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

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

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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 international 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

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1 Introduction

Economic linkages between low-income and emerging market countries have deepened dramatically in recent decades.[1] The "new" partners of low-income countries[2] (LICs) come from a relatively narrow group of emerging markets[3] (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) and 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 EMs, both within regions and across regions. Growth in EMs and in LICs has been highly correlated in the last decade but does growth in the EMs have "spillover effects" on LIC economic activity after controlling for global factors? Are these spillovers beneficial and what is their size across different LIC regions? Answers to these questions can provide important insights into the benefits of these linkages and the vulnerabilities to potential emerging market crises.

[1]This paper was written as input to the IMF Policy Paper "Managing Volatility-A Vulnerability Exercise for Low-Income Countries" (IMF, 2011b). However, the views expressed in this paper are those of the authors solely and do not represent those of the IMF or IMF policy. The authors would like to thank Marco Arena, Tamim Bayoumi, Hugh Bredenkamp, Catherine Pattillo and Sweta Saxena for helpful comments and suggestions. The authors are also grateful to Ke Wang for excellent research assistance.

[2]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: Afghanistan, Albania, Angola, Armenia, Azerbaijan, Bangladesh, Benin, Bolivia, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Rep., Chad, Dem. Rep. of Congo, Republic of Congo, Cte d'Ivoire, Ethiopia, The Gambia, Georgia, Ghana, Guinea, Guinea-Bissau, Haiti, Honduras, India, Indonesia, Kenya, Kyrgyz Republic, Lao People's Dem.Rep, Liberia, Madagascar, Malawi, Mali, Mauritania, Moldova, Mongolia, Mozambique, Myanmar, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Papua New Guinea, Rwanda, Senegal, Sierra Leone, Sri Lanka, Sudan, Syrian Arab Republic, Tajikistan, Tanzania, Togo, Uganda, Uzbekistan, Vietnam, Yemen, Zambia.

[3]The group of emerging markets used in the paper is composed of: Algeria, Argentina, Belarus, Bosnia and Herzegovina, Brazil, Bulgaria, Chile, China (Mainland), Colombia, Costa Rica, Croatia, Dominican Republic, Ecuador, Egypt, El Salvador, Guatemala, Iran, Jamaica, Jordan, Kazakhstan, Latvia, Lebanon, Lithuania, Macedonia, Malaysia, Mauritius, Mexico, Morocco, Paraguay, Peru, Philippines, Poland, Romania, Russian Federation, Serbia, South Africa, Thailand, Tunisia, Turkey, Ukraine, Uruguay, Venezuela.

Economic growth in EMs can influence LIC prospects through a variety of channels. The most obvious channel is the direct trade channel, with higher growth and external demand in EMs contributing to a rise in LIC exports. The growth effect can also be transmitted through remittances (Chami et al., 2008) and financial linkages (inward FDI mostly for LICs, e.g. Alfaro et al. 2004). EMs can also have indirect effects on LICs if demand in the former impacts global fuel and commodity prices (demand from China has attracted particular attention; see for instance Kaplinsky, 2006).

The paper employs both VAR methodologies and dynamic panel regressions to estimate spillovers from a group of systemically important EMs (called EM leaders, and identified in section II) 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 EMs is also an important driver of cycles in LICs within a geographical area, particularly in Asia, reflecting increased intra-regional integration in recent decades.

The panel regressions complement the VAR analysis by quantifying the spillovers to LICs using country-level data. The regressions 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 post-1995, for commodity-exporting LICs, demand from the major emerging market countries has been the main driver of growth, reducing the statistical significance of commodity prices and of growth in the other trading partners.

While a sizeable body of literature has examined the business cycle synchronization and spillovers of economic activity among advanced and emerging market countries, there are fewer studies on LICs, and the macroeconomic links between LICs and EM have been until recently overlooked. 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 few recent papers have

documented the linakges between BRICs and LICs (IMF, 2011a),[4] and explored the impact of global developments and individual EMs on specific LIC regions (Arora and Vamvakidis, 2005b; Shiells et al., 2005; Alturki et al., 2009; Drummond and Ramirez, 2009). Our paper contributes to this literature by distinguishing between the spillovers stemming from advanced economies and those arising from EM leaders. We disaggregate the results by region and also discuss the magnitude of within-region spillovers across different regions. Finally, we discuss the significance of the production structure.

The rest of the paper is structured as follows. Section 2 documents stylized facts on the extent and nature of linkages between EMs and LICs. Section 3 uses VAR models and section 4 panel regressions to assess the severity of shocks in advanced economies and EM leaders on LICs. Section 5 concludes.

