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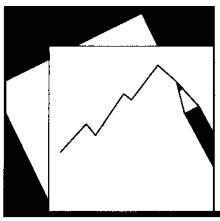

IMF Working Paper

Spillovers to Low-Income Countries: Importance of Systemic Emerging Markets

Era Dabla-Norris, Raphael Espinoza, Sarwat Jahan

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Spillovers to Low-Income Countries: Importance of Systemic Emerging Markets*

Prepared by Era Dabla-Norris, Raphael Espinoza, and Sarwat Jahan

Authorized for distribution by Catherine Pattillo

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Abstract

This paper documents the expanding economic linkages between low-income countries (LICs) and a narrow group of "Emerging Market leaders" that have become major players in regional and global trade and financial flows. VAR models show that these linkages have increased the share of growth volatility that can be attributed to foreign shocks in LICs. Dynamic panel models further analyze the impact of LIC trade orientation and production structure on the sensitivity to foreign shocks. The empirical results demonstrate that the elasticity of growth to trading partners' growth is high for LICs in Asia, Latin America and the Caribbean, and Europe and Central Asia. However, for commodity-exporting LICs in Sub-Saharan Africa and the Middle East, terms of trade shocks and demand from the emerging market leaders are the main channels of transmission of foreign shocks.

JEL Classification Numbers: C22, E32, F15, F43

Keywords: Growth Spillovers; Low-Income Countries; Economic Integration; Decoupling; Vector Autoregression; Panel Estimate

Author's E-Mail Address: edablanorris@imf.org; respinoza@imf.org; sjahan@imf.org

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I. INTRODUCTION

Economic linkages between low-income and emerging market countries have deepened dramatically in recent decades. The "new" partners of low-income countries[1] (LICs) come from a relatively narrow group of emerging markets (EMs) that have emerged as dominant players in regional and global trade and important hubs for remittances and financial flows. Within EMs, the BRICs (Brazil, Russia, India, and China) are the largest destination of LICs exports and rapidly growing sources of financial flows. China and India, in particular, have the widest geographical reach across LIC regions. But other emerging markets are equally important players within their regions. For example, South Africa is often described as the "engine of growth" in Sub-Saharan Africa (SSA) because of its financial links within the region and trade linkages with its immediate neighbors. Similarly, Saudi Arabia is the largest source of remittances for LICs in the Middle East and North Africa (MNA) region.

This growing economic integration raises questions about the significance and magnitude of the economic influence wielded on LICs by these systemic EMs—the inter- and intra-*regional leaders* that dominate trade and financial flows. This paper documents the nature and extent of economic linkages between EM leaders and LICs across various regions. Does growth in the EM leaders have "spillover effects" on LIC economic activity? Are these spillovers beneficial and what is their size across different LIC regions? Answers to these questions can provide important insights into the impact of economic activity in systemic EMs on LIC growth prospects.

Economic growth in EM leaders can influence LIC growth prospects through a variety of channels. The most obvious channel is the direct trade channel, with higher growth in EMs contributing to a rise in demand for LIC exports. This was evident during the recent global financial crisis, with recovery in many LICs mirroring growth in EM trading partners (IMF, 2010). The growth effect can also be transmitted through remittances and financial linkages (cross-border bank flows and FDI). EMs can also have indirect effects on LIC growth prospects if demand in the former impacts global fuel and commodity prices.

The paper employs both VAR methodologies and dynamic panel regressions to estimate spillovers from the EM leaders to LICs. Results from the VAR analysis indicate that for LICs as a whole (or for the average LIC) foreign shocks are increasingly important contributors to economic activity. In particular, spillovers from both advanced economies and EM leaders are substantial and increasing since the mid-1990s. Spillovers in SSA LICs, however, are primarily channeled through commodity price shocks. Activity in regional EMs is also an important driver of cycles in LICs, particularly in Asia, reflecting increased intra-regional integration in recent decades.

[1] In this paper, "low-income countries" refers to all countries on the IMF's list of countries eligible to borrow from the Poverty Reduction and Growth Trust (PRGT) at end-December 2010.

The panel regression models complement the VAR analysis by quantifying the effects of spillovers to LICs using country-level data. The regression results suggest that the magnitude of spillovers depends on the production structure and the regional orientation of LICs. In particular, consistent with the VAR results, LICs are sensitive to cycles in large emerging markets, even after controlling for growth in advanced economies. Moreover, the results suggest that demand from major emerging market countries in the post-1995 period has been the main driver of growth in commodity-exporting LICs, reflecting the importance of commodities in LIC-EM trading relations.

While a sizeable body of literature has examined the business cycle synchronization and spillovers of economic activity among advanced and emerging market countries, studies on LICs are more nascent. The literature typically finds that countries with greater trade and financial linkages have more synchronized business cycles (see Imbs, 2004; Akin, and Kose, 2007). A number of recent papers have explored the extent of spillovers from BRICs to LICs (IMF, 2011)[2], the impact of global developments and individual EMs on specific LIC regions (Arora and Vamvakidis, 2005; Shiells et al., 2005; Alturi et al., 2009; Drummond and Ramirez, 2009). Less attention has been paid in the literature, however, to inter-and intra-regional dimensions of the impact of dynamic emerging markets on LIC growth prospects. Our paper contributes to this literature by distinguishing between the spillovers stemming from advanced economies and those arising from EM leaders across different LIC regions. We also distinguish between spillovers based on the production structure and the regional orientation of LICs.

The rest of the paper is structured as follows. Section II documents stylized facts on the extent and nature of linkages between EMs and LICs. Section III uses VAR models and panel regressions to assess the dynamics and severity of shocks in advanced economies and EM leaders on LICs; while Section IV simulates the effect on LICs of a euro area-driven recession in 2011. Section V concludes.

II. LINKAGES BETWEEN EMS AND LICS

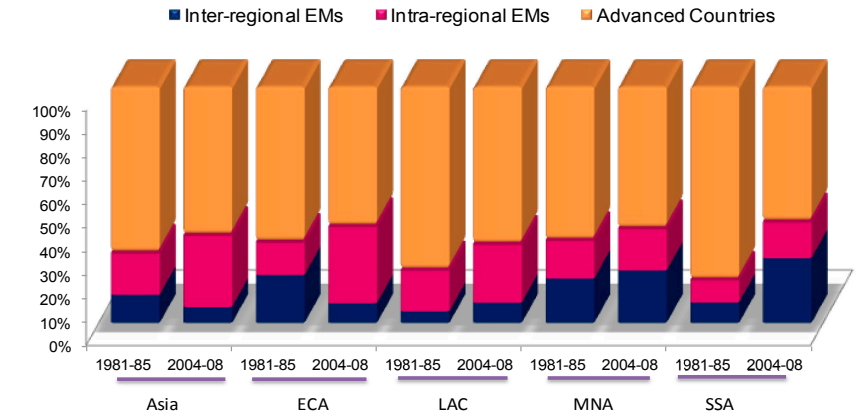
A. Trade Linkages

Trade linkages between LICs and emerging markets have increased dramatically over the past three decades. While the "traditional partners"—the advanced economies—remain the largest destination of LIC exports (accounting for about 60 percent of total LIC exports in 2008), their share fell by over 10 percentage points in the last 30 years. This trend is discernable across all LIC regions, and is particularly pronounced in SSA (a decline of about 30 percentage points), with non-traditional partners accounting for about half of SSA exports in 2004-2008 (Figure 1). In place of the traditional partners, inter- and intra-regional

[2] Using a Global VAR model, the paper finds that that the total impact (direct and indirect, via third-country trade) of a 1 percentage point increase in BRICs activity would increase LICs GDP by 0.7 percent over 3 years, and 1.2 over 5 years.

links with EMs and other LICs have expanded, albeit with considerable heterogeneity across LIC regions. Among LICs in Asia and ECA, this trend has largely been driven by an expansion of intra-regional trade, while inter-regional trade features more prominently for LICs in SSA. This change was especially rapid since the late 1990's, and occurred against the backdrop of the increasing spread and importance of global production chains, and the rapid growth of new sources of demand for commodities in large emerging economies (in particular China and India).

Figure 1. Share of LIC Exports by Destination
(1981-85 and 2004-08)



Note: ECA refers to Europe and Central Asia, LAC refers to Latin America and Carribean, MNA refers to Middle East and North Africa, and SSA refers to Sub-Saharan Africa.
Source: UN Comtrade database; IMF staff calculations.

