The End of an Era? The Medium- and Long-term Effects of the Global Crisis on Growth in Low-Income Countries

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Abstract

This paper investigates the medium- and long-term growth effects of the global financial crises on LICs. Using several methodological approaches, including impulse response function analysis, growth spells techniques and panel regressions, we show that external demand (ED) shocks are not historically associated with sharp declines in output growth. Given existing evidence that LICs were primarily impacted by such a shock, our analysis provides some optimism on the chances that LICs will avoid a protracted period of slow growth. However, we also show that there seems to be persistent output losses associated with ED shocks in the medium-run. In terms of policy recommendation, our analysis provides evidence that countries with lower deficits, lower debt, more flexible exchange rate regimes, and higher stock of international reserves are more likely to dampen the effects of an ED shock on growth.

JEL Classification Numbers: O11, O19, O23, O47

Keywords: Global financial crisis, external shocks, low-income countries, medium- and long- term growth, impulse response functions, growth spells, panel growth regressions.

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I. INTRODUCTION

Low-income countries (LICs) as a group have enjoyed relatively rapid growth in recent years. Since 1995, for example, sub-Saharan Africa has grown faster than developed countries, after many years of poor average performance (IMF 2008, and Collier et al., 2008). This growth has not been sufficient to put LICs on the path to meeting most of the Millennium Development Goals (MDGs), but it has reduced poverty and supported better health and education outcomes in many countries (Global Monitoring Report, 2010).

Estimates for 2009 suggest that the global financial crisis had already substantially slowed growth in most developing countries, thrusting millions back into poverty and setting back efforts to achieve the MDGs. If, in addition, the crisis has longer-run implications, that is, if it knocks countries off their track of solid medium-long-term growth, it will be a much greater disaster. The question is especially pressing insofar as the growth resurgence since the mid-1990s has been associated with generally supportive external conditions: strong global growth, stable or rising commodity prices, and increasing inflows of external capital. Thus, in considering the implications and policy response to the current crisis, it is important to consider not only the short-run implications of the crisis and policy responses, but also the risks to and the way to sustain medium-term growth.

In principle, a temporary negative shock to external demand or the terms of trade in a standard neoclassical growth model would be followed by a quick reversion to the steady state level of income, implying a growth "bounce-back" and benign transitory effects. However, history is not very optimistic that LICs can uniformly escape global shocks without absorbing long-lasting damages both on growth and welfare.[2] Over the past few decades, a low-income country's growth rate in one decade has generally been a poor predictor of its growth rate during the next decade, while many policies and country characteristics are more stable (Easterly et al., 1993). One influential view is that, as Easterly et al. put it: "shocks, especially shocks to the terms of trade, are an important determinant of growth over 10-year periods, and that they can help account for low [growth] persistence."

An emerging empirical literature has also shown that growth down-breaks, or periods of a severe growth slowdown, are more common than previously thought and are crucial in understanding the medium- to long-run growth process in LICs.[3] A related literature shows that countries that suffered spells of real income stagnation were more likely to be poor (see e.g. Reddy and Minoiu, 2009). Moreover, we know that crises can result in sharp declines in

[2] Notable contributions on the effects of shocks in LICs include Collier, Goderis, and Hoeffler (2006), and Collier and Goderis (2009, 2010).

[3] See e.g. Rodrik (1999), Pritchett (2000), Hausmann, Pritchett and Rodrik (2005), Hausmann, Rodríguez and Wagner (2006), Gupta, Pattillo and Carey (2006), and Berg, Ostry and Zettelmeyer (2008).

investment in education and health, declines that can potentially have long-lasting effects (Benhabib and Spiegel, 1994; Krueger and Lindah, 2001). Finally, there is an extensive theoretical literature that explores the possibility of growth nonlinearities that may result in LICs falling into prolonged periods of underdevelopment, commonly known as poverty traps. Nonlinearities in growth have been highly influential in shaping the thinking of both growth theorists and empiricists in recent years. The work on multiple-growth regimes and the world income distribution suggests that there may be growth factors strong enough to overcome the decreasing marginal productivity of the neoclassical production function, thereby producing persistent underdevelopment and income divergence across countries.[4]

Whether there will be a persistent negative growth effect on LICs depends crucially on the nature of the shock, its transmission mechanism, and the policy response. For example, is the shock transmission mechanism the same as in the emerging markets and advanced economies? How does its dynamic path compare to previous global crises? The growth effect will also be a function of country-specific characteristics; that is the ability of a country to absorb the shock quickly based on sound market fundamentals, favorable initial conditions, structural reforms and prudent procyclical policies.

Transmission mechanisms from the global crisis shock seem to vary considerably across countries. Advanced economies have primarily suffered a financial/banking crisis, and much ongoing research is devoted in understanding this type of shock. Most developing countries were primarily hit by an external demand (ED) effect, although some, notably fuel exporters, were also hit by a terms of trade (TOT) and perhaps at a lesser extend a foreign direct investment (FDI) effect.[5] From a methodological point of view, this difference is quite important because these external shocks are more familiar to LICs than the financial shock is to advanced countries, therefore more credibly permitting a historical analysis of the effects in LICs.

This paper puts the current crisis in historical perspective and examines the prospects for medium- to long-run growth in LICs. Although the uncertainties are enormous, and the amount of light that recent history can shed is limited, conditional answers are possible. In the analysis that follows, we focus on ED, TOT and FDI as the three main transmission mechanisms of the crisis impacting LICs, although FDI data are a constraining factor.

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[4] See the edited book by Bowles, Durlauf, and Hoff (2006), and the *Handbook of Economic Growth* Chapter by Azariadis and Stachurski (2007) for literature review, and more specifically the debt trap model in Kehoe and Levine (1993).

[5] Although changes in remittances could be another possible transmission mechanism, their effect during the global economic crisis were quite mixed; while remittances decrease in some countries, they increased in some others (a notable example is Pakistan where the increase was substantial). Moreover, their likely endogeneity to recipient-country events is difficult to handle.

The analysis will be based on a collection of exercises each tackling the question at hand from a slightly different angle. The first is a simple event study in which we illustrate the growth paths of past crises and compare these to outcomes and projections for the current crisis. The second and third exercises focus on the medium-run effects of the crisis. Specifically, we employ an impulse-response method, followed by an analysis based on 5-year growth panel regressions. We view these two approaches as complementary. While regression analysis is the traditional gold standard in hypothesis testing especially using cross-country data, panel regressions may not fully capture the considerable variation in the data across time. Employing impulse response functions to examine the recovery from shocks makes full use of the within-country variation. Our last exercise is concerned with the longer-run implications of the crisis using recently-developed methods to capture possible sharp structural downbreaks in growth rates.

II. Past and Current Global Shocks

The first exercise compares the growth experiences of LICs compared to those of the rest of the world economy, in past global crises. In particular, we consider three past global crises—1975, 1982 and 1991—and the current crisis, 2009. Current projections imply a more rapid recovery of growth in LICs than has been experienced in past global crises. Compared to past global crises, the current crisis is distinguished by the severity of the downturn (Berg et al., 2010) and the synchronization between LICs and global cyclical growth movement (Imbs, 2010). In past global crises, LICs have tended to recover more slowly than the rest of the world (Figure 1, top panel).

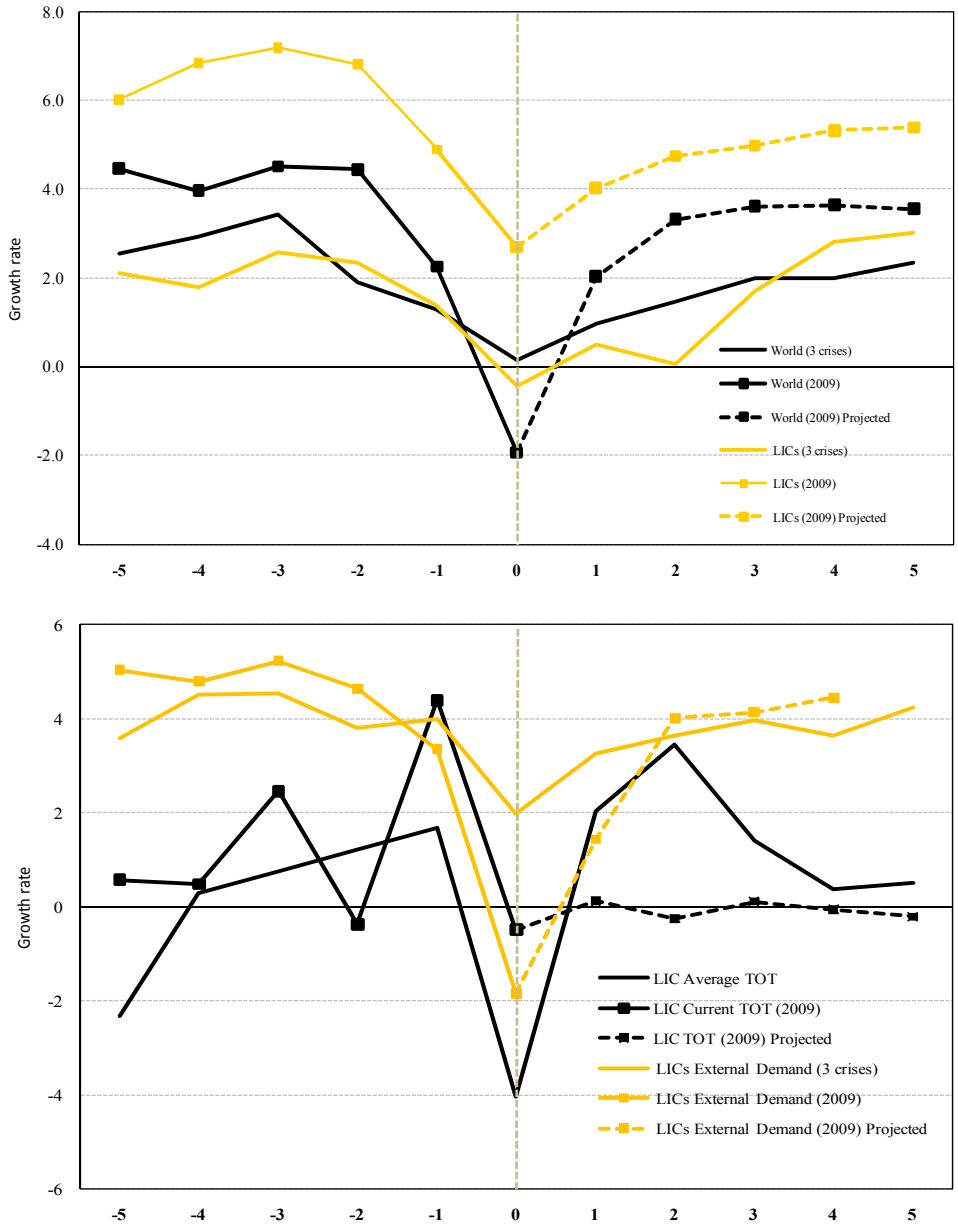
However, the current WEO forecasts imply a more rapid V-shaped recovery path out of the recession compared to previous crises. It could be that the different nature of the shocks faced by LICs in the current crisis is consistent with a more rapid recovery. A companion paper (Berg et al. 2010) looks more specifically at the plausibility of 2010-2011 forecasts, from the perspective of a relatively high frequency regression model. Here, we explore some of the medium- and long-term issues that frame the question.

