

Table 6: Investigating Post-Conflict Recovery

Dependent Variable: GDP per Capita Growth (% per annum)		
	Model 1	Model 2
Estimation Method: FE		
Severe Conflict	-0.0290***	-0.0288***
	(-3.13)	(-3.23)
PostConflict1 (yr=1 to yr = 5)	0.00884	
	(1.15)	
PostConflict2 (yr=6 to yr = 10)	0.00903	
	(1.27)	
PostConflict3 (yr=11 to yr = 15)	0.000400	
	(0.04)	
PostConflict1 After Severe Conflict		0.00988
		(0.69)
PostConflict2 After Severe Conflict		0.0156
		(1.21)
PostConflict3 After Severe Conflict		0.0146
		(1.55)
Constant	0.0204***	0.0202***
	(7.26)	(7.25)
Time Dummies	Yes	Yes
Observations	1539	1539
Countries	182	182
R-squared	0.12	0.12

Robust t statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In short, these results imply some economically significant super-normal growth after the end of a conflict, particularly in the case of severe conflicts, but because of the small sample the additional growth compared with normal peacetime periods is not statistically significant.

5) Post-Conflict Recovery and Aid

Whether overseas development aid (ODA) enhances economic growth has been the subject of much discussion (see Roodman, 2007, and the literature cited therein). There have also been a few studies of aid in post-conflict periods. Collier and Hoeffler (2004) present evidence that aid is particularly effective in promoting growth in post-conflict situations. Demekas *et al.* (2002) and Elbadawi *et al.* (2008) claim that there tends to be a surge of aid in post-

conflict situations. This claim rather ignores the evidence that aid flows *during* conflicts tend to be even higher, as we indicate below.

Table 7 reports statistics for the share of aid allocated in post-conflict economies. In normal (i.e. not post-conflict) periods of peace, on average countries receive 4.6% of GDP in aid, of which 1.4% of GDP is multilateral aid, compared with 6.9% and 2.2% respectively in conflict periods, and even more in times of severe conflict. Aid appears to decline gradually after the end of a conflict.

Table 7: Some Descriptive Statistics on Aid and Conflict (1960-2004)

ODA – All Donors	Obs	Mean	Std. Dev.	Min	Max
Peace (Not Post-Conflict)	1082	4.60	8.54	-0.22	78.53
Conflict	248	6.89	13.12	-0.58	92.53
Severe Conflict	79	12.23	20.87	0	92.53
First Post-Conflict Period	60	5.11	7.87	0	52.76
Second Post-Conflict Period	35	4.56	5.36	0	18.39
Third Post-Conflict Period	23	3.25	5.05	0	28.86
ODA – Multilateral	Obs	Mean	Std. Dev.	Min	Max
Peace (Not Post-Conflict)	1082	1.37	2.91	-0.074	28.31
Conflict	248	2.19	5.54	-0.181	72.92
Severe Conflict	79	3.76	9.06	-0.181	72.92
First Post-Conflict Period	60	1.77	2.93	0	18.54
Second Post-Conflict Period	35	1.60	2.15	0	7.26
Third Post-Conflict Period	23	0.95	2.04	0	7.07

The problem with the statistics presented in Table 7 is that they take no account of a possible correlation between a country's aid receipts and its propensity for civil conflict. If poorer countries are more prone to conflict, then Table 7 will exaggerate the extent to which aid to a *given* country tends to increase in the event of conflict. Accordingly Table 8 shows a fixed country effects regression of aid flows against conflict and post-conflict dummies. The only dummies that are statistically significant are those for a severe conflict. Relative to normal peacetime periods, neither total (bilateral plus multilateral) aid nor just multilateral aid is significantly different in post-conflict periods or in periods of mild conflict. The severe

conflict dummy in Table 8 is positive and significantly different from zero at the 1% level for total aid and at the 10% level for multilateral aid.