Who are the EM leaders? We classify as EM leaders (both inter- and intra- regional) eight EMs that are the largest destination of LIC exports in each major region (see Table 1). Using this classification, Turkey, Russia, and Brazil account for a significant share of LIC exports within their region (in Europe and Central Asia (ECA) and Latin America and the Caribbean (LAC) regions, respectively). On the other hand, China and India have a significant geographical presence across all regions.

Table 1. EM Leaders' Export Shares from LICs

Destination	Region	Share of Intra-Regional LIC Exports, mean	Share of Inter-Regional LIC Exports, mean
India	Asia	10.7%	5.9%
China	Asia	10.8%	8.2%
Russia	ECA	13.6%	0.9%
Turkey	ECA	9.4%	0.6%
Mexico	LAC	2.9%	0.4%
Brazil	LAC	15.1%	0.5%
Saudi Arabia	MNA	2.5%	0.5%
South Africa	SSA	3.3%	1.0%

Source: UN Comtrade database; IMF staff calculations.

Who are the LICs with the strongest trade links with EM leaders? For 10 LICs, intra-regional leaders account for 20 percent or more of total exports (Table 2). In Mongolia, Bolivia and Nepal, a single intra-regional leader accounts for more than 50 percent of their total exports. As the bottom half of Table 2 indicates, China and India clearly play the dominant role of inter-regional leaders. For instance, India accounts for over 60 percent of total exports from Guinea-Bissau, while over 40 percent of exports from Sudan, Democratic Republic of Congo and Mauritania are directed to China.

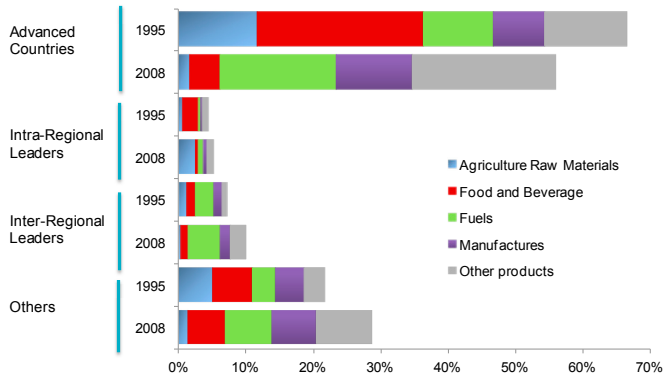
Table 2: Top Ten Ranking of LICs based on Exports Share to Regional Leaders, 2008

LICs	Exports to EM Leaders (in percentage of total exports)	Major EM Leader	Exports to Major EM Leader (in percentage of total exports)
Rank by Intra-Regional Leaders			
Mongolia	64.6	China	64.5
Bolivia	61.0	Brazil	60.1
Nepal	55.5	India	54.8
Tajikistan	35.1	Turkey	26.5
Zimbabwe	32.3	South Africa	32.3
Uzbekistan	24.5	Russia	17.0
Afghanistan, I.R. of	24.1	India	23.5
Kyrgyz Republic	21.9	Russian	19.2
Myanmar	21.1	India	12.3
Armenia	19.9	Russia	19.7
Rank by Inter-Regional Leaders			
Guinea-Bissau	65.0	India	64.0
Yemen, Republic of	54.3	China	30.9
Sudan	52.4	China	48.0
Congo, Dem. Rep. of	50.2	China	47.3
Mauritania	44.0	China	41.5
Gambia, The	41.7	India	36.7
Congo, Republic of	33.4	China	30.1
Benin	30.2	China	15.2
Mali	30.1	China	26.4
Guinea	30.0	India	17.8

Source: UN Comtrade database; IMF staff calculations.

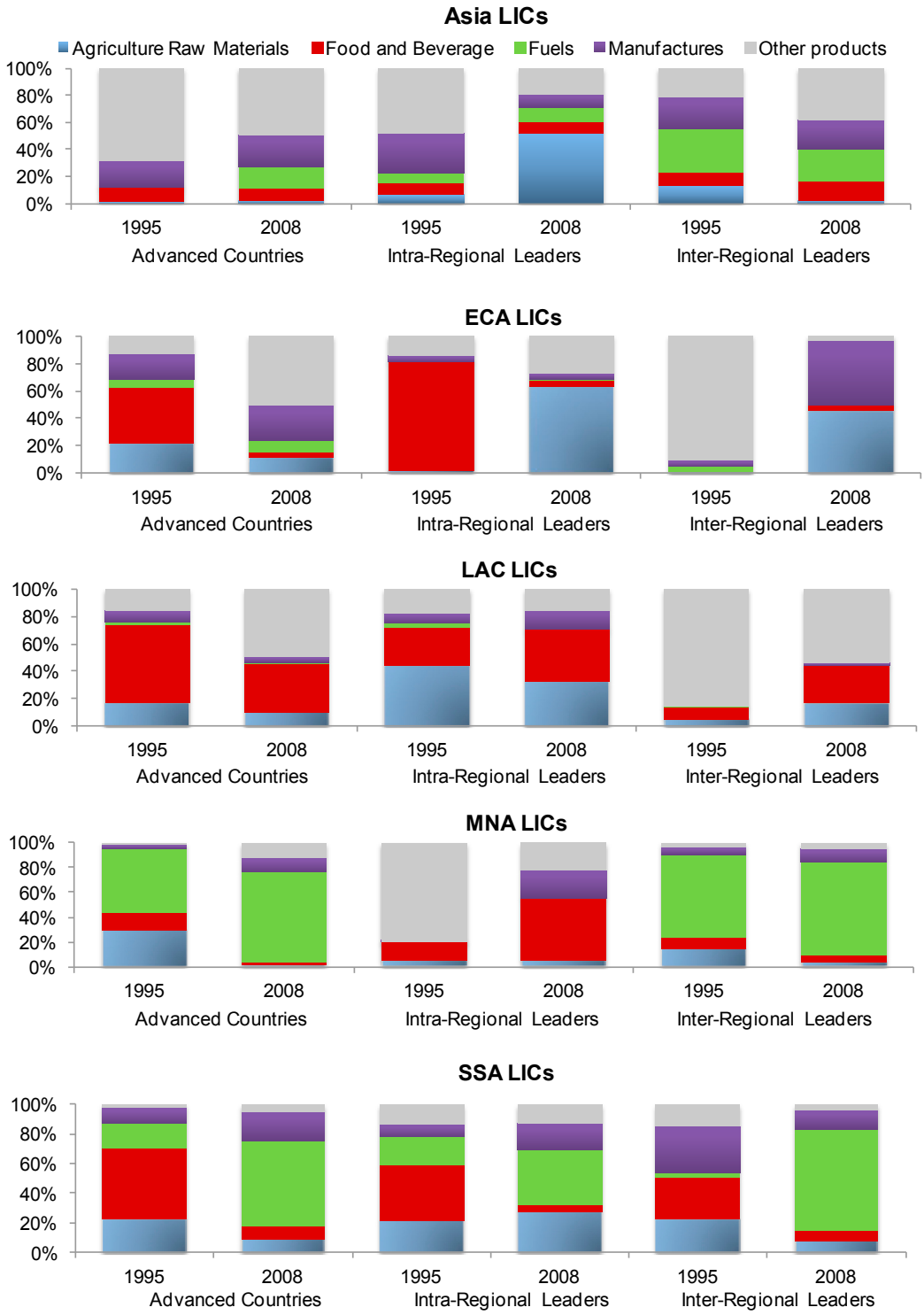
The reorientation of trade to EMs has coincided with a change in composition of LIC exports (Figure 2). In 1995, LIC exports to advanced economies, and to a lesser extent, intra-regional leaders were dominated by agricultural raw materials and food and beverage products. By 2008, fuels, manufactures, and other products accounted for the largest share of overall LIC export baskets, particularly to advanced economies and inter-regional leaders. This overall pattern is largely driven by LICs in SSA and MNA, where the share of fuel exports increased markedly since 1995 (Figure 3). By contrast, LICs in Asia, LAC, and ECA are relatively more diversified, with a higher share of exports of manufactured goods. As can be seen from Figure 3, in all LIC regions, intra-regional exports tend to have a larger share of products with higher local value added.

Figure 2. Exports Shares from All LICs, by product and destination income group



Note: Other products include Chemicals and related products, Machinery and transport equipment, Miscellaneous manufactured articles, and Commodities and and transactions not classified elsewhere in the SITC.
Source: UN Comtrade database; IMF staff calculations.

Figure 3. Exports Shares from LICs, by Product and Destination
(In percent)



Note: Other products include Chemicals and related products, Machinery and transport equipment, Miscellaneous manufactured articles, and Commodities and transactions not classified elsewhere in the SITC.
Source: UN Comtrade database; IMF staff calculations.