Next, we compare the TOT and ED growth effects of past global crisis (Figure 1, bottom panel). TOT growth is defined as growth of terms of trade for goods while ED growth is defined as trade partner real GDP growth weighted by exports to all partner countries.[6] It is notable that unlike in previous crises where TOT growth moved sharply downward relative to ED growth, in the current crisis it is ED that has resoundingly declined, while TOT growth continued at around the historical average rate. This transmission channel is also highlighted in IMF (2009) and more formal growth regression analysis in Berg et al. (2010). The

[6] An alternative definition weighing for trade shares was considered but not used as it drastically reduced our sample size rendering most exercises imprecisely estimated.

evidence below, however, is that like TOT shocks, ED shocks also have sharply negative short-to-medium-term output effects.[7]

Figure 1: GDP per capita TOT and ED growth in past and current crises



Note: The top panel plots the average per capita GDP growth in the world and in LICs while the bottom panel plots the TOT and ED growth in LICs 5 years before and 5 years after the global crises (centered at zero on the horizontal axis) of 1975, 1982 and 1991, and the current crisis. Also shown in dashed lines are WEO projections until 2013.

[7] FDI data were not sufficient to produce a similar plot.

III. GROWTH IN THE MEDIUM-TERM: AN IMPULSE-RESPONSE ANALYSIS

What happens to output over the medium term following a TOT and ED shocks? Does the path of output per capita remain below its pre-crisis trend and if so for how long? Do growth rates recover to their pre-crisis levels as suggested by the neoclassical growth models or could shocks derail growth permanently? Until recently, the emphasis on the medium term growth impact of shocks has been limited, with the notable exceptions of Boyd, Kwak, and Smith (2005) and Cerra and Saxena (2008). With the current crisis, interest in the topic has surged. For instance, Chapter 4 of the Fall 2009 World Economic Outlook concentrated on medium-term developments following financial crises in advanced, emerging, and developing economies over the past 40 years.[8]

In our second exercise we employ impulse-response-function analysis, which involves using an autoregressive model of output growth rates augmented by crisis dummies, as in Cerra and Saxena (2008).[9] Using panel data for a broad set of developed and developing countries, Cerra and Saxena documented that political and financial crises (i.e. wars, banking or currency crises) are not typically followed by high-growth recovery phases, either immediately following the trough, over several years of the subsequent expansion, or even over the complete expansion that follows a recession. Thus, when output drops following crises, it tends to remain well below its previous trend.

Using data from a panel of LICs we examine whether TOT and ED shocks have historically been associated with severe output losses and whether such output losses have been persistent. Specifically, we test the statistical relationship between growth and TOT and ED shocks by estimating a univariate autoregressive model in growth rates, which accounts for the nonstationarity of output and serial correlation in growth rates. The impulse response functions to each shock are shown with a one-standard-error band drawn from a thousand Monte Carlo simulations. The top and bottom panels in Figures 2a present impulse responses of output loss, measured as the percentage change from a linear growth trend, to a TOT shock and an ED shock, respectively.[10]

The key stylized facts that emerge from the analysis are as follows: The impact on output is negative and highly persistent under both types of shock. The medium-term output losses

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[8] IMF (2009), Furceri and Mourougane (2009) and Pisani-Ferry and van Pottelsberghe (2009) also look at the medium-term output effects of banking crises for different subsamples or case studies.

[9] Daniel Leigh very helpfully provided his Stata code and invaluable input.

[10] The shock dummy variable for both TOT and ED was constructed as follows: We first construct a restricted sample in which we excluded values below and above the 1st and 99th percentiles, to mitigate the effects from extreme values. The crisis periods belong to the left tail of the moving-average growth (based in 2 periods) distribution, where the left tail is based on one standard deviation of the restricted sample defined above. Results are qualitatively similar to two alternative shock definitions considered.

following ED shocks are particularly substantial. Output losses continue to rise without a sign of a reversal even 7 years after an ED shock, mounting to a cumulative loss of over 6 percent of GDP. As indicated by the dashed lines measuring the 90 percent confidence band, the average decline relative to trend is statistically significant. The output-loss path eventually becomes flat as growth tends to eventually return to the pre-crisis rate, but after a decade of lower growth and a substantial loss of output.

This may seem at first a surprising result given the neoclassical growth model's prediction of rebound to the steady state. However, it is broadly consistent with similar impulse responses to different types of shocks (e.g. financial crises, Fall 2009 WEO; political crises, Cerra and Saxena, 2008). Although the mechanisms under which such output loss could persist after an ED shock merit careful consideration and future research, a reasonable hypothesis is the plausible interactions between ED shocks and private and public investment decisions or policy responses. For example an ED shock could result in a drastic shift in public investment from tradable goods to non-tradable goods or a policy change to reduce exposure to trade.

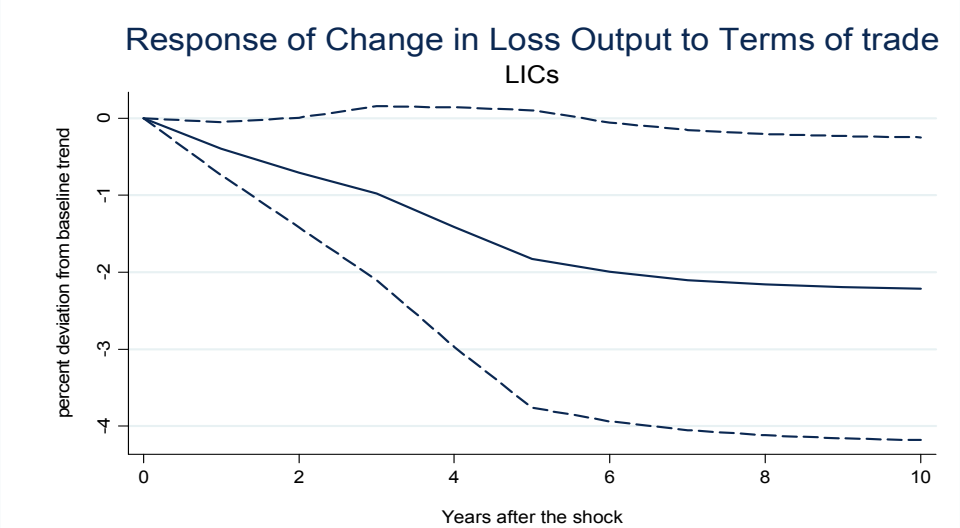
We replicate the impulse response analysis for Sub-Sahara African (SSA) countries given special interest in how the crisis may be affecting this region.[11] As shown in Figure 2b the main results obtained from the LIC sample extend to SSA. One notable difference is that TOT shocks seem to have had a larger and more persistent effect than ED shocks in SSA, relative to the rest of LICs. This may be due to the fact that many countries in SSA are commodity and particularly fuel exporters and therefore more prone to TOT shocks.

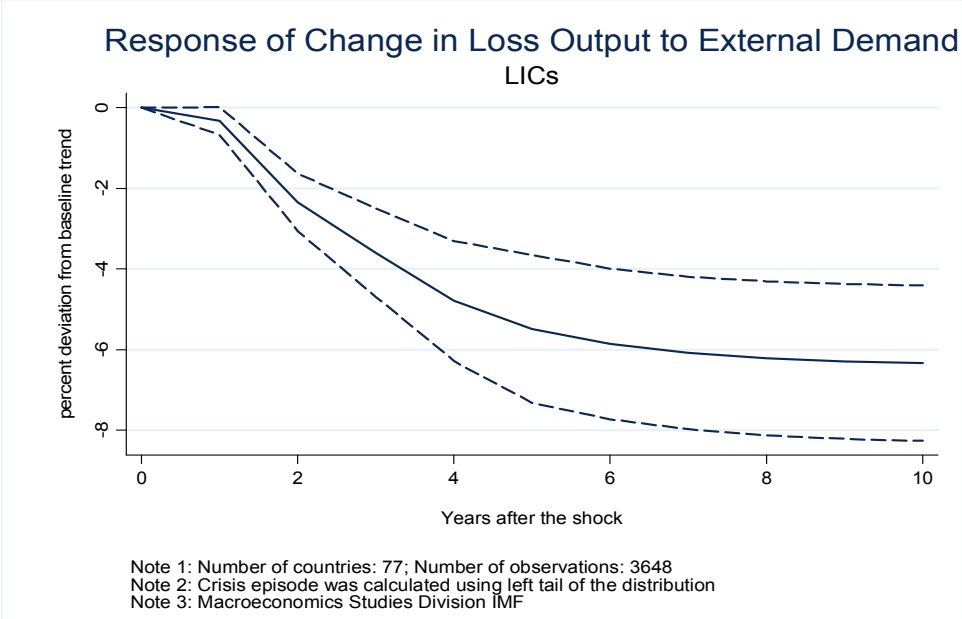
It is important to note that a key assumption of the Cerra-Sexana VAR method is that countries will eventually return to the pre-crisis growth trends. To examine whether this is a reasonable assumption for our analysis we plot histograms for TOT and ED reporting average growth for five years following a crisis relative to the pre-crisis trend. Figure 3 confirms that mean reversion is a reasonable assumption as the median of LICs considered in these exercises tends to revert back to its pre-existing growth trend in the 5 years following the shock.[12] There exists considerable variation around the median change in the five-year growth rate, with some countries topping their pre-crisis growth trends and others ending up with substantially lower growth.