2 Linkages between EMs and LICs

Exports

Trade linkages between LICs and emerging markets have increased dramatically over the past three decades. The increase in exports to EMs is particularly relevant to the analysis of spillovers because shocks in EMs can affect LICs growth via a reduction in exports. 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, according to the DOTS database[5]), their share fell by over 10 percentage points in the last 30 years. This trend is discernible across all LIC regions, but is particularly pronounced in SSA (a decline of about 30 percentage points) where non-traditional partners accounted for about half of exports in 2004-2008. In place of the traditional partners, links with EMs and other LICs have expanded, albeit with considerable heterogeneity across LIC regions. The expansion of within-region trade dominated in Asia and ECA driven by demand from China, India and Russia, while global trade featured more prominently for LICs in SSA. This change was especially rapid since the late 1990s, and occurred against the backdrop of the increasing spread of global production chains and the rapid growth of demand for commodities. We present some stylized facts for all LICs and their relation to

[4]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.

[5]Department of Trade Statistics database, IMF.

the eight EMs that are the largest destination of LIC exports in each major region. These EM leaders (Turkey, Mexico, Saudi Arabia, South Africa and the BRICs, see Table 1) are the EMs with largest trade relationships with LICs within their own region.

LIC trade is known to be undiversified but the data presented in Table 2 shows the staggering dependence of many LICs to a handful of EMs. Mongolia, Bolivia and Nepal (all landlocked countries) send more than 50 percent of their exports to a single neighbor. Guinea-Bissau, Yemen, Sudan, Dem. Rep of Congo, also send more or nearly 50 percent of their exports to India or China. The reorientation of trade to EMs has coincided with a change in composition of LIC exports (Figure 1). In 1995, LIC exports to advanced economies were dominated by agricultural raw materials and food and beverage products. By 2008, fuels and manufactures accounted for the largest share of LIC exports. This pattern is largely driven by LICs in SSA and MNA, where the share of fuel exports increased markedly since 1995. By contrast, LICs in Asia, LAC, and ECA are relatively more diversified, with a higher share of exports of manufactured goods.

Remittances

EM leaders are also an important source of remittances for LICs, particularly within their own region (Figure 2). India accounts for about 30 percent of total remittance inflows to LICs in Asia.[6] 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 within MENA but also 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.

Foreign Direct Investment

While advanced countries continue to be the most important source of FDI for LICs, FDI from the EM leaders has grown in the last decade. Complete data on bilateral FDI flows from the eight EM leaders identified in Table 1 are unavailable, but the available evidence suggests that

[6]The data is taken from Ratha and Shaw (2006). Bilateral data on remittances from China is not available.

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. Table 3 shows the wide range of LIC destination for Chinese FDI. Between 2003 and 2009, the stock of Chinese FDI to LICs increased 19 fold and between 2001 and 2005, the stock of Indian FDI in LICs grew four-fold, with an stronger presence in SSA. India invests in Asia, with Vietnam, Nepal and Bangladesh being the main recipients. South Africa is the 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 USD 11 billion in 2008 (22 percent, compared with 5 percent in 2000). Unlike other EM leaders, Brazil plays a less prominent role as source of FDI in LICs.[7]

3 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. VARs and forecast error variance decompositions similar to the ones estimated in this paper have been used in the literature on advanced economies. For instance Giannone, Lenza and Reichlin (2008) suggested that a change in economic structure explained the period of macroeconomic stability between 2000 and 2008 (the Great Moderation). Bayoumi and Swinston (2009) found on the contrary that fewer shocks in the U.S. had driven the Great Moderation, and also pointed at the financial linkages as the main channel of contagion across advanced economies.

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. 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, EMs, and advanced economies. Given our focus on growth spillovers, the key variable of interest is real GDP growth. Since this 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

[7] An exception is Bolivia that received 74 percent of Brazil FDI to LICs.

in reduced form as:

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

where Y is the vector of endogenous variables that includes real GDP growth for advanced countries, the annual percentage change in global commodity prices (for the MNA region, fuel prices are used instead), 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.[8] 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 matrix 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).[9] 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 are 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 cumulative impulse responses of the VAR models, with one-standard deviation error bands estimated using 1000 Monte Carlo replications, are shown in Figure 3.[10] 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. A one-standard deviation positive growth shock to

[8] All the variables are I(1).

[9] 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. For the ECA region, for which data is only available after 1992, only one lag was used.

[10] The cumulative impulse response functions were found to be very similar to the impulse response functions of VARs estimated on the log-levels of the variables.