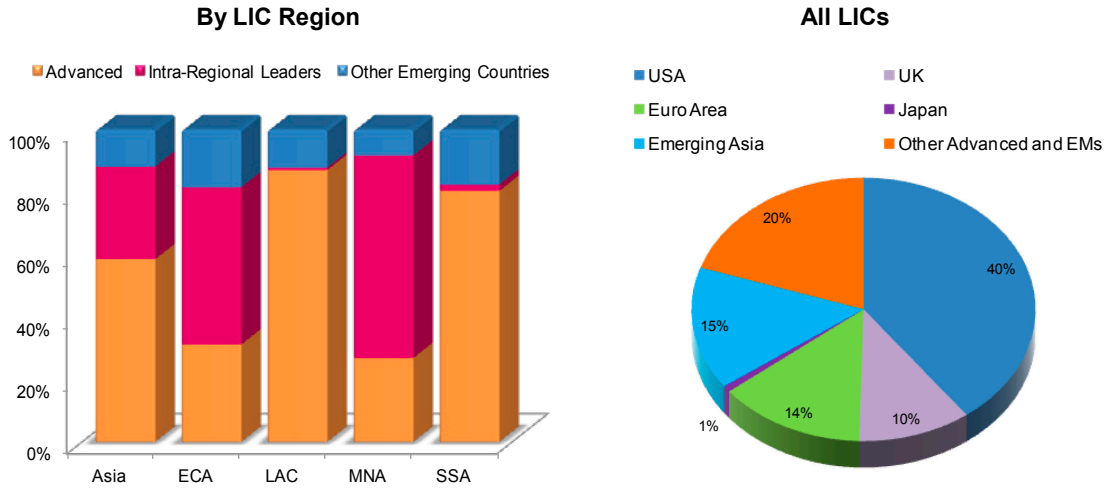
B. Other Linkages

This section documents the growing integration between LICs and EM leaders through other flows: remittances, FDI, and cross border banking. While the paucity of bilateral data for these flows renders detailed analysis difficult, this section provides some preliminary evidence of the growing role of EMs as sources of remittances and capital flows in LICs.

Remittances

EM leaders are an important source of remittances for LICs, particularly within their own region. India accounts for about 30 percent of total remittance inflows to LICs in Asia.[3] Similarly, Russia and Saudi Arabia account for respectively 50 and 65 percent of total remittance flows to LICs within their own regions. For instance, remittances from Russia account for 28 and 36 percent of GDP in the Kyrgyz Republic and Tajikistan, respectively. Saudi Arabia plays a pivotal role globally, accounting for close to 10 percent of total remittance flows to LICs in Asia and about 1 percent of flows to SSA. Among LICs in the LAC region, advanced economies (in particular the United States) are the major source of remittances, accounting for over 80 percent of the total. In SSA, over 75 percent of remittances originate from the U.K. and the euro area.

Figure 4. Remittance Flows to LICs, 2006



Note: Based on countries with reported data. EM leaders exclude China as bilateral data on remittances are not available.
Source: Ratha and Shaw (2006); www.worldbank.org/prospects/migrationandremittances.

Foreign Direct Investment

While advanced countries continue to be the most important source of FDI for LICs, on average, FDI from the EM leaders is becoming increasingly important. Detailed data on bilateral FDI flows from all the EM leaders identified in Table 1 are unavailable, but the available evidence suggests that FDI from China and India has tended to spread around the world while investments from other EM leaders are largely concentrated in LICs within their region.

[3] Bilateral data on remittances from China is not available.

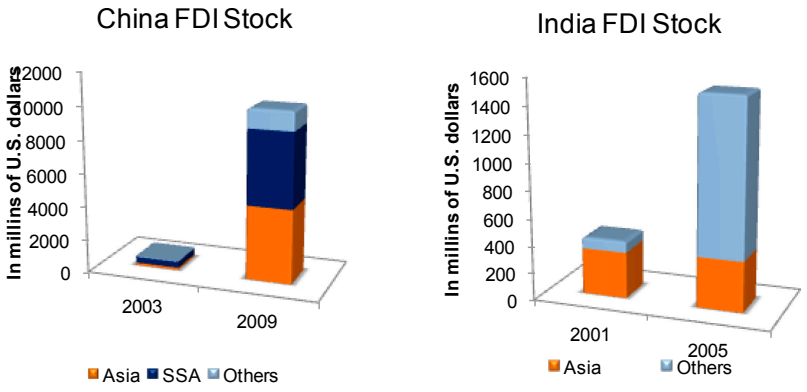
Among the EM leaders for which comparable data are available, China dominates the expansion of FDI to LICs, in the resource sector (especially in SSA) and in manufacturing (especially for Asia)—see Table 3. [4] Between 2003 and 2009, the stock of Chinese FDI to LICs increased 19 fold (Figure 5). Among Asian LICs, Mongolia, Myanmar, Cambodia, Laos PDR and Vietnam are the largest recipients of FDI. In SSA, Nigeria, Zambia and Democratic Republic of Congo are the top destinations. Following the global crisis, China has also emerged as a major foreign investor among LICs in ECA, with projects in sectors such as mining, oil refining, and energy generation.

Table 3. Top Recipients of Chinese FDI,
(Rank by average, 2003-09)

Country	In millions of U.S. dollars	Percent of total FDI to LICs (Percent)
Nigeria	131	11.4
Mongolia	127	11.1
Myanmar	122	10.6
Cambodia	79	6.8
Zambia	79	6.8
Laos PDR	74	6.4
Vietnam	62	5.4
Guyana	60	5.2
Congo, Dem. Rep. of	52	4.5
Sudan	52	4.5
Papua New Guinea	44	3.9
Afghanistan	26	2.3
Niger	26	2.3
Tajikistan	21	1.8
Madagascar	19	1.6
Ethiopia	18	1.6

Source: UNCTAD database; IMF staff calculations.

Figure 5. EM Leaders Stock of FDI in LICs



Source: UNCTAD and staff calculations.

Between 2001 and 2005, the stock of Indian FDI in LICs grew almost four-fold, with an increasing presence in SSA. India is also an important source of FDI in LICs within Asia, with a majority of its FDI flowing to Vietnam, Nepal and Bangladesh. Unlike other EM leaders, Brazil plays a less prominent role as source of FDI in majority of LICs. Among LICs, Bolivia receives the bulk of the Brazilian FDI (74 percent of all Brazilian FDI to LICs), with Liberia, Armenia, and Mozambique receiving the rest. South Africa is the

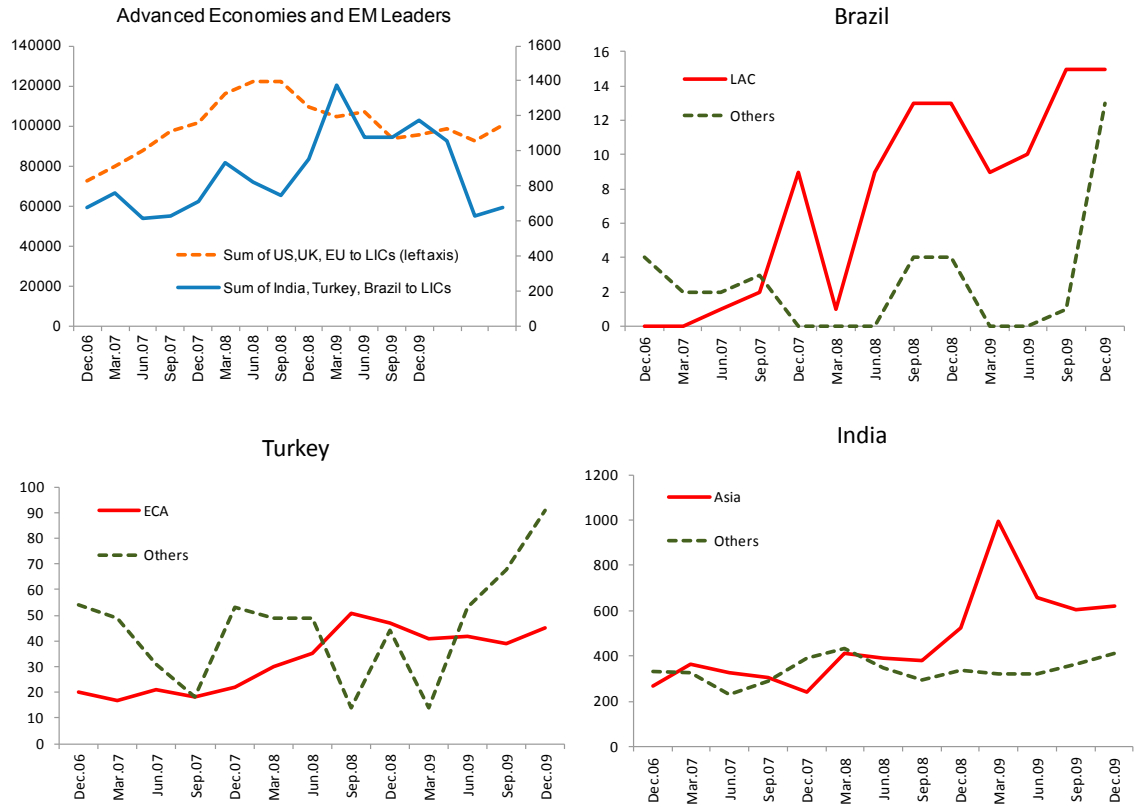
[4] This is based on data from UNCTAD which has bi-lateral data available for limited number of EM leaders. The latest data available for India and China are 2005 and 2009 respectively.