[11] The impulse response analysis was also performed using several other subsamples, including all non-advanced countries, non-LICs, commodity- and non-commodity exporters.

[12] Of course, the maintained assumption that growth eventually returns does not drive how long it will take, or whether it bounces back so that it is temporarily above trend. The above results speak to those questions.

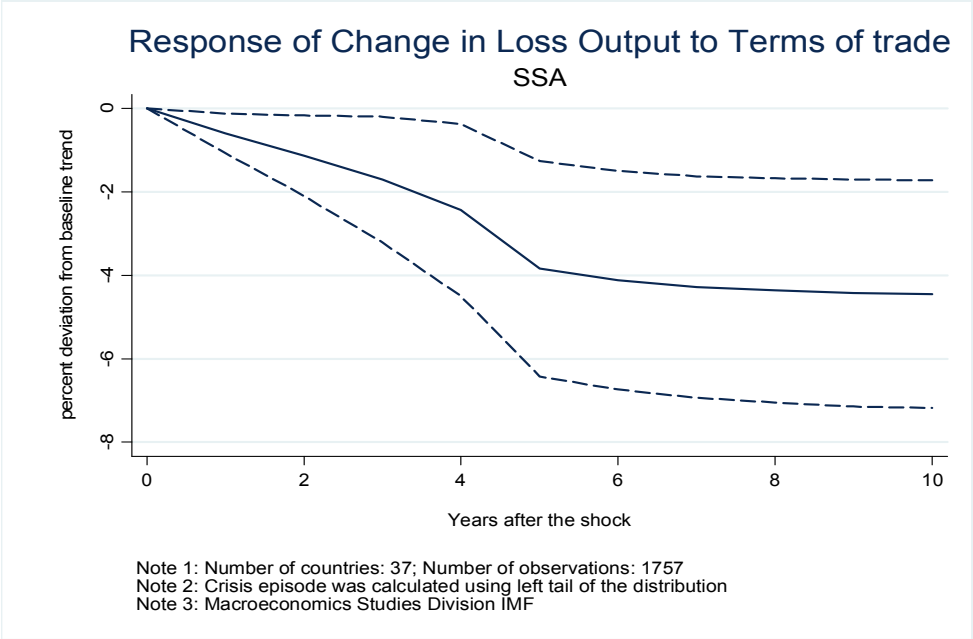
Figure 2a: Impulse response of output loss in LICs to TOT and ED shocks

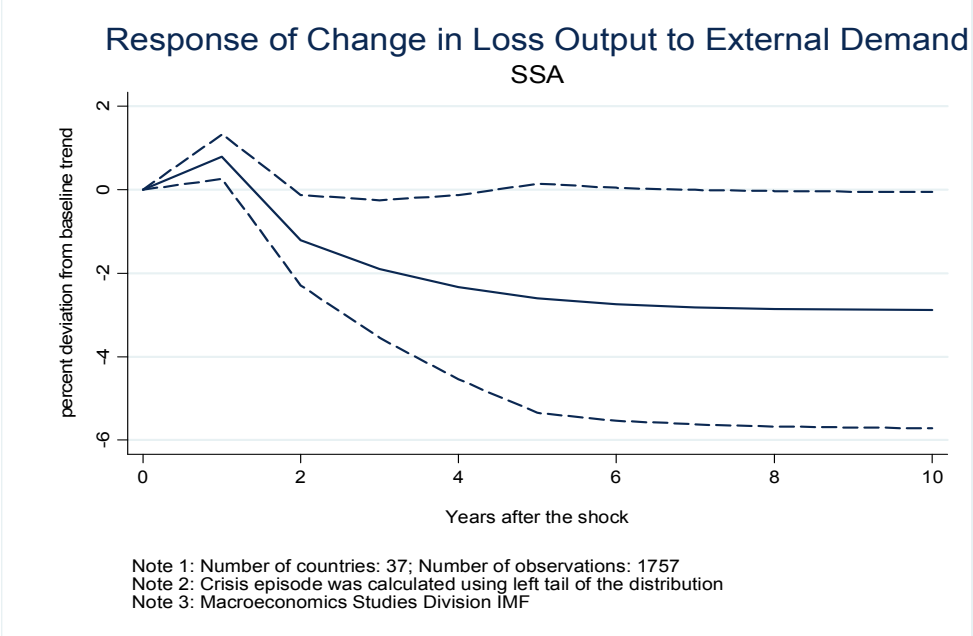




Note: The top and bottom panels present impulse responses of output loss in LICs, measured as the percentage change from a linear growth trend, to a TOT shock and an ED shock, respectively. The solid line is the mean of output loss, and the dashed line reflects one standard deviation from the mean.

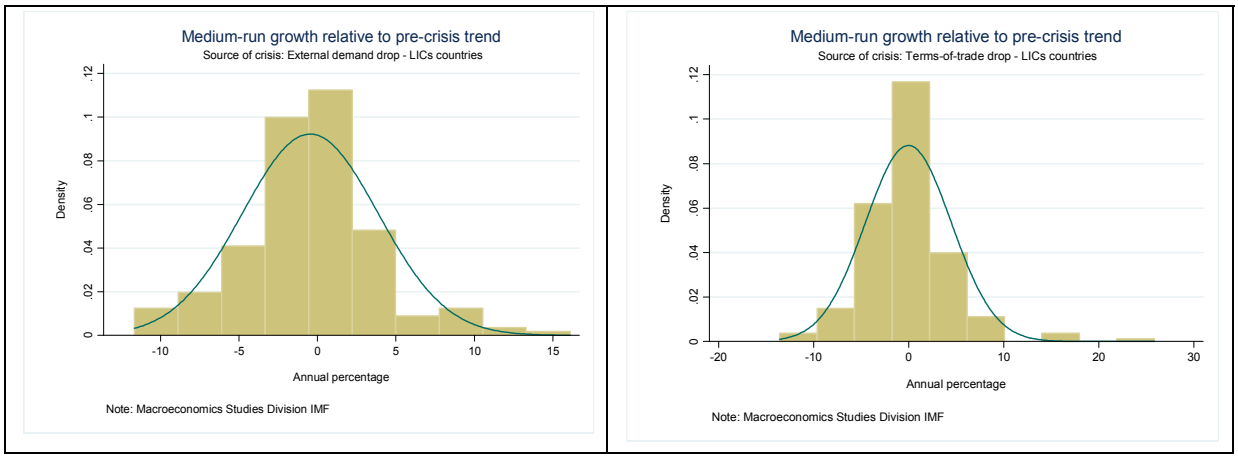
Figure 2b: Impulse response of output loss in SSA to TOT and ED shocks





Note: The top and bottom panels present impulse responses of output loss in SSA, measured as the percentage change from a linear growth trend, to a TOT shock and an ED shock, respectively. The solid line is the mean of output loss, and the dashed line reflects one standard deviation from the mean.

Figure 3: Post-crisis growth relative to pre-crisis trend



Note: Histograms report five-year average growth ending in *t+5* relative to pre-crisis trend, where crisis begins at period *t*.

This raises the question of whether, at least for some important subset of countries, the stationarity assumption for the growth rate is violated. We return to that question in the final section, when we look for breaks in the growth.

IV. GROWTH IN THE MEDIUM-TERM: PANEL REGRESSION ANALYSIS

While the impulse response analysis allowed us to examine the dynamic effects of shocks, we are also interested in the medium-term average effects of shocks in a framework that allows for an extended set of variables including, for example, policy interactions. Therefore, next we employ 5-year panel growth regressions as an alternative approach to investigating the impact of shocks on medium-term per capita GDP growth.[13] In particular, our estimation results are based on panel GMM regressions in which the main explanatory variables are the three shocks: the change ED, the change in TOT, and the change in the ratio of FDI to GDP. Other controls include the lagged output growth and a full set of country- and year-specific fixed effects. The full sample covers 87 non-advanced economies, including both LICs and MICs. The sample excludes fuel-exporters since these countries' growth experience has been heavily influenced by external demand for fuel commodities.

Although omitted variable bias is a source of concern in most cross-country regression estimation, it is less so under our regression specification. This is because we are happy to assign to our shock variables any of their variation that is correlated with Barro/Solow-type variables (which we do implicitly by omitting the latter variables) on the grounds that our

[13] A similar estimation methodology was followed by Drummond and Ramirez (2009).

shock variables are plausibly exogenous to other omitted growth determinants, such as policies, institutions, investment rates, and so on, at least at the sorts of horizon of interest to us here.[14]

Results are presented for "All" non-advanced non-fuel countries, non-fuel LICs, and non-fuel non-LICs (Table 3). The comparison is intended to provide some insights regarding the differential effects of these shocks in LICs and middle-income countries.