Table 8: A Fixed Effects Regression for Aid

	Dependent Variable: ODA/GDP	
	All Donors	***Multilateral***
Estimation Method: FE		
Incidence of Conflict	0.340	0.155
	(0.39)	(0.45)
Severe Conflict	7.332***	2.032*
	(3.02)	(1.71)
PostConflict1 (yr=1 to yr = 5)	0.176	0.321
	(0.15)	(0.67)
PostConflict2 (yr=6 to yr = 10)	-0.601	0.276
	(-0.53)	(0.57)
PostConflict3 (yr=11 to yr = 15)	-0.533	0.0144
	(-0.49)	(0.03)
Time Dummies	Yes	Yes
Observations	1448	1448
Countries	183	183
Within Variance (sigma_e)	8.12	2.27
Between Variance (sigma_u)	6.62	2.70
R-squared	6.91	0.11

Robust t statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Even though aid is not higher in post-conflict situations, it might still be especially effective then. In order to evaluate the unconditional effect of aid in post-conflict economies, in Table 9 we interact post-conflict dummies with the share of ODA in terms of GDP. We first interact post-conflict dummies with the total share of ODA (bilateral and multilateral) and then we distinguish between bilateral and multilateral ODA. Data for net ODA at current prices are collected from the OECD statistics. The WDI (World Bank Development Index) represents the source for countries' GDP at current price.

In Model 1 the total share of ODA has a significant and positive effect on economic growth in the second post-conflict period only (years 6 to 10 after the conflict). In average, a one percent increase in the share of aid fosters economic growth by a 0.24 percent. Bilateral aid in Model 2 has also a significant and positive effect in the second post-conflict period, while

Multilateral aid is significant in all post-conflict periods (even though its effect in the first post-conflict period is only marginally significant at a 10 percent level). In Model 4 we include bilateral and multilateral aid together and, consistent with the literature in the field (e.g. Alesina and Dollar, 2000; Minoiu and Reddy, 2009), we find that multilateral aid dominates bilateral aid[2].

In Table 10 we repeat the same exercise but instead of interactions with post-conflict dummies we now interact aid with post-severe conflict dummies. The total share of aid in Model 1 is now significant in the third post-severe conflict period too (years 11 to 15). The average yearly effect of aid on economic growth in the third post-severe conflict is equal to 0.19 percent (per a one percent increase in aid). Also Bilateral aid is now significant in the second and third post-severe conflict periods (Model 2), while multilateral aid in Model 3 is significant in the third post-sever conflict period only. When we enter bilateral and multilateral aid together we find that multilateral aid dominates in the first and third post severe conflict periods, but bilateral aid dominates in the second post-conflict period (Model 4).

[2] Significance levels are smaller because of the correlation between the two forms of aid.

Table 9: Aid and Growth in Post-Conflict Periods

Dependent Variable: GDP per Capita Growth (% per annum)				
	Model 1	Model 2	Model 3	Model 4
Estimation Method: FE				
Severe Conflict	-0.0251***	-0.0285***	-0.0231***	-0.0245***
	(-3.32)	(-3.07)	(-3.22)	(-3.41)
Net ODA/GDP – All Donors	-0.0540			
	(-1.22)			
PostConflict1* ODA All Donors	0.107			
	(0.86)			
PostConflict2 * ODA All Donors	0.237***			
	(3.13)			
PostConflict3* ODA All Donors	-0.0840			
	(-0.63)			
Net ODA/GDP – Bilateral		-0.0239		0.0299
		(-0.85)		(0.93)
PostConflict1* Bilateral ODA		0.105		-0.402
		(0.70)		(-0.88)
PostConflict2 * Bilateral ODA		0.348***		0.226
		(3.66)		(1.55)
PostConflict3*Bilateral ODA		-0.221		-0.818*
		(-1.00)		(-1.83)
Net ODA/GDP – Multilateral			-0.263*	-0.286*
			(-1.83)	(-1.93)
PostConflict1* Multilateral ODA			0.431	1.076
			(1.04)	(1.16)
PostConflict2 * Multilateral ODA			0.631***	0.302
			(2.66)	(0.93)
PostConflict3* Multilateral ODA			0.243	1.397**
			(1.49)	(2.43)
Constant	0.0312***	0.0304***	0.0306***	0.0300***
	(9.82)	(10.02)	(9.69)	(9.44)
Time Dummies	Yes	Yes	Yes	Yes
Observations	1406	1406	1406	1406
Countries	182	182	182	182
R-squared	0.14	0.13	0.16	0.17