second most important developing country investor in Africa after China. The share of African host economies in South Africa's outward FDI stock reached almost USD11 billion in 2008 (22 percent, compared with 5 percent in 2000).

Cross-border bank lending

The growth of capital flows from EM leaders to LICs has also been reflected in a strengthening of banking sector links. Advanced economies overwhelmingly dominate LIC banking sectors, but cross-border bank flows from the EM leaders have increased in recent years (although their share, using available data, remains around 1 percent of total cross border flows to LICs).[5] Figure 6 shows how lending from the EM leaders to LICs within their own regions has increased rapidly from 2006 onwards. Lending from EM leaders to other LICs has also increased, but is comparatively more volatile.

Figure 6. Consolidated Foreign Claims of Reporting Banks by Region, 2006-09
(In millions of U.S. dollars)



Source: Bank for International Settlements (BIS) Consolidated banking statistics, Fund staff calculations.
Note: Consolidated foreign claims of reporting banks - immediate borrower basis, on individual countries by nationality of reporting banks/Amounts outstanding.

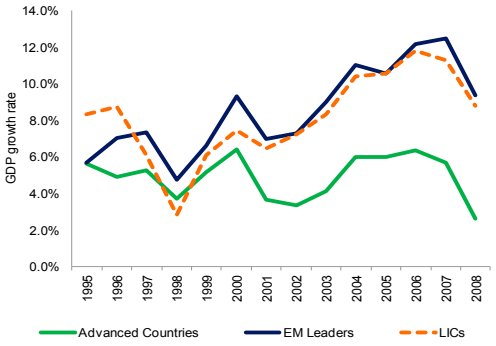
[5] The Industrial and Commercial Bank of China, Brazil's Itau Unibanco, Russia's Sberbank and State Bank of India are some examples of emerging market banks that have broken into the top 25 banks worldwide. See Massa (2010), "Cross-border bank lending to developing countries: the new role of emerging markets", for details.

In India, the expansion of cross-border lending has mostly occurred within the region (Maldives and Bangladesh) but new markets have opened up in SSA (Kenya, Nigeria, Niger and Ghana). Similarly cross-border flows from Brazil to LICs in SSA (Nigeria, Senegal, and Kenya) have increased. Turkey has had greater lending outside its own region, mainly with SSA (Liberia and Sudan), but also plays an important role in the ECA region (Georgia, and Kyrgyz Republic).

C. Is There Evidence of Decoupling and Coupling?

The increasing integration of the LICs with the EM leaders raises questions about spillovers that can be expected and the vulnerabilities that might ensue from these economies. In the last business cycle, there has been a decoupling away from the advanced economies, but growth correlations between LICs and the EM leaders have strengthened (Figure 7 and Table 4). Similarly, there is a strong correlation between the GDP growth rate of the EM leaders and the growth rate of LIC exports over GDP over 2000-08.

Figure 7. GDP Growth Rate by Income Groups, 1995-2008



Source: WEO database; IMF staff calculations.

Table 4. LICs Correlation with Other Economies

Correlation	1995-99	2000-08
	GDP Growth	
Advanced Countries	0.796	0.605
EM Leaders	0.566	0.958
	GDP Growth and LIC Exports	
Advanced Countries	0.598	0.701
EM Leaders	-0.055	0.630

Source: WEO database; IMF staff calculations.

III. Analytical Findings

A. VAR Analysis

This section uses VAR models applied to five regional groups of LICs to analyze the importance of shocks from advanced economies and EMs for LICs. VAR models permit an analysis of the dynamic relationships between the different variables under study and allow for the identification of shocks (Bayoumi and Swinston, 2007). Identification is crucial for analyzing the effect of different shocks given significant co-movements across variables. These co-movements create the risk that a correlation between two variables is incorrectly interpreted as a causal link, even when both variables are driven by a different shock. In a setting in which multiple economies affect activity in LICs, the VAR takes into account such interactions, thereby tracing the effect of each shock back to the appropriate source.

The data cover all LICs in our sample (See Appendix A for a list of countries), EMs, and advanced economies. Given our focus on growth spillovers, the key variable of interest is real GDP growth. Since the analysis examines broad trends affecting LIC growth cycles, idiosyncratic components of growth in individual countries were filtered out by using regional GDP averages. A VAR is estimated for each region in reduced form as:

$$Y_t = \sum_{i=1}^{m} A_i Y_{t-i} + \varepsilon_t \quad (1)$$

where Y is the vector of endogenous variables that includes real GDP growth for advanced countries, global commodity prices, the GDP growth of a group of emerging markets (either EM leaders or intra-regional EMs) and the real GDP growth of LICs within the region. For each group, GDP in US$ PPP was summed before computing the growth rate—this is akin to weighting the growth rates using GDP in PPP. A is a vector of coefficients, ε_t is a vector of error terms, and there are m lags in the system (with m set to 2 in the baseline specifications of the model).[6] The identification of shocks was based on a Cholesky decomposition. This identification attributes the correlation between two variables to be driven by the variable ordered first in the VAR. Impulse-response functions can be computed once the shocks are orthogonalized using this ordering.

The ordering assumes that the advanced economy business cycle is the most exogenous variable, followed by the cycle in EM leaders, and global commodity prices. The LIC region under study is ordered last. This ordering is predicated by the relative weight of these countries in the global economy. Alternative orderings were also considered with commodity prices placed before growth in EMs. The impulse responses of the VAR models, with one-standard deviation error bands estimated using 1000 Monte Carlo replications, are shown in Figure 8. Given the paucity of quarterly real GDP data for a large number of LICs, the VARs are run using annual data since 1980. For LICs in the MNA and ECA regions, the VARs are estimated from 1990 onwards (with only one lag).

The VARs suggest significant spillovers to LICs. The average LIC is affected by economic activity in advanced economies, EM leaders, and by changes in global commodity prices, albeit with considerable differences across regions. The impulse-response functions that trace out the cumulative impact on real GDP across LICs to shocks elsewhere are shown in Figure 8. A one-standard deviation positive growth shock to advanced country economy activity (i.e., a 1.5 percentage point shock in GDP) is associated with a strong and statistically significant rise in activity in LICs in Asia and ECA of about 1-2 percentage points. LICs in the LAC and in the MNA regions are, however, affected with some delay.

[6] The results of standard lag-selection tests varied, generally selecting anywhere from 1 to 4 lags, but two lags were included in all runs for uniformity, as well as *a priori* assumptions about the amount of time necessary for the transmission of shocks across regions. Specifically, the Akaike and Schwarz criterion suggest a shorter lag structure, but is known to underestimate the optimal lag structure. By contrast, the LR-test tended to suggest a very long lag structure, which was incompatible with the sample size.

LICs in SSA are least affected by a shock to advanced countries, after controlling for commodity prices and growth in the EM leaders.

Shocks to growth in EM leaders have a statistically significant effect on economic activity that varies across LIC regions. The results suggest that a one standard deviation positive shock to economic activity in the EM leaders (i.e., a one percentage point increase in GDP growth in EM leaders) raises activity by about one percentage point in MNA and ECA LICs; by between ½ and one point in SSA LICs; and by smaller amounts in Asian LICs. These spillovers are statistically significant at various horizons for LICs in these regions. A one standard deviation shock to global commodity prices (i.e., a 6 percent increase in commodity prices) raises economic activity by slightly less than ½ percentage point in Asian and LAC LICs, with surprisingly statistically insignificant effects for LICs in the ECA and MNA regions once economic activity in advanced countries and EM leaders is controlled for. Commodity price shocks have the most sizeable impact on economic activity in SSA LICs, reaching a cumulative 2.8 percent 3 years after the initial shock. The impact is also statistically significant.