Table 1: Panel GMM growth regressions

	Entire time period			Before 1989			After 1989		
Variables	All	**LICs**	NonLICs	All	**LICs**	NonLICs	All	**LICs**	NonLICs
Lagged Growth	-0.245***	**-0.216*** **	-0.217**	-0.610***	**-0.524*** **	-0.683***	-0.269***	**-0.197** **	-0.079
	(0.061)	**(0.077)**	(0.089)	(0.106)	**(0.100)**	(0.173)	(0.056)	**(0.080)**	(0.053)
Growth in Terms of Trade	0.103**	**0.098**	0.096***	0.030	**0.028**	0.044	0.136**	**0.148** **	0.187***
	(0.044)	**(0.060)**	(0.027)	(0.028)	**(0.045)**	(0.027)	(0.059)	**(0.071)**	(0.037)
Growth in External Demand	2.050***	**1.843*** **	2.177***	0.667**	**0.670**	0.421	1.958***	**1.340** **	1.879***
	(0.281)	**(0.471)**	(0.242)	(0.316)	**(0.598)**	(0.295)	(0.295)	**(0.525)**	(0.270)
Lagged Change in (FDI/GDP)	0.668***	**0.308**	0.965***	0.451	**-0.486**	1.464***	0.725***	**0.664***	0.531**
	(0.178)	**(0.216)**	(0.184)	(0.631)	**(0.745)**	(0.437)	(0.186)	**(0.345)**	(0.227)
Observations	522	**281**	241	178	**92**	86	344	**189**	155
Number of countries	87	**48**	39	85	**47**	38	87	**48**	39

Notes: Robust standard errors in parentheses. ***, **, and * denote statistical significance at 1, 5, and 10 percent levels, respectively. All specifications were estimated by panel data with year fixed effects, and 5 year averages over 1979-2009.

For the nonfuel LICs subsample, the coefficient estimate on ED growth is positive and highly significant, indicating a positive impact on medium-term growth (Table 1, column 2). While the coefficient estimates on TOT and FDI for LICs using the entire time period in our sample are insignificant, they are highly significant for the entire sample and for non-LICs along with the coefficient estimates for ED (columns 1 and 3, respectively). Columns (4-9) present results from splitting the sample into the periods before and after 1989 (the median year in our sample). Coincidentally, the period after 1989 (particularly after the mid-1990s) when growth increased dramatically in most LICs. It is interesting to note that most of the effect of TOT and ED growth for LICs has been driven by variation in the period after 1989 (see columns 5 and 8). Even more notable is that in the post-1989 sample the FDI coefficient

[14] Our approach makes much more sense for low-income countries than for others. One reason is that, for advanced countries, we might worry that common shocks (such as global shocks to productivity growth) could produce co-movements in output not driven by trade linkages. Clearly, this is a risk in our context as well. However, given that trade between low-income countries is relatively unimportant, the common shocks that would be problematic would be those that jointly affect rich and poor countries but are not mediated through output, the terms of trade, or FDI flows (which we also control for). These shocks would seem to be unlikely.

becomes positive and significant.[15] This may not be surprising given that FDI flows to LICs have become sizable only in the last decade or so.[16]

Next, we ask the question, how does the projected average annual per capita growth obtained from using our coefficient estimates from the regression analysis presented in Table 1 compare with the actual WEO growth projections?[17] Given that most of the effect of TOT and ED growth for LICs has been driven by variation in the post-1989 period, we use the coefficient estimates based on the period 1989-2009 (Table 1, column 8), to produce a projection for average growth for the period 2010-2014.[18] We calculated our 5-year growth regression based projections for 2010-2014 to be 3.3 percent per year, which matches exactly the WEO's projection for the same period. Our projected growth highlights that WEO's medium-run projected recovery path out of the recession is par to the recent historical patterns, as suggested by our regression analysis.

We now investigate how macroeconomic policies may amplify or moderate the effects of shocks on growth. We first present simple illustrations of the bivariate relationship between a select sample of policy variables prior to the shock and GDP growth 5 years after the shock, giving the data a chance to speak with the minimum of auxiliary assumptions. This analysis is then extended to a multivariate regression analysis in which we interact the policy variables with the shock variables TOT, ED and FDI. Figures 4a and 4b plot pre-crisis government balance-to-GDP ratio, debt-to-GDP ratio, exchange-rate regime, and international reserves accumulation (measured in months of imports) against post-crisis growth, where the former variables are calculated as the average over the 5 years preceding the crisis and the later as the annual average GDP per capita growth over the 5 years following the crisis.

The top set of plots (left ED, right TOT) in Figure 4a show evidence of a positive, albeit weak, correlation between government balance and medium-run post-crisis growth, implying that countries with higher government deficits prior to a TOT or ED shocks experience slower growth in the aftermath. The bottom set of plots from the top present a negative

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[15] This result is consistent with Dabla-Norris et al. (2010) who focus on the effects of FDI on LICs.

[16] We have checked the robustness of these results to alternative specifications and subsamples. Using trade weighted TOT and ED shocks reduced our sample by more than 30 percent rendering most coefficient estimates imprecisely estimated. Furthermore, to consider concerns regarding the unreliability of FDI data in LICs due to measurement error, we examined and confirmed robustness of our TOT and ED results by dropping the FDI shock from the baseline regressions.

[17] Given our five-year-panel structure, we cannot readily ask whether the crisis of 2008/2009 would have been well forecast by our regression. This question is better addressed in a shorter-horizon framework, as in Berg et al. (2010).

[18] Predicted growth is calculated as the sum of the contributions of the four regressors (lagged growth, external demand, terms of trade, and lagged difference in FDI/GDP). To calculate the contribution for each variable, we multiply the regression coefficient by the WEO predicted average growth of each of the four regressors.

relationship between the change in the debt-to-GDP ratio over the five preceding the crisis year, and the subsequent 5-year annual growth rate. This suggests that countries that build more debt in the run-up to the crisis tend to have lower medium-term post-crisis growth. This finding is evident under both ED and TOT shocks. The top set of plots in Figure 4b shows the relationship between a measure of the flexibility of the exchange rate regime ("1" corresponds to fixed- and "5" corresponds to flexible-exchange-rate regime) and medium-term growth. In this case too, there is some evidence that a more flexible exchange regime is associated with higher medium-term growth after a TOT shock. A positive but weaker relationship also exists under ED shocks. Finally, the bottom set of plots illustrates that the level of international reserves prior to either TOT or ED shocks does not seem to have much of an effect on GDP growth in the medium run, at least in the bilateral relationship presented.

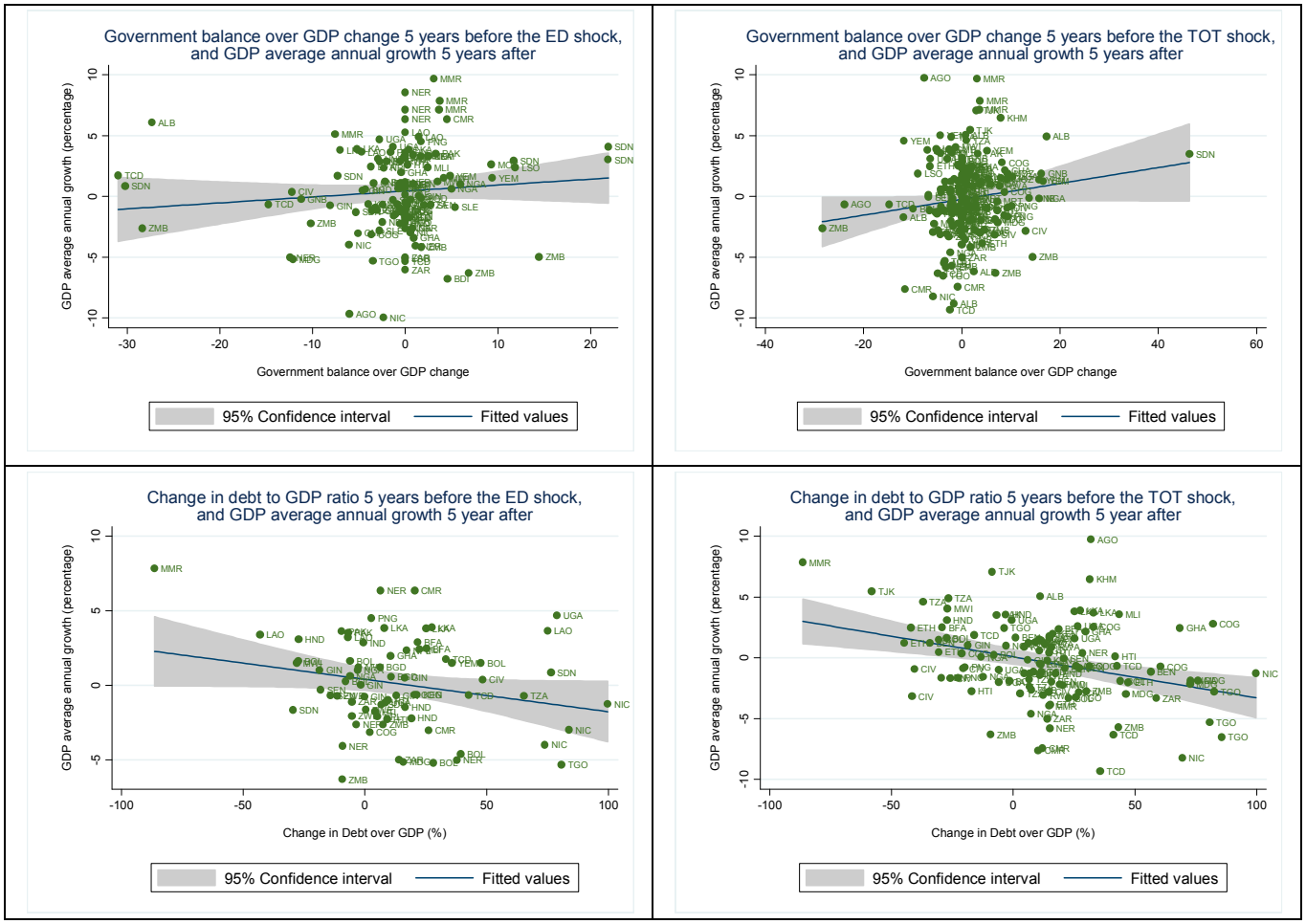
Some of these bivariate results—in themselves only suggestive—hold up in a multivariate regression context. In what follows we extend the analysis using multivariate growth regressions in which interaction terms between shocks and the four policy variables are included. We focus our discussion on interactions with the ED shock, seemingly the primary shock impacting LICs in the 2007-2009 global crisis. Table 2, column 2 presents the results of an interaction regression specification in which the government balance-to-GDP ratio is interacted with the three shock variables. The coefficient estimate capturing the direct effect of this variable on growth obtains the expected sign but it is not statistically significant. More importantly though, the interaction term with an ED shock is negative and significant implying that countries with lower deficits may be better equipped to dampen some of the effects of the shock on growth.