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. 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 (about a one percentage point increase in GDP growth in EM leaders) raises activity by one percentage point in MNA and ECA LICs; by between 1/2 and one point in SSA LICs; and by smaller amounts in Asian LICs. The growth spillovers are statistically significant at longer horizons as well. 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 1/2 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. These results were robust to a longer lag structure and to a change in the ordering of commodity prices and EM leaders growth.

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 4). 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 a protracted effect of advanced country shocks, the impact (short-term) elasticity tends to be higher across all LIC regions.

Variance decompositions of real GDP growth were computed using the VARs estimated above. These decompositions attribute the variation in domestic activity to the orthogonalized shocks 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 4, the contribution of external shocks to economic activity after three years has increased over time for LICs.[11] The contribution of external shocks to LIC growth over the whole sample period was estimated at 70 percent for Asia, and at 53 percent for LAC, and 45 percent in SSA. Over the more recent period (1990-2008), the contribution increased to 77 percent for Asia, 90 percent for LAC and 53 percent in SSA. In LAC, the increased proportion of external shocks reflected in fact a lower variance of GDP (but an unchanged variance attributed to external shocks), whereas in Asia and in SSA the variance of GDP was roughly constant and it is the impact of external shocks that increased.

Shocks to advanced economies are responsible for around 30 percent of growth volatility in 1990-2008 with LICs in LAC depending the most (and SSA depending the least) on advanced economy events. The contribution of shocks to EM leaders has been increasing across periods in Asia, LAC and SSA, by about 5 percentage points (but the difference is not statistically significant). In SSA, the variance decomposition suggests that spillovers in SSA LICs are increasingly channeled through commodity prices shocks, which would be responsible for around 50 percent of the region's volatility.

4 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 (2005a) and Berg et al. (2011). The empirical framework is a panel growth regression with the following specification:

[11] This result is independent of the ordering as long as LICs growth is ordered last.

$$g_{i,t} = c_i + \beta X_{i,t} + \epsilon_{i,t} \quad \text{for country } i = 1, \ldots, n \text{ and time } t = 1, \ldots, T \tag{2}$$

where the dependent variable $g_{i,t}$ is real GDP growth, the constant term c_i is country-specific, β is a vector of parameters to be estimated, and $\epsilon_{i,t}$ 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 mitigate endogeneity). 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.[12] 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 the Appendix 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.[13] The regressions include time dummies to control for developments that may affect all countries in a similar fashion.

The baseline regressions shown in Table 5 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 0.5-0.6, 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 GMM estimator also suggests that the strength of spillovers from partner country growth have increased in the post- 1995 period, with an elasticity of 1 (Column 8)[14]. 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

[12] 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.

[13] 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).

[14] The Fixed Effect estimator shows a lower coefficient for the shorter sample, a result that can be attributed to the Nickell bias given that the time dimension of the panel is only 13 in that sub-sample.

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 (Column 12). 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 6 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 (Figure 4), 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 5 (Column 12). 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 their greater reliance on commodity exports. To investigate this further, separate regressions for commodity and non-commodity exporting LICs were estimated (Columns 2-3 in Table 6). The results show that growth in commodity exporters is typically insensitive to growth in trading partners (however, we show later that the subcomponent of EM leaders' growth matters for commodity exporters). By contrast, the elasticity to trading partner growth in non-commodity exporting LICs was estimated to be around 1.2 (Column 2).[15]

The degree of trade openness could be an additional factor determining the size and magnitude of spillovers across LIC regions. For instance, LICs in the SSA and MNA regions are the least open.[16] To test this hypothesis, 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 6 shows that for all countries in our sample (LICs and EMs) the interaction term is economically and statistically significant (Column 4). In particular, an economy with trade openness of 100 percent has an elasticity 0.56 higher than a closed economy (*i.e.* an elasticity of 0.96). We refine the regression for LICs (Column 5). Partners GDP growth was not significant and was

[15]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.

[16]Trade openness for LICs, measured as (exports+imports)/GDP averages 91 percent in ECA, 78 percent in Asia, 76 percent in LAC, 71 percent in MNA, and 68 percent in SSA.

dropped, resulting in a higher coefficient for the interaction term (and a proportional relation between trade openess and sensitivity to partners growth): an economy with trade openess at 100 percent would have a sensitivity to partners growth of 1.2 percent. In addition, the elasticity to partners growth is reduced by 0.63 for commodity exporting LICs.

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 eight 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 (Table 6, Column 6). The elasticities of around 1 for both types of trading partners are in line with the estimates reported in the baseline regressions in Table 5. However, we find that growth in EM leaders matters particularly for commodity exporters (with an elasticity of around 1). Column 7 in Table 6 shows that for commodity exporters, the other trading partners have a negligible (negative) effect (computed as 1.308 - 1.586), leaving growth in EM leaders as the only important component of trade partners' growth. 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 7 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 if it is not significant at the 95 percent confidence threshold, 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. This suggests that the global variables chosen are not fully capturing the time variation that matters for LICs, and may explain the high elasticity to partners' growth found even for commodity exporters. 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 7 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 6 (Column 6).