The impulse response functions show the time path of the impact of one standard deviation orthogonalized shocks. These results can be used to compute the elasticity of domestic growth to external growth (in advanced countries and EM leaders, Table 5). In particular, three elasticities are calculated: the average response in year one, the additional lagged response in year two, and the total effect on the level of economic activity over two years.

Historically, a one percentage point positive shock to annual growth in advanced economies has caused, on average, an increase in growth in year one ranging from 0.1 in SSA LICs to 1.1 in ECA LICs. The lagged effects are also relevant for the LICs in the LAC, MNA, and ECA regions. Accounting for these lags raises the impact on the ECA region to around 2.0 over a two-year period, and around 1 or more percent on Asia and MNA LICs. Spillovers from shocks in EM leaders are typically front-loaded, and end up having an important effect on all LIC regions. A one percent shock to growth in EM leaders shifts economic activity by 0.3 to over 1 percent, on average. Moreover, in contrast to strong lagged effect of advanced country shocks, the impact elasticity tends to be higher across all LIC regions.

Figure 8. Impact of External Shocks on LICs Growth (Annual VAR)
(Cumulative response, in percentage points, to one standard deviation shock)

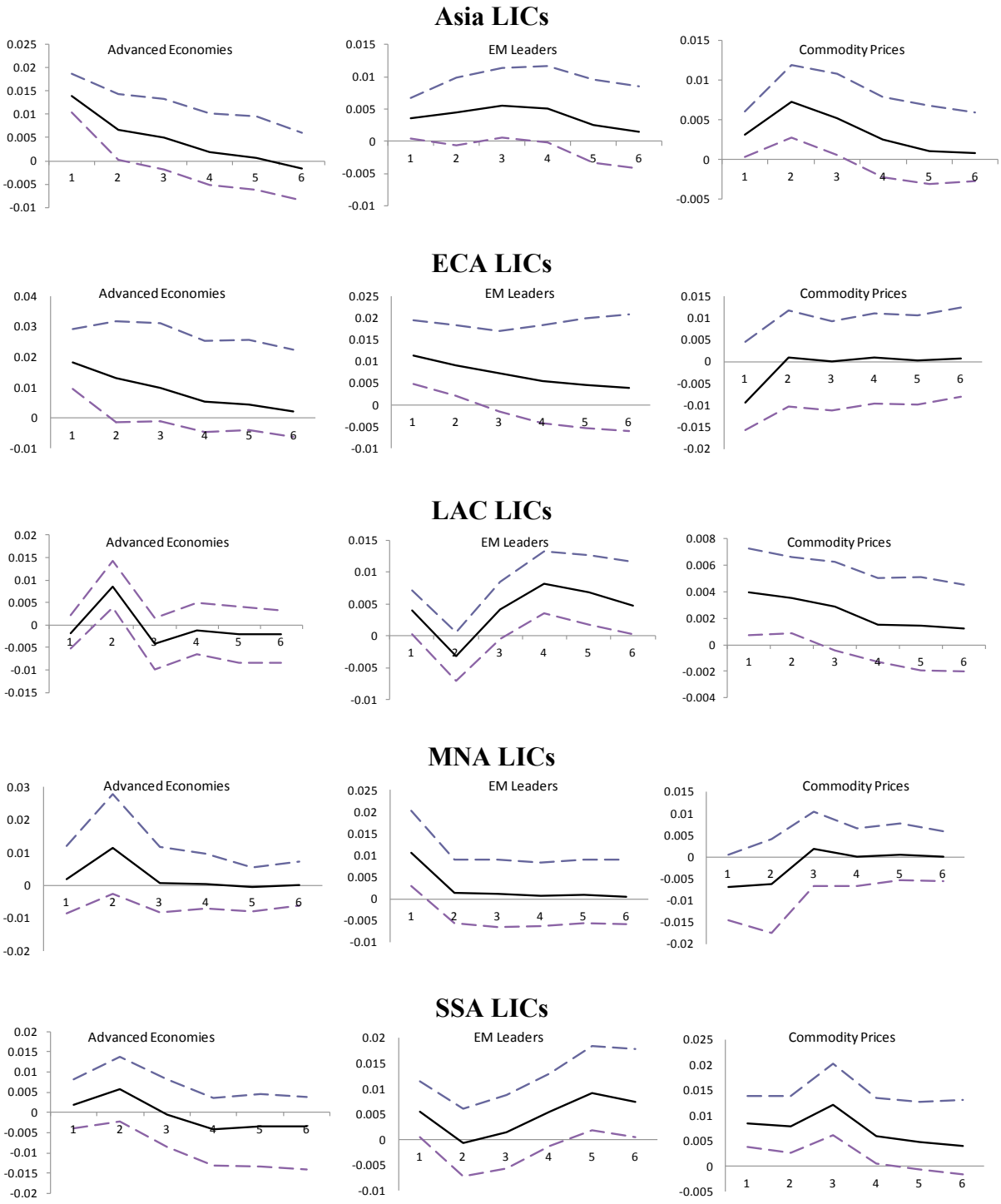
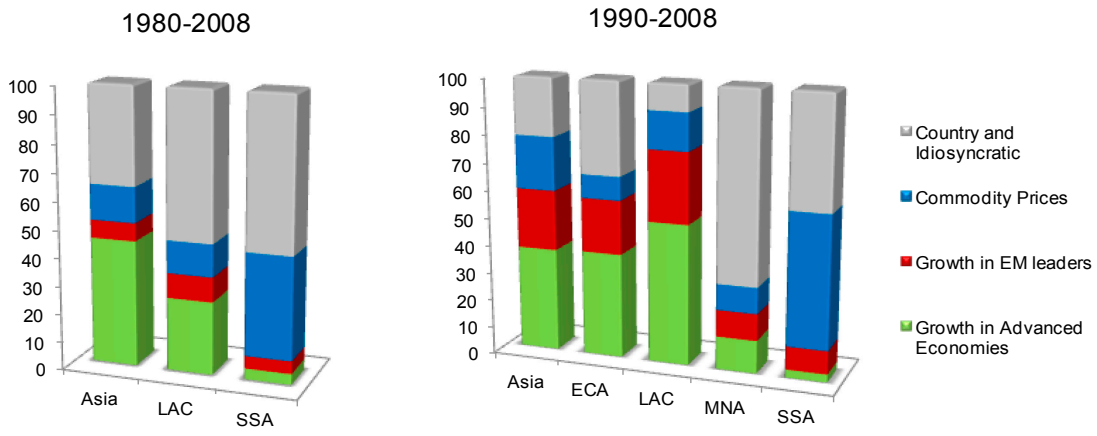


Table 5. Elasticity of LIC Domestic Growth to External Growth

	Asia	LAC	SSA	MNA (post 1990)	ECA (post 1990)
Advanced Economies					
Year 1	0.92	-0.13	0.13	0.14	1.09
Year 2	0.44	0.59	0.41	0.85	0.79
Cumulative	1.37	0.46	0.54	0.98	1.88
EM Leaders					
Year 1	0.32	0.37	0.46	1.13	1.41
Year 2	0.39	-0.29	-0.06	0.15	1.13
Cumulative	0.71	0.08	0.40	1.28	2.54

Variance decompositions of real GDP growth were computed using the VARs estimated above. These decompositions attribute the variation in domestic activity to the countries/type of shock from which the fluctuations originated. Two time periods (1980-2008 and 1990-2008) were considered to examine if external shocks play an increasingly important role in LICs, in line with their growing integration with the global economy. The results for the post-1990 period should be interpreted with caution as the short time span over which data are available adds a measure of uncertainty to these inferences. As can be seen from Figure 9, the contribution of external shocks to economic activity in the average LIC has increased over time. In the 1980-2008 period, external shocks contributed, on average, about 45 to 60 percent of the variation in LIC economic activity at a two-year horizon, with a higher contribution for LICs in Asia and LAC regions. This range increased over 1990-2008, on average, for all the three LIC regions (Asia, LAC, and SSA) for which data are available for the entire sample period.