Next we incorporate an interaction term of the shocks with the debt-to-GDP ratio in the regression specification and find that, consistent with theory, the interacted term's coefficient estimate is positive and significant (Table 2, column 5). This suggests that accumulation of large debt-to-GDP ratios could amplify the effects of ED shocks on growth. For the exchange rate regime variable, the direct effect on growth obtains a negative but insignificant coefficient estimate (Column 8). The coefficient estimate on the interaction with ED is positive (but not precisely estimated), consistent with the hypothesis that more flexible exchange rate regimes can buffer the effects of an ED shock on growth. Finally, there is a positive and large direct effect of international reserves on growth (Column 11). More importantly, the interaction coefficient estimate is negative (significant at the 14 percent level) which implies that countries with a higher stock of reserves are more capable of reducing the effects of an ED shock on growth. We also used the four interaction specifications to recalculate the 5-year growth projections for 2010-2014 obtaining values slightly lower but not statistically different from the WEO projections.

In summary, the regression results reinforce the impulse response findings showing economically significant effects of TOT and ED shocks on growth in the post-1989 period, consistent with most literature that emphasizes that LICs pushed for reforms to liberalize their economies starting in the early to mid-1990s. Regression results also show that FDI

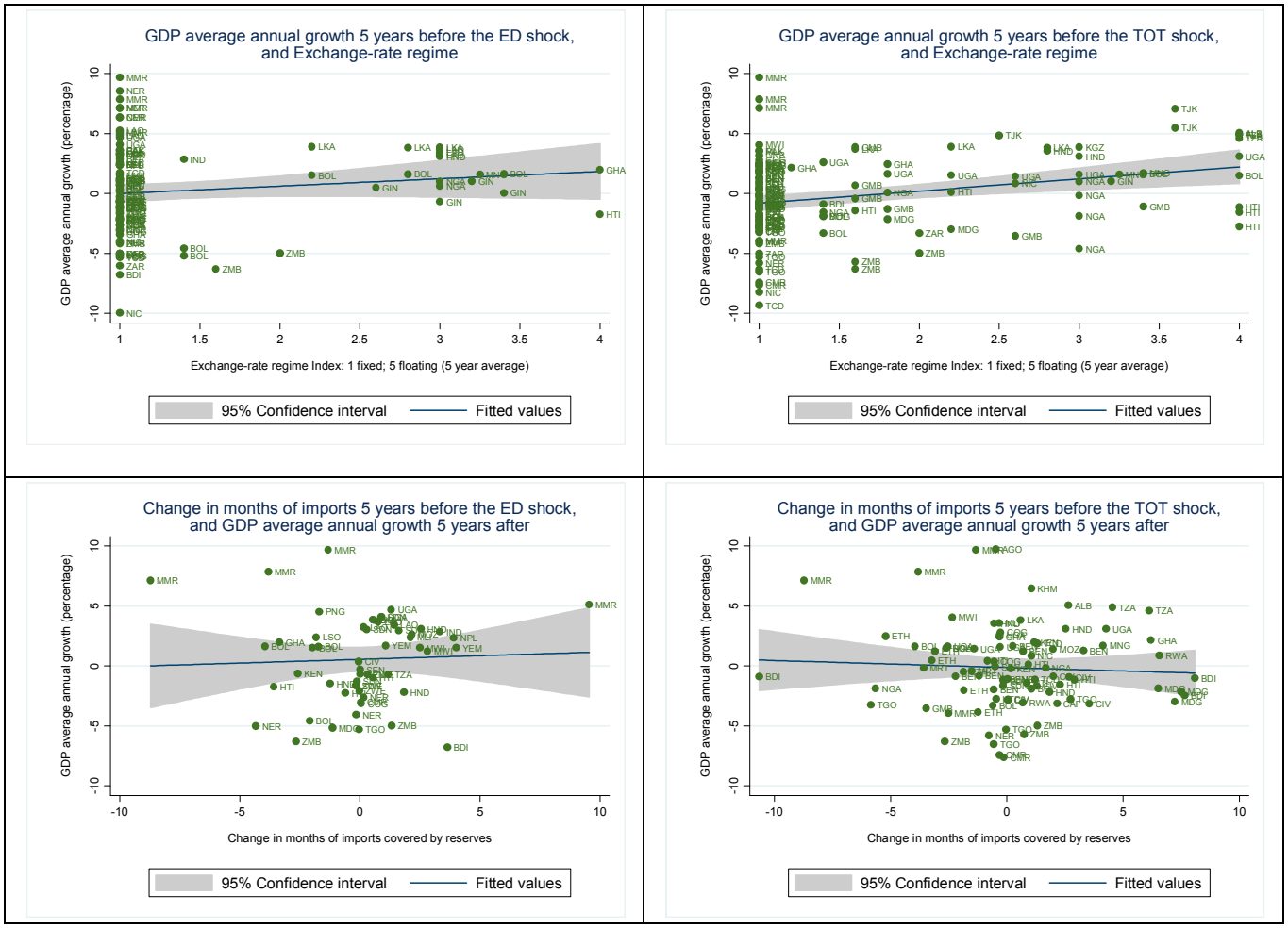
shocks played a significant role on growth. Annual average growth projections for 2010-2014 based on our regression coefficient estimates match closely the WEO projections. Finally, we have investigated interaction effects between our three shocks and several policy variables. Both an illustrative bivariate and a multivariate regression analysis provide evidence that lower budget deficits, lower debt, more flexible exchange rate regimes, and higher international reserves help LICs to dampen the effects of an ED shock on medium-term growth.

Figure 4a: Initial conditions and post-crisis medium-term growth



Note: Pre-crisis debt was calculated as the difference between t-5 and t, where t is the crisis year. Post-crisis growth is the annual GDP per capita growth over the 5 years after the crisis.

Figure 4b: Initial conditions and post-crisis medium-term growth



Note: Pre-crisis reserves were calculated as the difference between t-5 and t, where t is the crisis year. Post-crisis growth is the annual GDP per capita growth over the 5 years after the crisis.

Table 2. Panel GMM growth regressions with interactions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables	All	LICs	NonLICs	All	LICs	NonLICs	All	LICs	NonLICs	All	LICs	NonLICs
Lagged Growth	-0.596***	-0.284***	-0.092**	-0.112*	0.055	-0.062	-0.353***	-0.326***	-0.170***	-0.337***	-0.279***	-0.190***
	(0.067)	(0.077)	(0.037)	(0.059)	(0.070)	(0.052)	(0.067)	(0.082)	(0.056)	(0.057)	(0.089)	(0.054)
Growth in Terms of Trade	0.126***	-0.013	0.154***	0.129	0.028	0.234***	0.084	0.095	0.069	-0.029	-0.078	0.109
	(0.042)	(0.063)	(0.053)	(0.089)	(0.116)	(0.060)	(0.077)	(0.086)	(0.084)	(0.048)	(0.053)	(0.106)
Growth in External Demand	0.731*	-0.244	0.653*	0.928***	-0.584	0.350	2.065***	1.739***	2.374***	1.855***	1.295**	2.127***
	(0.400)	(0.267)	(0.346)	(0.325)	(0.356)	(0.623)	(0.369)	(0.577)	(0.292)	(0.275)	(0.507)	(0.390)
Lagged Change in (FDI/GDP)	-2.257	0.098	0.405	0.361	-1.219**	-0.398	-0.291	-0.373	1.608**	0.838	2.046*	0.382
	(1.390)	(0.336)	(0.405)	(0.348)	(0.521)	(0.453)	(0.529)	(0.658)	(0.756)	(0.521)	(1.093)	(0.828)
Central government balance over GDP (1 lag)	-0.263*	0.200	0.523***									
	(0.141)	(0.152)	(0.144)									
Growth in Terms of Trade * lagged government balance over GDP	0.005	-0.006	-0.001									
	(0.005)	(0.011)	(0.005)									
Growth in external demand * lagged government balance over GDP	0.077**	-0.065**	-0.129***									
	(0.031)	(0.032)	(0.040)									
Lagged Change in (FDI/GDP) * lagged government balance over GDP	-0.465**	-0.012	-0.017									
	(0.229)	(0.045)	(0.017)									
Debt over GDP (1 lag)				0.014	-0.000	-0.078						
				(0.014)	(0.015)	(0.057)						
Growth in Terms of Trade * Debt over GDP (lag 1)				-0.001*	-0.000	-0.001						
				(0.001)	(0.001)	(0.001)						
Growth in external demand * Debt over GDP (lag 1)				0.000	0.006*	0.016						
				(0.004)	(0.004)	(0.014)						
Lagged Change in (FDI/GDP) * Debt over GDP (lag 1)				-0.001	0.008*	0.010**						
				(0.003)	(0.004)	(0.004)						
Exchange rate regime (fixed=1 floating =0)							0.774	-1.429	1.919			
							(1.791)	(2.662)	(1.405)			
Growth in Terms of Trade * Exchange rate regime							0.060	-0.009	0.076			
							(0.097)	(0.130)	(0.099)			
Growth in external demand * Exchange rate regime							-0.067	0.286	-0.147			
							(0.480)	(0.708)	(0.372)			
Lagged Change in (FDI/GDP) * Exchange rate regime							1.365**	1.277	-0.827			
							(0.689)	(1.151)	(0.949)			
Reserves										5.768***	7.192***	2.428
										(1.676)	(2.765)	(4.477)
Growth in Terms of Trade * Reserves										0.118***	0.167	-0.029
										(0.045)	(0.128)	(0.103)
Growth in external demand * Reserves										-1.015**	-1.111	0.076
										(0.444)	(0.766)	(1.197)
Lagged Change in (FDI/GDP) * Reserves										0.206	-3.952	1.270
										(0.592)	(2.919)	(1.013)
Constant	-1.631	1.275	1.259	-3.202***	2.466*	3.134	-6.714***	-7.084***	-6.710***	-6.369***	-4.320**	-6.790***
	(1.320)	(1.425)	(1.195)	(1.150)	(1.372)	(2.529)	(1.398)	(2.007)	(1.242)	(1.069)	(2.047)	(1.713)
Observations	125	161	137	275	137	138	213	108	105	212	109	103
Number of countries	65	43	37	78	39	39	75	38	37	81	44	37

Notes: Robust standard errors in parentheses. ***, **, and * denote statistical significance at 1, 5, and 10 percent levels, and 5 year averages over 1989-2009.