Robust t statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Aid and Growth in Post-Severe-Conflict Periods

Dependent Variable: GDP per Capita Growth (% per annum)				
	Model 1	Model 2	Model 3	Model 4
Estimation Method: FE				
Severe Conflict	-0.0258***	-0.0289***	-0.0240***	-0.0248***
	(-3.39)	(-3.11)	(-3.29)	(-3.48)
Net ODA/GDP – All Donors	-0.0531			
	(-1.18)			
Post-Severe1* ODA All Donors	0.112			
	(0.70)			
Post-Severe2 * ODA All Donors	0.260*			
	(1.90)			
Post-Severe3* ODA All Donors	0.186***			
	(2.62)			
Net ODA/GDP – Bilateral		-0.0217		0.0237
		(-0.76)		(0.74)
Post-Severe1* Bilateral ODA		0.101		-1.256
		(0.53)		(-1.47)
Post_Severe2 * Bilateral ODA		0.490***		1.680***
		(3.22)		(4.24)
Post-Severe3*Bilateral ODA		0.440**		-0.352
		(2.51)		(-0.15)
Net ODA/GDP – Multilateral			-0.261*	-0.271*
			(-1.81)	(-1.86)
Post-Severe1* Multilateral ODA			0.484	2.614*
			(0.89)	(1.78)
Post-Severe2 * Multilateral ODA			0.617	-1.821***
			(1.60)	(-3.46)
Post-Severe3* Multilateral ODA			0.516***	0.805
			(4.91)	(0.40)
Constant	0.0311***	0.0304***	0.0305***	0.0300***
	(9.76)	(9.98)	(9.63)	(9.37)
Time Dummies	Yes	Yes	Yes	Yes
Observations	1406	1406	1406	1406
Countries	182	182	182	182
R-squared	0.14	0.13	0.16	0.17

Robust t statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

6) Robustness Checks

In this section we test whether the effectiveness of aid in post-severe conflict is robust to alternative estimators and specifications. In Table 11 we re-estimate Table 10, replacing the country fixed effects with a set of explanatory variables. This makes little difference to the results. In Model 1 ODA significantly affects economic growth in the second post-severe-

conflict period by approximately 0.35 percent *per annum* for each one percent of GDP increase in aid, and by 0.24 percent in the third post-severe-conflict period. Both Bilateral ODA (Model 2) and Multialteral ODA (Model 3) are associated with significantly higher economic growth in the second and third post-severe-conflict periods. The estimated effects of Bilateral and Multilateral ODA account respectively for roughly 0.60 percent and 0.74 percent in the second post-conflict period, and for approximately 0.48 percent and 0.56 percent in the third period. Because of the upward bias of OLS estimates in dynamic panels with small T and large N, and of the downward bias of FE estimators, we should expect that consistent estimates for ODA lie between those in Tables 10 and 11.

The possible endogeneity of ODA represents a second potential source of bias in our estimates. In order to deal with this, we re-estimate Table 10 using a Two-Step GMM estimator, with the lagged values of variables as instruments for endogenous regressors (together with lagged values of the dependent variable). Table 12 shows the results for this alternative estimator. Severe conflict has significant negative effects on growth, as in previous tables, but the results for aid in post-conflict recovery are more ambiguous. Although the estimated coefficients on ODA in post-severe conflict are much larger than OLS and FE estimates, z-statistics fail to reject the null. For example, coefficients on Multilateral ODA in Model 3 are 0.93 percent for the first post-severe-conflict period, 1.13 in the second period, and 2.53 in the third period, against 0.49, 0.73, and 0.56 respectively for OLS estimates. Only Multilateral ODA in the second post-conflict period (Model 3) retains some significance (significant at a 10 percent level), increasing economic growth by an approximate 1.13 percent for each one percent of GDP increase in the share of ODA. However, the size of standard errors seems to suggest that the insignificant effect of ODA in Table 12 may be imputable to a loss of efficiency relative to OLS.