Figure 9. Contributions to Variations in Growth in LIC Regions
(In percent)

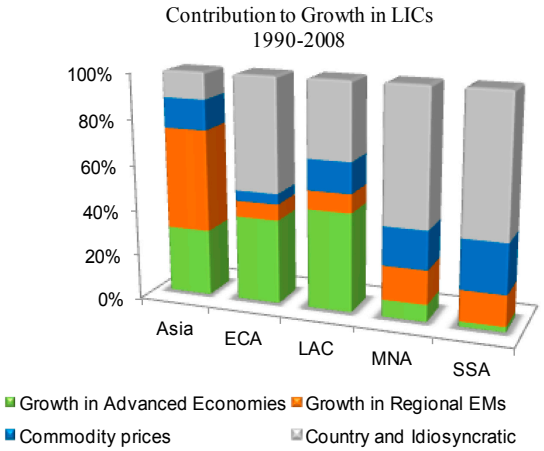


Shocks to advanced economies are responsible for over 28 percent of business cycle variation in 1990-2008 on average, with LICs in LAC depending the most on advanced

economy events (accounting for over 50 percent of the variation). The lowest contribution of advanced economy shocks is amongst LICs in SSA. As can be seen from Figure 9, the contribution of shocks to EM leaders has increased in the post-1990 period for LICs in Asia, SSA, and LAC. Shocks to EM leaders are, on average, responsible for over 17 percent of variation in economic activity in the average LIC, ranging from less than 10 percent for MNA and SSA LICs to around 20 percent or more for LICs in LAC, ECA, and Asia. The variance decomposition also suggests that spillovers in SSA LICs are primarily channeled through commodity prices shocks, which are responsible for around 48 percent of the typical country's cycle.

Domestic shocks are responsible for roughly 30 to 50 percent, on average, of the typical country's cycle, but their contribution has declined over time. It is important to note, however, that country-specific elements were removed through averaging and therefore the VARs largely present determinants of global trends on LIC growth.

To examine the contribution of EMs in specific regions to economic activity in LICs, we replaced the EM leaders in the previous model with all EMs in any given region. The variance decomposition results suggest that shocks in regional EMs matter most for LICs in Asia, contributing around 45 percent of the variation of economic activity of the typical LIC.



B. Panel Regressions

The VARs estimated in the previous section present an overall picture of the contribution of external growth shocks for an average LIC. However, the estimates depend on the specific identification procedure used, and the robustness of the estimation is hampered by the limited degrees of freedom. To undertake a more systematic analysis of growth spillovers to LICs, we follow Arora and Vamvakidis, 2005 and Berg et al., 2011. The empirical framework is a panel growth regression with the following specification:

$$g_i = c_i + \beta X_i + \varepsilon_i \qquad \text{for country } i = 1,...n$$

where the dependent variable g_i is real GDP growth, the constant term c varies for each country, β is the matrix of parameters to be estimated, and ε is the error term. X is the matrix of explanatory variables.

The main variables of interest are foreign shocks, in particular trading partner growth (as a proxy for external demand), as well as the ratio of FDI to GDP (lagged by one period to attenuate endogeneity concerns). Following Alesina et al., 1999, changes in the external

terms of trade (TOT) are scaled by the degree of openness of the economy, measured as the sum of exports and imports to GDP.[7] Specifically, we interact changes in the terms of trade with a dummy variable that takes the value of 1 for countries that fall in the top quartile in trade openness and 0 otherwise. The sample covers 55 EMs and 54 LICs and uses annual data for 1980–2008 (see Appendix A for the list of countries and Appendix B for a description of data and sources). Several econometric specifications of the model were estimated, including fixed effects and the panel Arellano-Bond difference GMM estimator.[8] The regressions include time dummies to control for developments that may affect all countries in a similar fashion.

The baseline regressions shown in Table 6 suggest that for the entire sample (both EMs and LICs) growth spillovers from partner countries are strong (Columns 1, 7). In particular, the regressions point to an elasticity of around 0.5-0.7, depending on the estimation procedure used, and in line with Arora and Vamvakidis (2005a and 2005b). FDI also matters for growth, with a semi-elasticity of around 0.1-0.2. The empirical results also suggest that the strength of spillovers from partner country growth have increased in the post- 1995 period (Column 8). When comparing LICs and EMs, we find that while the elasticity to partner growth is higher for EMs than LICs, FDI is a significant determinant of growth in LICs across specifications, particularly in the post-1995 period (Columns 5-6, 11-12). Moreover, changes in the terms of trade matter for LIC growth in the post-1995 period for the very open economies (countries in the top quartile of trade openness), with an elasticity of 0.04. This suggests that a 25 percent increase in commodity prices increases growth in these LICs by around 1 percentage point.

We further examine growth spillovers in LICs in the post-1995 period by region and separately for commodity and non-commodity exporters. Table 7 shows that spillovers from partner countries vary significantly across LIC regions (Column 1). In particular, in line with the forecast error variance decomposition results presented in the previous section, partner country growth is not a significant determinant of growth in SSA and MNA LICs. However, elasticities to partner country growth for other LIC regions are close to or even above 1, consistent with the spillovers estimates for EMs reported in Table 6 (Column 10). The spillover effects of partner country growth were found to be strongest for LICs in Asia and the ECA regions. The lack of significance of partner country growth for LICs in SSA and MNA could reflect the greater reliance on commodity exports in these regions.

[7] A number of additional specifications were also attempted, which included one or two lags of these variables, changes in the REER, and the ratio of changes in aid to GDP. In some specifications (not shown, but available upon request) additional lags proved significant; however, the overall thrust of our results remained unchanged.

[8] In the GMM specifications, the method of Holtz-Eakin et al., 1988 to collapse instruments is used. Partners' growth, terms of trade, were considered as strictly exogenous (i.e., instrumented using a one-column "IV-style" instrument, see Roodman, 2006), while lagged variables were assumed to be predetermined (and instrumented GMM-style in the same way as the lagged dependent variable).

To investigate this further, separate regressions for commodity and non-commodity exporting LICs were estimated (Columns 2-3 in Table 7). The results show that growth in commodity exporters is typically insensitive to growth in trading partners. By contrast, the elasticity to trading partner growth in non-commodity exporting LICs was estimated to be around 1.2 (Column 2). To examine whether this result is driven by the sample size, we also estimated a regression with a larger group of commodity exporters (including both LICs and MICs). The regression results (not reported here) confirmed this result.

The degree of trade openness could be an additional factor determining the size and magnitude of spillovers effects across LIC regions. For instance, LICs in the SSA and MNA regions are the least open (see below). To examine this, we interacted partner country growth with the degree of trade openness of a country (expressed as the ratio of exports and imports to GDP). Table 7 shows that the interaction term is economically and statistically significant (Column 4). In particular, a 100 percent increase in trade openness increases the elasticity to partners growth by 0.56, suggesting that trade is either a major channel of transmission in LICs or a good proxy for the other channels

Trade openness, by LIC region (average, 1995-2008)

	SSA	MNA	LAC	ASIA	ECA
(Exports+Imports)/GDP, in percent	68.4	70.9	75.9	77.7	91.5

Table 6. Baseline Regressions for EMs and LICs

VARIABLES	Fixed Effects						GMM Estimator					
	Full Sample		Emerging markets		LICs		Full Sample		Emerging markets		LICs	
	1980-2008	1995-2008	1980-2008	1995-2008	1980-2008	1995-2008	1980-2008	1995-2008	1980-2008	1995-2008	1980-2008	1995-2008
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(Real GDP growth)$_{-1}$	0.320***	0.305***	0.350***	0.346***	0.303***	0.293***	0.387***	0.368***	0.274*	0.407***	0.442**	0.372***
	[8.003]	[4.065]	[7.030]	[4.654]	[5.331]	[3.001]	[3.839]	[4.284]	[2.003]	[3.761]	[2.430]	[3.009]
Partners GDP growth	0.542***	0.342***	0.783***	0.658***	0.384***	0.156*	0.577***	0.974***	0.657*	1.110***	0.506*	0.897**
	[5.354]	[3.093]	[5.282]	[3.544]	[2.807]	[1.697]	[2.776]	[4.148]	[1.760]	[3.528]	[1.759]	[2.553]
Change in (FDI/GDP)$_{-1}$	0.117***	0.109***	0.0717***	0.0347	0.129***	0.135***	0.240*	0.241***	-0.16	-0.0768	0.319	0.194*
	[3.949]	[3.736]	[3.210]	[1.149]	[3.447]	[3.695]	[1.707]	[2.643]	[-0.516]	[-0.211]	[1.454]	[1.802]
Change in ToT* **I**(very open economy)	0.0136	0.0313*	0.00492	0.0291	0.017	0.0287	-0.00885	0.0277	-0.106	-0.0249	0.00896	0.0443*
	[0.655]	[1.674]	[0.0506]	[0.774]	[1.115]	[1.333]	[-0.354]	[1.216]	[-1.026]	[-0.389]	[0.352]	[1.792]
Time dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	2,444	1,353	1,026	578	1,418	775	2,346	1,350	984	576	1,362	774
Number of countries	98	98	42	42	56	56	98	98	42	42	56	56
No. of instruments							62	48	44	32	40	48
Hansen test p-value							0.192	0.433	0.0267	0.207	0.231	0.667
A-B AR(2) test p-value							0.566	0.562	0.378	0.594	0.883	0.492

t-statistics in brackets; *** p<0.01, ** p<0.05, * p<0.1

Table 7. Regressions by LIC region, Exporter-type
(Panel Regression, post-1995)