V. GROWTH IN THE LONGER-RUN: GROWTH DOWN-BREAKS ANALYSIS

The second and third exercises above were designed to examine the response of growth over the medium term. Our last approach looks at longer-run possible implications of the crisis. Both previous approaches implicitly assume that the growth process itself is not affected by the shock. In other words, it is assumed that growth will return to its pre-crisis trend in the medium run. The previous analysis does not focus on what is perhaps the most telling source of variation in the underlying growth data for LICs. As Easterly et al. (1993) first pointed out, growth performance tends to be highly unstable, a "stop and go" process. Only a few countries have experienced consistently high growth rates over periods of several decades.

The more typical pattern is that countries experience phases of growth, stagnation, or decline of varying length (Pritchett 2000). As convincingly argued in Hausmann, Pritchett, and Rodrik (2005), "Standard growth theory, whether of the neoclassical or the endogenous variant, suggests that our best bet for uncovering the relation between growth and its fundamentals is to look for instances where trend growth experiences a clear shift." However, while output paths in the advanced countries tend to be reasonably steady, in developing countries they are often characterized by "mountains, cliffs, and plains" (Pritchett, 2000).

Next we present evidence from graphical analysis on the association between TOT and ED shocks and growth down-breaks. Growth down-breaks, broadly defined as extended periods of markedly slow growth, are a striking feature of the development process. Recent work by Hausmann, Pritchett, and Rodrik (2005), Berg, Ostry, and Zettelmeyer (2008), and Jones and Olken (2008) use this new approach to understand the differential growth experiences of rich and poor countries.[19] In this section we use a set of growth down-breaks—identified by the econometric methodology of Berg et al.[20] for the period 1960-2009—to examine whether growth decelerations are associated with TOT and ED shocks.[21] The exercises below examine possible associations between GDP growth decelerations (growth down-breaks) and TOT and ED shocks from two different angles.

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[19] Two early precursors of the current work on growth spells are Ben-David and Papell (1998), and Pritchett (2000), both of which employed novel econometric methods to identify shifts in growth performance.

[20] Berg et al. (2008) in turn follow Antoshin, Berg, and Souto (2008) who identify "growth spells" by modifying the procedure pioneered by Bai and Perron (1998) to determine sample-specific critical values, as is appropriate when the time dimension is 30 years or less.

[21] In Appendix B we list all the episodes of down-breaks in economic growth since 1960 that we are able to detect by using the aforementioned statistical methodology.

Figure 5a: GDP growth decelerations and TOT shocks

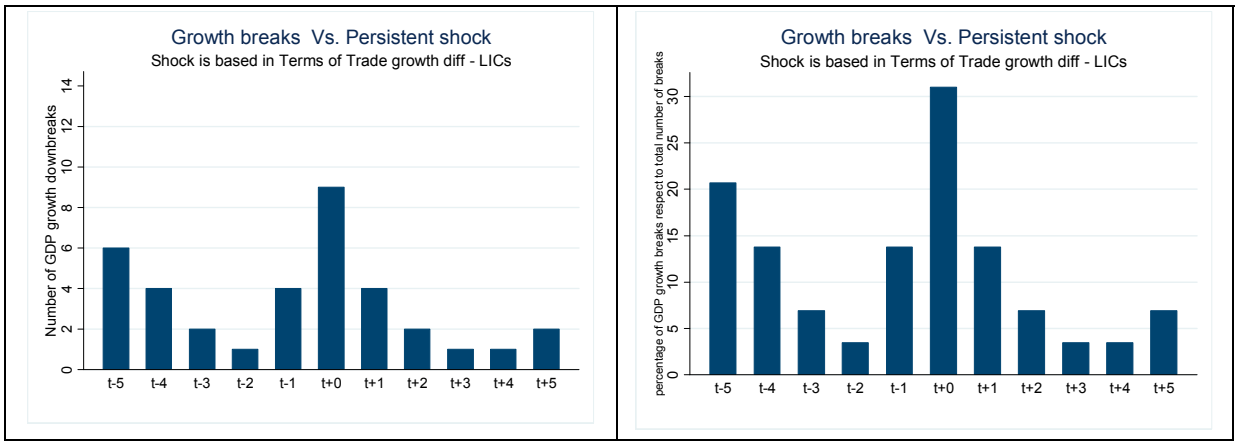
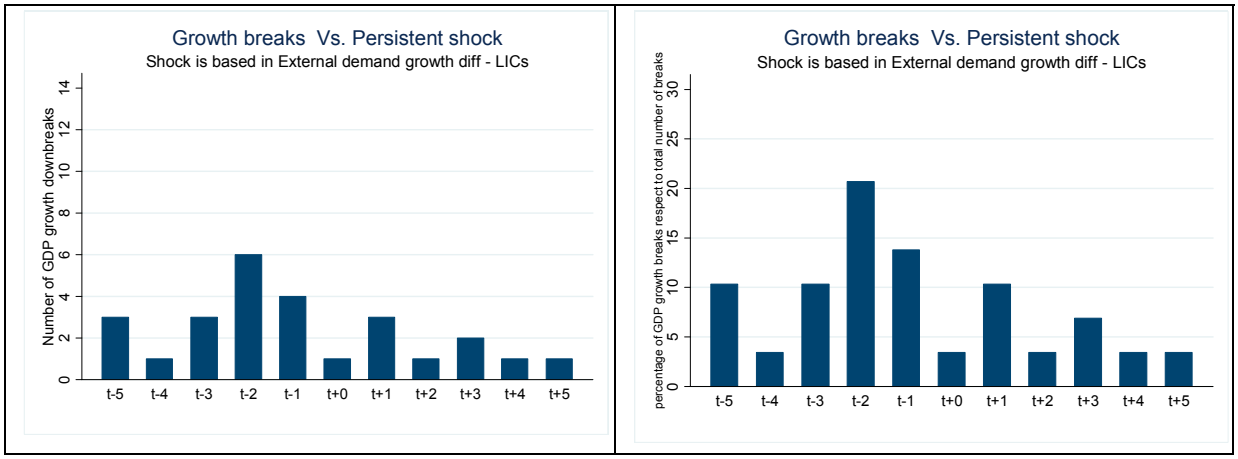


Figure 5b: GDP growth decelerations and ED shocks



Note: The left panels plot the number of GDP growth downbreaks in a large sample of low-income countries (excluding transition economies) during the periods leading up to, and following, a large persistent terms of trade shock (year t+0 on the horizontal axis). The right panels convert the number of breaks to a conditional probability given the total number of down-breaks identified by our methodology. A large persistent TOT shock is defined as the worst 10 percent of the distribution of all TOT shocks, measured as the difference of the average 3 year TOT growth before and after period t. The right panel is the same, except that the shock is to external demand, measured as partner country real growth weighted by export shares.

First, we considered the number and conditional probability of growth down-breaks during the period leading up to, and following a major negative TOT or ED shock.[22] The idea here is to see whether GDP growth down-breaks coincide or follow large TOT and ED shocks (Figures 5a and 5b). One pattern that emerges from is that persistent negative TOT shocks have often coincided with growth downbreaks.[23] However, persistent negative ED shocks have shown no association with growth downbreaks. Why would persistent negative TOT shocks be more likely to have quasi-permanent negative effects on growth? One explanation is that countries that are hard-hit by TOT shocks find it difficult to adjust, even after a few years. The factors that have (usually) produced the commodities in question cannot easily switch to other uses, such as satisfying domestic demand or finding other export markets. Thus, the resulting decline in foreign income could squeeze imports and activity persistently, thus impeding productive activities throughout the economy. This remarkable observation suggests that if indeed the current crisis primarily has affected low-income countries through ED and not through TOT, there may be more reason for hope for a smoother recovery.[24]

Second, the top and bottom panels of Figures 6 plot the behavior of TOT and ED in the period leading up to, and following growth downturns (year 0 on the horizontal axis). This exercise differs from the previous one in that the main focus is on episodes of down-breaks rather than episodes of large TOT or ED shocks. The idea here is to see whether there is any association of sharp decreases in GDP growth and growth of TOT and ED. Once again the pattern that emerges is that TOT growth tends to decrease sharply in the run-up to growth decelerations, providing suggestive evidence that sharp TOT growth declines may lead to a sustained period of slow growth. On the contrary, ED growth shows virtually no co-movement with a growth downturn. This observation is consistent with the previous exercise.