Table 11: Post-Severe Conflict and ODA (OLS Estimates)

Dependent Variable: GDP per Capita Growth (% per annum)			
Estimation Method: OLS	Model 1	Model 2	Model 3
Log GDP (t -1)	-0.00991***	-0.00840***	-0.0106***
	(-5.41)	(-5.23)	(-5.48)
Log (Investment/GDP)	0.0180***	0.0175***	0.0171***
	(6.45)	(6.43)	(6.42)
Severe Conflict Dummy	-0.0288***	-0.0305***	-0.0286***
	(-3.61)	(-3.43)	(-3.88)
Log(1+Trade/GDP)	0.00189	0.00172	0.00177
	(1.29)	(1.14)	(1.20)
Log (1+ Gov. Consumption/GDP)	-0.00404	-0.00533**	-0.00549**
	(-1.37)	(-2.13)	(-2.18)
Population Growth	-0.338**	-0.323*	-0.412***
	(-2.28)	(-1.96)	(-3.76)
Africa Dummy	0.00168	-0.000288	0.00295
	(0.42)	(-0.07)	(0.72)
Asia Dummy	0.0103***	0.0111***	0.0106***
	(3.20)	(3.49)	(3.32)
	All Donors	Bilateral	Multilateral
ODA/GDP	-0.100***	-0.0831***	-0.335***
	(-2.60)	(-3.14)	(-2.96)
Post-Severe 1*ODA/GDP	0.122	0.111	0.491
	(1.10)	(0.78)	(1.26)
Post-Severe 2* ODA/GDP	0.345***	0.603***	0.738**
	(2.81)	(4.14)	(1.98)
Post-Severe 3 * ODA/GDP	0.240***	0.478***	0.562***
	(5.34)	(3.57)	(6.62)
Constant	0.0742***	0.0665***	0.0861***
	(4.63)	(3.96)	(5.16)
Time Dummies	Yes	Yes	Yes
Observations	1299	1299	1299
R-squared	0.26	0.24	0.28
Number of Countries	182	182	182

Robust t statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 12: Post-Severe Conflict and ODA (2-Step GMM Estimates)

Dependent Variable: GDP per Capita Growth (% per annum)			
Estimation Method: 2-step System GMM	Model 1	Model 2	Model 3
Log GDP (t -1)	-0.0174***	-0.0164***	-0.0201***
	(-3.78)	(-3.85)	(-4.48)
Log (Investment/GDP)	0.0306***	0.0305***	0.0324***
	(4.73)	(4.81)	(4.65)
Severe Conflict Dummy	-0.0303**	-0.0283*	-0.0405***
	(-2.05)	(-1.85)	(-2.63)
Log(1+Trade/GDP)	-0.00366	-0.00195	-0.00258
	(-0.79)	(-0.41)	(-0.54)
Log (1+ Gov. Consumption/GDP)	-0.00135	-0.00142	-0.00307
	(-0.19)	(-0.20)	(-0.45)
Population Growth	-0.358	-0.314	-0.447**
	(-1.54)	(-1.04)	(-2.49)
Africa Dummy	0.00247	0.000760	0.00187
	(0.29)	(0.07)	(0.25)
Asia Dummy	0.00146	0.00239	0.000487
	(0.21)	(0.32)	(0.08)
	All Donors	Bilateral	Multilateral
ODA/GDP	-0.119***	-0.137**	-0.329***
	(-2.69)	(-2.15)	(-3.47)
Post-Severe 1*ODA/GDP	0.206	0.220	0.930
	(0.83)	(0.60)	(1.32)
Post-Severe 2* ODA/GDP	0.121	0.0816	1.131*
	(0.34)	(0.13)	(1.80)
Post-Severe 3 * ODA/GDP	2.227	4.189	2.530
	(0.98)	(0.87)	(1.22)
Constant	0.117**	0.0999*	0.137***
	(2.48)	(1.90)	(2.98)
AR(1) Test – p-values	0.000	0.000	0.000
AR(2) Test – p-values	0.491	0.420	0.638
Hansen Test – p-values	0.233	0.264	0.194
Time Dummies	Yes	Yes	Yes
Observations	1299	1299	1299
Number of Countries	182	182	182