VARIABLES	By region	Exporter type		Openness interaction	EM leaders	
		Non-commodity	Commodity		All LICs	Commodity exporters
	(1)	(2)	(3)	(4)	(5)	(6)
(Real GDP growth)$_{-1}$	0.303***	0.326	0.390*	0.237***	0.359**	0.357**
	[2.936]	[1.332]	[1.829]	[3.638]	[2.461]	[2.290]
Partners GDP growth		1.198*	0.172	0.389		
		[1.972]	[0.417]	[1.265]		
Partners GDP growth * **I**(SSA)	0.23					
	[0.960]					
Partners GDP growth * **I**(MNA)	0.386					
	[0.470]					
Partners GDP growth * **I**(LAC)	0.606*					
	[1.713]					
Partners GDP growth * **I**(ECA)	1.301**					
	[2.180]					
Partners GDP growth * **I**(Asia)	1.534**					
	[2.178]					
Change in (FDI/GDP)$_{-1}$	0.183	-0.063	0.196	0.0986	0.213*	0.329**
	[1.507]	[-0.288]	[1.137]	[1.234]	[1.929]	[2.359]
Change in ToT* **I**(very open economy)	0.0430*	0.0990***	0.000777	0.0243	0.0427	0.0353
	[1.797]	[2.962]	[0.0151]	[1.065]	[1.406]	[1.189]
Partners GDP growth * trade openness				0.562**		
				[2.084]		
EM Leaders GDP growth (trade-weighted)					1.046**	0.976*
					[2.055]	[1.963]
Other partners GDP growth					0.984**	1.308**
					[2.115]	[2.562]
Other partners GDP growth * **I**(comm exp.)						-1.586***
						[-2.907]
Time dummies	YES	YES	YES	YES	YES	YES
Observations	774	480	406	1,350	774	774
Number of countries	56	35	29	98	56	56
No. of instruments	50	30	26	70	39	22
Hansen test p-value	0.694	0.402	0.233	0.349	0.671	0.319
A-B AR(2) test p-value	0.491	0.172	0.155	0.815	0.595	0.496

t-statistics in brackets
*** p<0.01, ** p<0.05, * p<0.1

How important are the EM leaders for LICs? To examine this question, we split partner GDP growth into two components: (i) EM Leaders GDP growth, where GDP growth in the 8 EM leaders identified earlier is averaged using bilateral trade weights for each LIC; and (ii) trade-weighted GDP growth of all other trade partners. For the full sample of LICs, we find similar statistically significant spillover effects from EM Leaders and other trading partners (Column 5). The elasticities of around 1 for both types of trading partners are in line with the estimates reported in the baseline regressions in Table 6. However, we find that growth in EM leaders matters particularly for commodity exporters (with an elasticity of around 1). While growth in other trading partners matter for non-commodity exporters (an elasticity of 1.3, Column 6), this elasticity is offset by a -1.6 elasticity for commodity exporters (see the

last variable in Column 6). This result is consistent with the importance of the EM leaders as the major destination of LIC commodity exporters in the post-1995 period.

To check the robustness of our results, Table 8 reports the regressions results for the baseline model removing time dummies and including the following global variables: world trade growth, world real GDP growth, change in oil prices, change in non-fuel commodity prices, and the Federal Funds rate. Starting from the most general specification and removing the least significant global variables one-by-one, the only global variable that remains significant (for the overall sample) is lagged world trade growth. In this specification, growth spillovers from partner countries remain significant (Column 1), with an elasticity that is lower than that estimated using time dummies (around 0.5). Column 2 reports the regressions results for commodity exporters. Contrary to what was found in the model with time dummies (Table 7), spillovers from partner countries are statistically significant, with an elasticity higher than 1, even after controlling for global variables. Changes in the country's terms of trade were also found to be highly significant (though the global indices of commodity prices – which are not tailored country-by-country -were insignificant). The last column of Table 8 reports the regression for SSA. Controlling for the global variables, we find statistically significant spillover effects from the EM leaders to LICs in SSA (but not from the other trade partners), in line with what was found for commodity exporters in Table 7 (Column 6).

Table 8. Robustness Check: Global Variables
(Panel Regression, post-1995)

VARIABLES	All LICs	Commodity Exporters	SSA LICs
	(1)	(2)	(3)
(Real GDP growth)$_{-1}$	0.267*	0.313	0.192
	[1.810]	[1.654]	[1.149]
Partners GDP growth	0.523**	1.051**	
	[2.544]	[2.265]	
(FDI/GDP)$_{-1}$	0.15	-0.169	
	[1.282]	[-0.349]	
Change in ToT * **I**(very open economy)	0.0412	0.0827***	
	[1.647]	[2.849]	
EM Leaders GDP growth (trade-weighted)			0.699**
			[2.120]
World GDP growth		-0.542	-0.0353
		[-1.252]	[-0.0604]
(Fed Funds Rate)$_{-1}$		0.163	0.19
		[0.443]	[0.722]
(Change in oil prices)$_{-1}$		-0.00213	0.00366
		[-0.276]	[0.236]
(Change in nonfuel commodity prices)$_{-1}$		-0.0403	0.00669
		[-1.212]	[0.226]
(Change in world trade)$_{-1}$	0.0743**	0.0485	-0.0475
	[2.283]	[0.542]	[-0.665]
Time dummies	NO	NO	NO
Observations	774	480	308
Number of countries	56	35	22
No. of instruments	35	21	21
Hansen test p-value	0.477	0.491	0.487
A-B AR(2) test p-value	0.726	0.14	0.216

t-statistics in brackets
*** p<0.01, ** p<0.05, * p<0.1

IV. SIMULATION

The results from the panel regression can be used to generate predictions for real GDP growth in LICs, given the performance of external demand. As an illustration, we assume a global double-dip recession in 2011-12, using a downside scenario from the October 2010 WEO. The scenario, based on the IMF's Global Projection Model (GPM), assumes that escalation of financial stress, particularly in the Euro area, and contagion prompted by rising concern over sovereign risk, results in lower global growth of 1.4 percentage points in 2011, relative to the WEO baseline (Table 9).[9]

Table 9. The Downside: GPM Projections of Real GDP Growth (in percent)

	WEO Oct 2010 Baseline	Difference from Baseline
	2011	2011
GPM World	3	-1.4
United States	1.5	-1.9
Euro Area	-0.9	-2.2
Japan	0.2	-1.3
Emerging Asia	7.2	-0.9
Latin America	3.2	-0.8
Remaining GPM Countries	2.5	-1.1

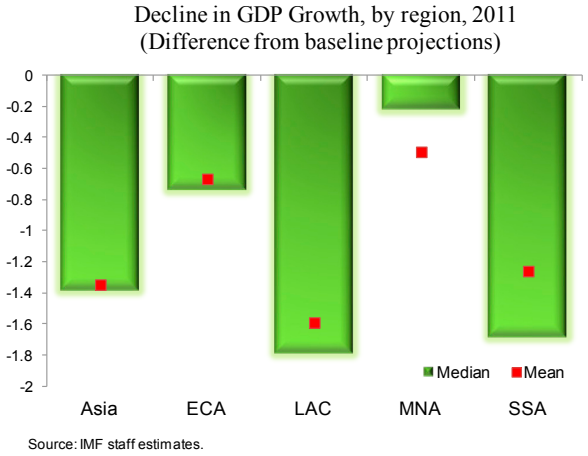
Source: Global Projection Model, IMF.

Using the above projections of growth differences relative to the baseline for advanced and emerging economies as a starting point, a downside scenario was developed for each LIC. First, alternative projections for the global economy and six relevant regions from the GPM, along with alternative country-by-country projections for the terms of trade, were used to estimate the potential downside growth impacts for LICs. This calculation made use of information on trading patterns taken from the IMF's Direction of Trade. Second, the simulation uses the elasticity of LICs' growth to its main trading partners (both advanced economies and EMs) from the panel growth regressions in the previous section (Column 1 in Table 7).