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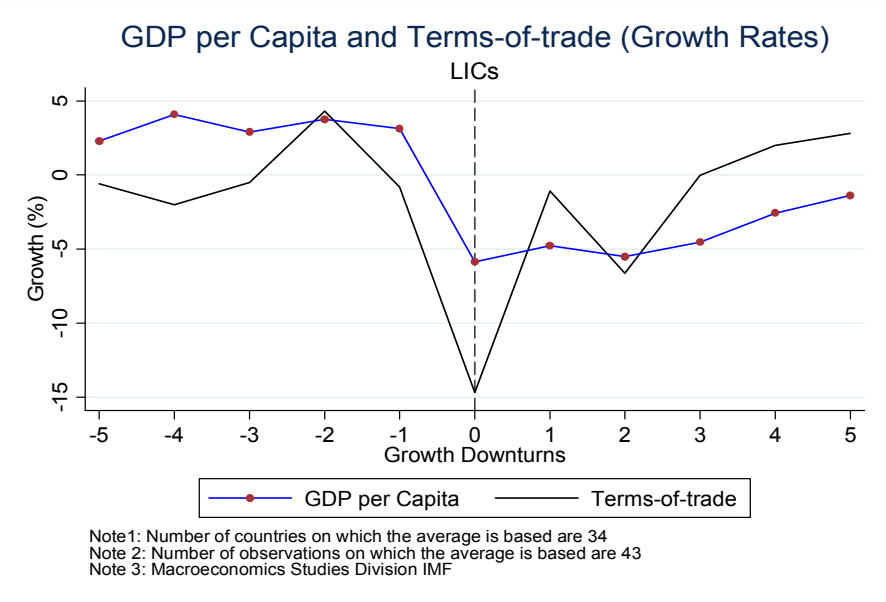
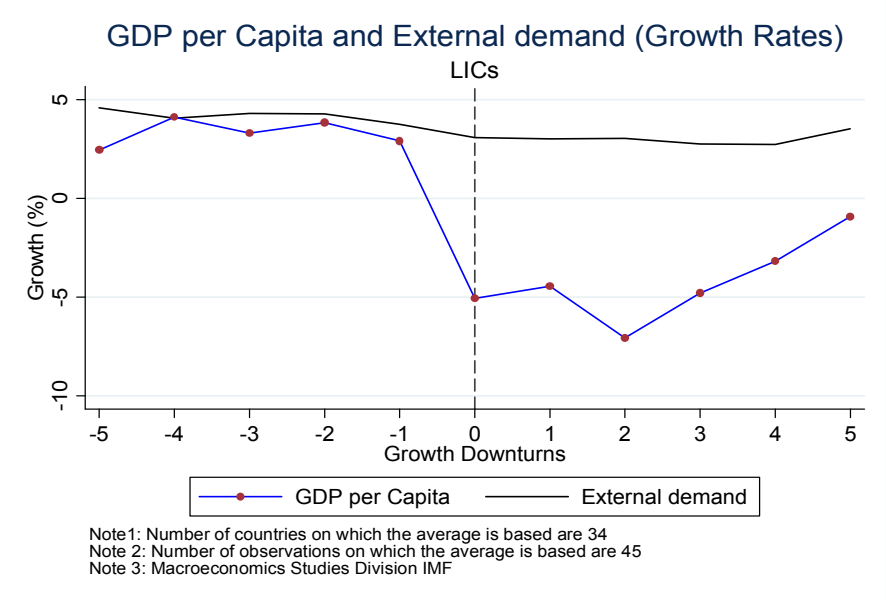
[22] In our baseline we consider a large permanent shock defined as the 10 percent of the left tail of the distribution of all permanent shocks measured as the difference of the average 3 year TOT and ED growth before and after period *t*. We have also considered a large transitory shock – the 10 percent of the left tail of the distribution of the difference in annual TOT and ED growth. In addition we considered shocks that resemble the intensity of the current TOT and ED shocks (the difference of the growth in TOT and ED between 2007 and 2009). For ED, given that the current shock is the largest that most LICs have seen in current history and therefore we could not identify more than a handful of such shocks in our sample, we considered lower intensity shocks by taking fractions of the current shock. For TOT we consider the intensity of the current shock which was quite mild in historical terms. Results using the last two alternative definitions of the shock are consistent with our baseline plots and are available upon request.

[23] This is consistent with the results of Berg et al. (2008) on terms of trade shocks and the ends of growth spells.

[24] The definitions of "persistent" and "large" can be found in the notes to the table. It turns out that large negative external demand shocks such as those experienced by many countries in 2009 are not unprecedented for many LICs. In the sample used for figure 5, there were 68 instances in which countries faced external demand shocks larger than they faced in 2009 (assuming WEO projections for the out-years).

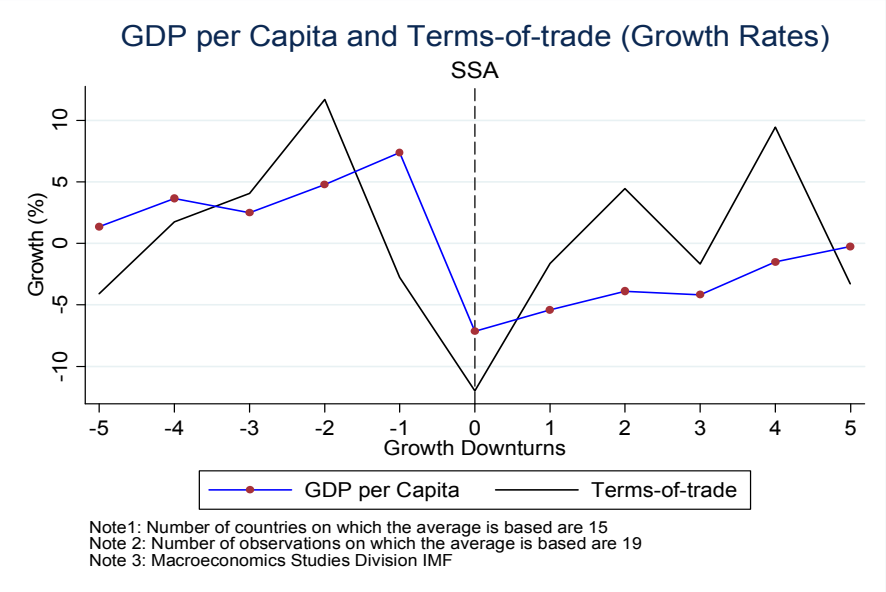
Figure 6: TOT vs. ED around periods of growth decelerations in LICs

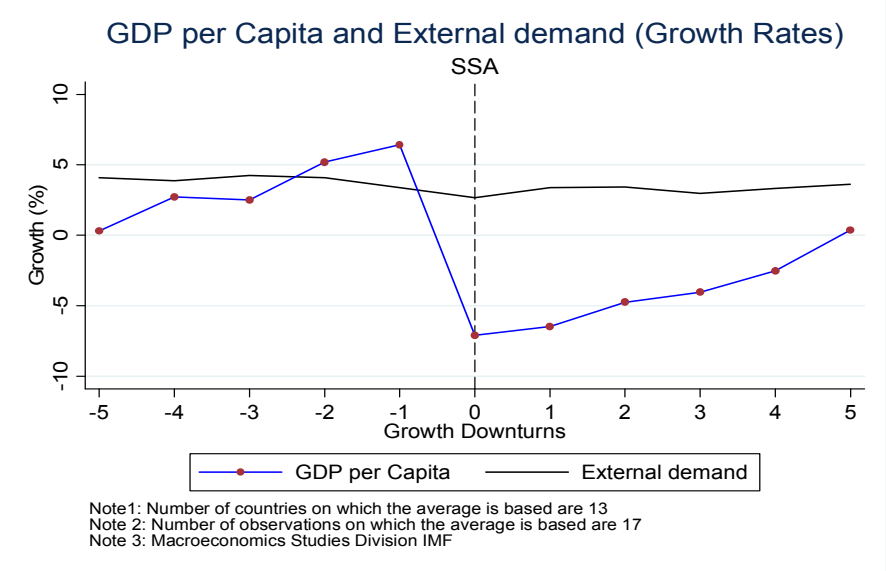




Note: The top and bottom panels plot the behavior of TOT and ED, respectively, in the period leading up to, and following, growth downturns (year 0 on the horizontal axis) in LICs.

Figure 7: TOT vs. ED around periods of growth decelerations in SSA





Note: The top and bottom panels plot the behavior of TOT and ED, respectively, in the period leading up to, and following, growth downturns (year 0 on the horizontal axis) in SSA.

The results from the two exercises relating growth down-breaks with shocks were confirmed when the sample is restricted to SSA countries (Figure 7). One additional observation from this exercise is that the growth down-breaks experienced by SSA countries are sharper and seem to occur after a period of steady rise in growth.

VI. CONCLUSIONS

Although the short-run growth prospects for emerging and developing countries appear to be positive (see Berg et al. 2010), there is still a question on the extent to which the current shock has longer-run implications that may knock LICs off their track record of solid medium-term growth. History is not encouraging that LICs can uniformly escape global shocks without absorbing long-lasting damage to growth and welfare. In past crises, it has often taken several years for LICs to bring growth rates back into positive territory. Could this be pattern be different in the 2009 global crisis? This paper has attempted to answer this question by several econometric methodologies to analyze historical data in a panel of countries.

On the positive side, based on the history of growth decelerations, our results suggest that ED shocks are not associated with sharp declines in output growth. Given existing evidence that LICs were primarily impacted by such a shock, the exercise assigns a low probability that many LICs will suffer from persistently low growth due to the crisis. However, our impulse response analysis shows that there seem to be quite substantial and highly persistent output losses associated with TOT and ED shocks in the medium-run.

Panel growth regressions re-enforced the impulse response findings that show economically significant effects of TOT, ED and FDI shocks in the medium-run. Finally, by using simple illustrations and by extending the regression analysis to include interaction terms we investigated how macroeconomic policies may amplify or moderate the effects of the three shocks on growth. It was shown that countries with lower budget deficits, lower debt, more flexible exchange rate regimes, and higher international reserves are more likely to dampen the effects of an ED shock on growth.

These conclusions are too broad-brush to do more than inform country-specific policy recommendations. These empirical exercises are only rough guides to current circumstances. First, there has always been substantial heterogeneity in the response of countries' growth to large negative terms of trade shocks, and it is important to avoid over-emphasizing average reactions to average shocks. Second, the current shock is different in many ways. Clearly there is a need for vigilance and prudent policy to prevent a protracted slowdown in some countries. Nonetheless, this paper suggests some cause for optimism about recovery of LICs to their pre-crisis growth rates.

References

Antoshin, S., A. Berg, and M. Souto (2008) "Testing for Structural Breaks in Small Samples," *IMF Working Papers 08/75*, Washington: International Monetary Fund.

Azariadis, C. and J. Stachurski (2007) "Poverty Traps," In *Handbook of Economic Growth*, Vol. 1, Chapter 5, edited by Philippe Aghion and Steven N. Durlauf, The Netherlands: Elsevier Science.

Bowles, S., S. N. Durlauf, and K. R. Hoff (2006) *Poverty Traps*, Russell Sage Foundation.