Robust z statistics (Windmeijer, 2005) in parentheses, *** p<0.01, ** p<0.05, * p<0.1
GMM Instruments: L(2/3) Xt and $\Delta X(t-1)$
IV Instruments: Population Growth, Time, Africa, and Asia Dummies

7) Conclusions

The negative growth effects of conflict are largely confined to the more severe cases where fatalities exceed ten thousand annually and/or more than half the country is affected. The point estimates suggest economically significant post-conflict recovery, in the sense of

growth that exceeds the rate of normal peacetime, although wide confidence intervals mean that the difference is not statistically significant. Consistent with research in the field we find some evidence that bilateral and multilateral aid enhance post-conflict growth, but this finding may be subject to endogeneity bias.

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Appendix A1: Countries, Episodes of Conflict, and Extent

	Extent of Conflict					Extent of Conflict			
Country	1	2	3	Total	Country	1	2	3	Total
Afghanistan	0	0	6	6	Lesotho	1	0	0	1
Albania	0	0	1	1	Liberia	2	0	1	3
Algeria	2	0	2	4	Mali	2	0	0	2
Angola	1	0	5	6	Moldova	1	0	0	1
Azerbaijan	2	0	0	2	Morocco	3	0	0	3
Bangladesh	4	0	0	4	Mozambique	1	1	2	4
Bosnia and Herzegovina	0	0	2	2	Nepal	0	1	1	2
Burundi	1	1	3	5	Nicaragua	2	0	1	3
Cambodia	1	2	2	5	Nigeria	4	0	0	4
Chad	6	0	0	6	Oman	2	0	0	2
China	4	0	1	5	Pakistan	6	1	0	7
Colombia	4	1	4	9	Papua New Guinea	3	0	0	3
Congo, Dem. Rep.	3	0	3	6	Peru	2	2	0	4
Congo, Republic of	0	0	3	1	Philippines	3	3	1	7
Cote d`Ivoire	0	0	1	1	Romania	0	1	0	1
Croatia	0	0	2	2	Russia	3	0	0	3
Cuba	0	0	3	1	Rwanda	2	2	1	5
Cyprus	0	1	1	2	Senegal	2	0	0	2
Djibouti	0	0	1	1	Serbia	0	1	1	2
Dominican Republic	1	0	0	1	Sierra Leone	0	0	3	3
Egypt	0	2	0	2	Somalia	1	1	2	4
El Salvador	0	4	0	4	South Africa	3	1	0	4
Ethiopia	6	1	2	9	Sri Lanka	4	1	0	5
Georgia	0	0	1	1	Sudan	2	7	0	9
Guatemala	1	3	3	7	Syria	2	0	0	2
Guinea	1	0	0	1	Tajikistan	0	1	1	2
Guinea-Bissau	0	0	1	1	Thailand	2	1	1	5
Hungary	0	0	1	1	Turkey	4	1	0	5
India	8	0	0	8	Uganda	4	2	0	6
Indonesia	11	0	0	11	United Kingdom	3	0	0	3
Iran	2	0	1	3	Vietnam	1	0	4	5
Iraq	1	8	1	10	Yemen	3	1	2	6
Israel	0	4	0	4	Zambia	1	0	0	1
Jordan	0	1	0	1	Zimbabwe	3	1	0	4
Kenya	2	1	0	3					
Laos	1	0	3	4					
Lebanon	4	0	1	5	Total	139	55	74	268