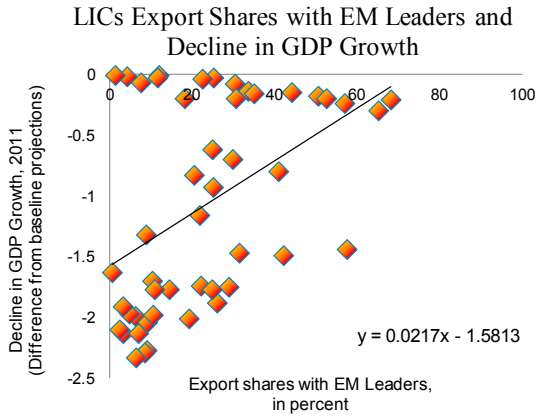
The simulation points to a variegated impact of a global double-dip on LIC growth prospects, depending on growth developments in trading partners. Depressed external demand is expected to lower LIC growth prospects for 2011, shaving off close to 2 percentage points from baseline growth projections for nearly a quarter of LICs. However, overall growth is expected to remain positive in most countries. The decline in growth is expected to be more significant for LICs in LAC, given strong trade and tourism linkages with the U.S. However, higher growth in the EM leaders is expected to support LIC growth prospects in the ECA region (Figure 10, left panel). The simulation also shows that LICs with higher export shares to EM leaders are expected to show a smaller decline in their growth rates (Figure 10, right panel).

[9] The GPM provides a baseline and an alternative scenario for growth in six regions of the world (U.S.A., Euro Area, Japan, Emerging Asia, Latin America, Remaining GPM countries) and associated global commodity price changes.

Figure 10. Simulation Results from a Global Double-Dip Recession



Source: IMF staff estimates.



Source: UN Comtrade Database; IMF staff estimates.

V. CONCLUSION

LICs have become increasingly integrated with EMs, through stronger trade links, rising cross-border financial asset holdings and capital flows, and higher remittance flows. One policy challenge posed by economic integration is greater exposure to external shocks. To quantify the magnitude of spillovers from EMs to LICs, this paper estimates VAR models and several panel growth regressions. The analysis also captures the role played by the production structure and the regional orientation of LICs in determining the extent of spillovers.

The empirical findings of this paper indicate that economic growth in LICs depends increasingly on external factors. In 1980-2008, 45 to 60 percent of the average LIC cycle was determined by external factors; this proportion increased to 60-90 percent over the 1990-2008 period. The bulk of this difference can be attributed to the new relationships developed with the large EM leaders. However, the extent of growth spillovers varies across LIC regions, depending on the strength of trade, and commodity price linkages. The growth elasticity to partners' GDP growth was estimated to be higher for LICs in Asia, ECA and LAC as compared to commodity-exporting LICs in MNA and SSA. Instead, spillovers to LICs in SSA and MNA are primarily channeled through terms of trade changes and economic activity in the EM leaders.

Our results suggest that the increasing trade and financial ties between LICs and the EM leaders will strengthen their business cycle synchronization. These links were beneficial to LICs during the Great Recession of 2008-09 (as EMs were less affected than advanced economies) but could also be a source of vulnerability as historically economic contractions in EMs have tended to be deeper and more frequent.

REFERENCES

Akın, Ç., and M. Kose, 2007, "Changing Nature of North-South Linkages: Stylized Facts and Explanations," IMF Working Paper 07/280 (Washington).

Alturki, F., J. Espinosa-Bowen, and N. Ilahi, 2009, "How Russia Affects the Neighborhood: Trade, Financial, and Remittance Channels," IMF Working Paper 09/277 (Washington).

Arora, V., and A. Vamvakidis, 2005a, "How Much Do Trading Partners Matter for Economic Growth?" *IMF Staff Papers*, Vol. 52, No. 1, pp. 24-40 (Washington).

Arora, V., and A. Vamvakidis, 2005b, "The Implications of South African Economic Growth for the Rest of Africa," IMF Working Paper 05/58 (Washington).

Bayoumi, T., and Swiston, 2007, "Foreign Entanglements: Estimating the Source and Size of Spillovers across Industrial Countries," IMF Working Paper 07/182 (Washington).

Berg, A., C. Papageorgiou, C. Pattillo, M. Schindler, N. Spatafora, and H. Weisfeld, 2011, "Global Shocks and their Impact on Low-Income Countries: Lessons from the Global Financial Crisis," IMF Working Paper 11/27 (Washington).

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

Holtz-Eakin, D., W. Newey, and H. Rosen, 1988, "Estimating Vector Autoregressions with Panel Data," *Econometrica,* Vol. 56, pp. 1371-96.

Imbs, J., 2004, "Trade, Finance, Specialization, and Synchronization," *The Review of Economics and Statistics*, Vol. 86(3), pp. 723-34.

International Monetary Fund, 2011, "New Growth Drivers for Low–Income Countries—The Role of BRICs." Available via the internet at: www.imf.org/external/np/pp/eng/2011/011211.pdf

International Monetary Fund, 2011 "Managing Volatility-A Vulnerability Exercise for Low-Income Countries." Available via the internet at: www.imf.org/external/np/pp/eng/2011/030911.pdf

International Monetary Fund, 2010, "Emerging from the Global Crisis: Macroeconomic Challenges Facing Low-Income Countries." Available via the internet at: www.imf.org/external/np/pp/eng/2010/100510.pdf

Massa, I., 2010, "Cross-border Bank Lending to Developing Countries: The New Role of Emerging Markets," in *The G-20 Framework for Strong, Sustainable, and Balanced Growth: What Role for Low-Income Small and Vulnerable Countries?* ed. by Dirk Willem te Velde (London: Overseas Development Institute).

Roodman, D., 2006, "How to Do xtabond2: An Introduction to "Difference" and "System" GMM in Stata," Center for Global Development Working Paper No. 103 (Washington).

Shiells, C. R., M. Pani, and E. Jafarov, 2005, "Is Russia Still Driving Regional Growth?" IMF Working Paper 05/192 (Washington).

Appendix A. List of Countries

Low-income Countries		Emerging Market Countries
Afghanistan, I.R. of	Nigeria	Algeria
Albania	Pakistan	Argentina
Angola	Papua New Guinea	Belarus
Armenia	Rwanda	Bosnia & Herzegovina
Azerbaijan, Rep. of	Senegal	Brazil
Bangladesh	Sierra Leone	Bulgaria
Benin	Sri Lanka	Chile
Bolivia	Sudan	China,P.R.: Mainland
Burkina Faso	Syrian Arab Republic	Colombia
Burundi	Tajikistan	Costa Rica
Cambodia	Tanzania	Croatia
Cameroon	Togo	Dominican Republic
Central African Rep.	Uganda	Ecuador
Chad	Uzbekistan	Egypt
Congo, Dem. Rep. of	Vietnam	El Salvador
Congo, Republic of	Yemen, Republic of	Guatemala
Côte d'Ivoire	Zambia	Iran, I.R. of
Ethiopia		Jamaica
Gambia, The		Jordan
Georgia		Kazakhstan
Ghana		Latvia
Guinea		Lebanon
Guinea-Bissau		Lithuania
Haiti		Macedonia, FYR
Honduras		Malaysia
India		Mauritius
Indonesia		Mexico
Kenya		Morocco
Kyrgyz Republic		Paraguay
Lao People's Dem.Rep		Peru
Liberia		Philippines
Madagascar		Poland
Malawi		Romania
Mali		Russian Federation
Mauritania		Serbia, Republic of
Moldova		South Africa
Mongolia		Thailand
Mozambique		Tunisia
Myanmar		Turkey
Nepal		Ukraine
Nicaragua		Uruguay
Niger		Venezuela, Rep. Bol.

Appendix B. Data and Sources

Variable	Source
Real GDP growth	IMF World Economic Outlook
Trade shares	IMF DOTS Database, UN Comtrade Database
FDI	IMF World Economic Outlook, UNCTAD Database
Terms of Trade	IMF World Economic Outlook
Fed Funds Rate	IMF World Economic Outlook
Oil prices	IMF World Economic Outlook
Nonfuel Commodity prices	IMF World Economic Outlook
World trade	IMF World Economic Outlook
Real Effective Exchange Rate	IMF World Economic Outlook
remittance	Ratha and Shaw (2006)
Consolidated foreign claims	Bank for International Settlements (BIS) Consolidated Banking Statistics