Bai, J. and P. Perron (1998) "Estimating and Testing Linear Models with Multiple Structural Changes," *Econometrica*, 66, 47–78.

Ben-David, D. and D. H. Papell (1998) "Slowdowns and Meltdowns: Postwar Growth Evidence from 74 Countries," *Review of Economics and Statistics*, 80, 561–571.

Benhabib, J. and M. Spiegel (1994) "The Role of Human Capital in Economic Development: Evidence from Cross-Country Data," *Journal of Monetary Economics*, 34, 143–173.

Berg, A., D., O. Jonathan, and J. Zettelmeyer (2008) "What Makes Growth Sustained," *IMF Working Paper 08/59*, Washington: International Monetary Fund.

Berg, A., C. Papageorgiou, C. Pattillo, M. Schindler, N. Spatafora, and H. Weisfeld (2010) "The Short-Run Effects of the 2007-09 Global Financial Crisis on Growth in Low-Income Countries," draft working paper, IMF.

Boyd, J. H., S. Kwak, and B. Smith (2005) "The Real Output Losses Associated with Modern Banking Crises," *Journal of Money, Credit, and Banking*, 37, 977–999.

Cerra, V. and S. C. Saxena (2008) "Growth Dynamics: The Myth of Economic Recovery," *American Economic Review*, 98, 439–457.

Collier, P. and B. Goderis (2009) "Structural Policies for Shock-Prone Developing Countries," *Oxford Economic Papers*, 61, 703–726.

Collier, Paul and B. Goderis (2010) "Does Aid Mitigate Shocks?" *Review of Development Economics* (forthcoming).

Collier, Paul, B. Goderis, and A. E. Hoeffler (2006) "Shocks and Growth: Adaptation, Precaution and Compensation," working paper, Oxford University.

Collier, Paul, J. W. Gunning, B. J. Ndulu, and S. A. O'Connell (2008) "Harnessing Growth Opportunities: How Africa Can Advance," in *The Political Economy of Economic Growth in*

Africa, 1960-2000, eds., B. J. Ndulu, S. A. O'Connell, R. H. Bates, P. Collier, and C. C. Soludo, Cambridge University Press.

Dabla-Norris, Era, J. Honda, A. Lahreche, and G. Verdier (2010) "FDI Flows to Low-Income Countries: Global Drivers and Growth Implications," IMF Working Paper WP/10/132.

Drummond, P. and G. Ramirez (2009) "Spillovers from the Rest of the World into Sub-Saharan African Countries," IMF Working Paper WP/09/155.

Easterly, W., M. Kremer, L. Pritchett, and L. H. Summers (1993) "Good Policy or Good Luck?: Country Growth Performance and Temporary Shocks," *Journal of Monetary Economics*, 32, 459–483.

Furceri, D. and A. Mourougane (2009) "The Effect of Financial Crises on Potential Output: New Empirical Evidence from OECD countries," *OECD Economics Department Working Paper No. 699* (Paris: Organization for Economic Cooperation and Development).

Global Monitoring Report (2010) "The MDGs after the Crisis," World Bank – IMF.

Gupta S., Catherine Pattillo, and K. Carey (2006) "Sustaining and Accelerating Pro-Poor Growth in Africa," IMF Special Issues Paper.

Hausmann, R., F. Rodríguez, and R. Wagner (2006) "Growth Collapses," *CID Working Paper No. 136*.

Hausmann, R., L. Pritchett, and D. Rodrik (2005) "Growth Accelerations," *Journal of Economic Growth,* 10, 303–329.

Jones, B. F. and B. A. Olken (2008) "The Anatomy of Start-Stop Growth," *Review of Economics and Statistics*, 90, 582–587.

Imbs, J. (forthcoming) "The First Global Recession in Decades," *IMF Economic Review*.

IMF, (2009) "The Impact of the Financial Crisis on LICs-An Update."

Kehoe, T. and D. Levine **(**1993**) "**Debt-Constrained Asset Markets," *Review of Economic Studies*, 60, 865–888.

Krueger A. B. and M. Lindahl (2001) "Education for Growth: Why and for Whom?," *Journal of Economic Literature*, 39, 1101–1136.

Pisani-Ferry, J. and B. van Pottelsberghe (2009) "Handle with Care! Post-Crisis Growth in the EU," *Bruegel Policy Brief No. 2009/02* (Brussels: Bruegel).

Pritchett, L. (2000) "Understanding Patterns of Economic Growth: Searching for Hills among Plateaus, Mountains, and Plains," *World Bank Economic Review*, 14, 221–225.

Reddy, S. G. and C. Minoiu (2009) "Real Income Stagnation of Countries 1960-2001," The *Journal of Development Studies*, 45, 1–23.

Regional Economic Outlook: Sub-Sahara Africa (Spring 2008), IMF.

Regional Economic Outlook-Sub-Sahara Africa (Fall 2009), IMF.

Rodrik, D. (1999) "Where Did All the Growth Go? External Shocks, Social Conflict, and Growth Collapses," *Journal of Economic Growth*, 4, 385–412.

Souto M., S. Antoshin and A. Berg, 2008. "Testing for Structural Breaks in Small Samples," IMF Working Papers 08/75.

World Economic Outlook (Fall 2009), IMF.

Appendix A
List of countries and subsamples used in the quantitative analysis

LICs	Non LICs
Afghanistan	Algeria *
Albania	Argentina
Angola *	Belarus
Azerbaijan *	Bosnia and Herzegovina
Bangladesh	Botswana
Benin	Brazil
Bolivia	Bulgaria
Burkina Faso	Chile
Burundi	China
Cambodia	Colombia
Cameroon	Costa Rica
Central African Republic	Croatia
Chad *	Dominican Republic
Congo, Dem. Rep. of	Ecuador *
Congo, Rep. *	Egypt, Arab Rep.
Côte d'Ivoire	El Salvador
Eritrea	Estonia
Ethiopia	Gabon *
Gambia, The	Guatemala
Georgia	Hungary
Ghana	Indonesia
Guinea	Iran, Islamic Rep. *
Guinea-Bissau	Jamaica
Haiti	Jordan
Honduras	Kazakhstan *
India	Kuwait *
Kenya	Latvia
Kyrgyz Republic	Lebanon
Lao PDR	Libya *

Note: All countries in sample are classified as LICs and non LICs. Fuel exporters are marked with stars. The dataset used in this paper is available by the authors upon request. For a data appendix see Berg et al. (2010).

List of countries and subsamples used in the quantitative analysis (cont.)

LICs	Non LICs
Lesotho	Lithuania
Madagascar	Macedonia
Malawi	Malaysia
Mali	Mauritius
Mauritania	Mexico
Moldova	Morocco
Mongolia	Namibia
Mozambique	Oman *
Myanmar	Panama
Nicaragua	Paraguay
Niger	Peru
Nigeria *	Philippines
Pakistan	Poland
Papua New Guinea	Romania
Rwanda	Russian Federation *
Senegal	Saudi Arabia *
Sierra Leone	Serbia
Sri Lanka	South Africa
Sudan *	Swaziland
Tajikistan	Syrian Arab Republic
Tanzania	Thailand
Togo	Trinidad and Tobago *
Uganda	Tunisia
Uzbekistan	Turkey
Vietnam	Turkmenistan *
Zambia	Ukraine
	United Arab Emirates *
	Uruguay
	Venezuela *

Note: All countries in sample are classified as LICs and non LICs. Fuel exporters are marked with stars. The dataset used in this paper is available by the authors upon request. For a data appendix see Berg et al. (2010).

Appendix B
List of down-breaks episodes in our sample

country	year	country	year	country	year
Albania	1988	Estonia	1990	Namibia	1981
Angola	1975	Estonia	2005	Nicaragua	1978
Armenia	1971	Gabon	1977	Nigeria	1972
Armenia	1990	Georgia	1990	Oman	1977
Armenia	2005	Guatemala	1981	Oman	1986
Azerbaijan	1974	Haiti	1982	Papua New Guinea	1975
Azerbaijan	1990	Haiti	1999	Paraguay	1982
Bangladesh	1973	Honduras	1969	Peru	1988
Bangladesh	1979	Hungary	1979	Philippines	1957
Belarus	1961	Iran, Islamic Rep.	1977	Philippines	1981
Belarus	1978	Jamaica	1973	Poland	1980
Belarus	1991	Jordan	1968	Romania	1989
Bolivia	1978	Jordan	1983	Russian Federation	1961
Botswana	1990	Kazakhstan	1974	Russian Federation	1975
Brazil	1981	Kazakhstan	1990	Russian Federation	1991
Bulgaria	1982	Kuwait	1996	Saudi Arabia	1982
Bulgaria	1990	Kyrgyz Republic	1971	Sierra Leone	1975
Burundi	1972	Latvia	1974	Sierra Leone	1995
Cameroon	1971	Latvia	1989	South Africa	1982
Cameroon	1987	Latvia	2005	Tajikistan	1990
Chile	1972	Libya	1969	Thailand	1997
Congo, Dem. Rep. of	1975	Lithuania	1974	Togo	1970
Congo, Dem. Rep. of	1990	Lithuania	1991	Trinidad and Tobago	1983
Costa Rica	1979	Lithuania	2005	Tunisia	1973
Croatia	1980	Macedonia, FYR	1980	Turkmenistan	1974
Croatia	1990	Macedonia, FYR	1990	Turkmenistan	1991
Côte d'Ivoire	1979	Mauritania	1972	Turkmenistan	2005
Ecuador	1974	Mexico	1982	Uganda	1970
Egypt, Arab Rep.	1979	Moldova	1974	Ukraine	1974
El Salvador	1979	Moldova	1991	Ukraine	1991
Eritrea	1995	Mongolia	1990	Uzbekistan	1974
Eritrea	2000	Mozambique	1975	Uzbekistan	1991
Eritrea	2001	Mozambique	1982	Zambia	1970
Estonia	1974	Myanmar	1986	Zimbabwe	1999

Note: Growth breaks are produced using the methodology developed in Souto, Antoshin and Berg (2008) and subsequently used in Berg, Ostry and Zettelmeyer (2008).