5 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 LIC regions depends increasingly on external factors. In 1980-2008, 45 to 70 percent of the average LIC cycle was determined by external factors; this proportion increased to 53-90 percent over the 1990-2008 period. A large part 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.

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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	0.11	0.06
China	Asia	0.11	0.08
Russia	ECA	0.14	0.01
Turkey	ECA	0.09	0.01
Mexico	LAC	0.03	0.00
Brazil	LAC	0.15	0.00
Saudi Arabia	MNA	0.03	0.01
South Africa	SSA	0.03	0.01

Source: UN Comtrade database; authors' calculations.

Table 2. Top ten ranking of LICs based on exports share to EM leaders

LICs	Major EM Leader	Exports to Major EM Leader (in percentage of total exports)
	Within region	
Mongolia	China	64.5
Bolivia	Brazil	60.1
Nepal	India	54.8
Tajikistan	Turkey	26.5
Zimbabwe	South Africa	32.3
Uzbekistan	Russia	17.0
Afghanistan, I.R. of	India	23.5
Kyrgyz Republic	Russian	19.2
Myanmar	India	12.3
Armenia	Russia	19.7
	Across region	
Guinea-Bissau	India	64.0
Yemen, Republic of	China	30.9
Sudan	China	48.0
Congo, Dem. Rep. of	China	47.3
Mauritania	China	41.5
Gambia, The	India	36.7
Congo, Republic of	China	30.1
Benin	China	15.2
Mali	China	26.4
Guinea	India	17.8

Source: UN Comtrade database; authors' calculations.

Table 3. Top recipients of Chinese FDI (average 2003-2009)

Country	In millions of US dollars	FDI to LICs, in percent of total FDI to LICs
Nigeria	130.8	11.4
Mongolia	127.2	11.1
Myanmar	121.6	10.6
Cambodia	78.8	6.8
Zambia	78.6	6.8
Laos PDR	73.9	6.4
Vietnam	62.4	5.4
Guyana	60.0	5.2
Congo, DR	51.7	4.5
Sudan	51.7	4.5
Papua New Guinea	44.4	3.9
Afghanistan	26.2	2.3
Niger	26.0	2.3
Tajikistan	20.7	1.8
Madagascar	18.9	1.6
Ethiopia	18.2	1.6

Source: UNCTAD database, authors' calculations

Table 4. 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

Source: authors' calculations.

Table 5. 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 6. Regressions by region and by type of exports (panel regression, post-1995)

VARIABLES	By region	Exporter type (LICs)		Openess		Role of EM leaders	
	(LICs)	Non-commodity	Commodity	(interaction term, LICs and EMs)	LICs, by type of exports	All LICs	Commodity exporters
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(Real GDP growth)$_{-1}$	0.303***	0.326	0.390*	0.237***	0.338**	0.359**	0.357**
	[2.936]	[1.332]	[1.829]	[3.638]	[2.46]	[2.461]	[2.290]
Partners GDP growth		1.198*	0.172	0.389			
		[1.972]	[0.417]	[1.265]			
Partners GDP growth ***I***(SSA)	0.230						
	[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***(AsiaA)	1.534**						
	[2.178]						
(FDI/GDP)$_{-1}$	0.183	-0.0630	0.196	0.0986	0.211*	0.213*	0.329**
	[1.507]	[-0.288]	[1.137]	[1.234]	[1.70]	[1.929]	[2.359]
Change in ToT ***I***(very open economy)	0.0430*	0.0990***	0.000777	0.0243	0.041	0.0427	0.0353
	[1.797]	[2.962]	[0.0151]	[1.065]	[1.31]	[1.406]	[1.189]
Partners GDP growth* trade openess				0.562**	1.166***		
				[2.084]	[2.90]		
Partners GDP growth* ***I***(comm. exp.)					-0.6284**		
					[-2.15]		
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	YES
Observations	774	480	406	1,350	774	774	774
Number of countrycode	56	35	29	98	56	56	56
No. of instruments	50	30	26	70	39	39	22
Hansen test p-value	0.694	0.402	0.233	0.349	0.645	0.671	0.319
A-B AR(1) test p-value	0.00540	0.0746	0.0383	0.000182	0.008	0.00891	0.00712
A-B AR(2) test p-value	0.491	0.172	0.155	0.815	0.531	0.595	0.496

t-statistics in brackets

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

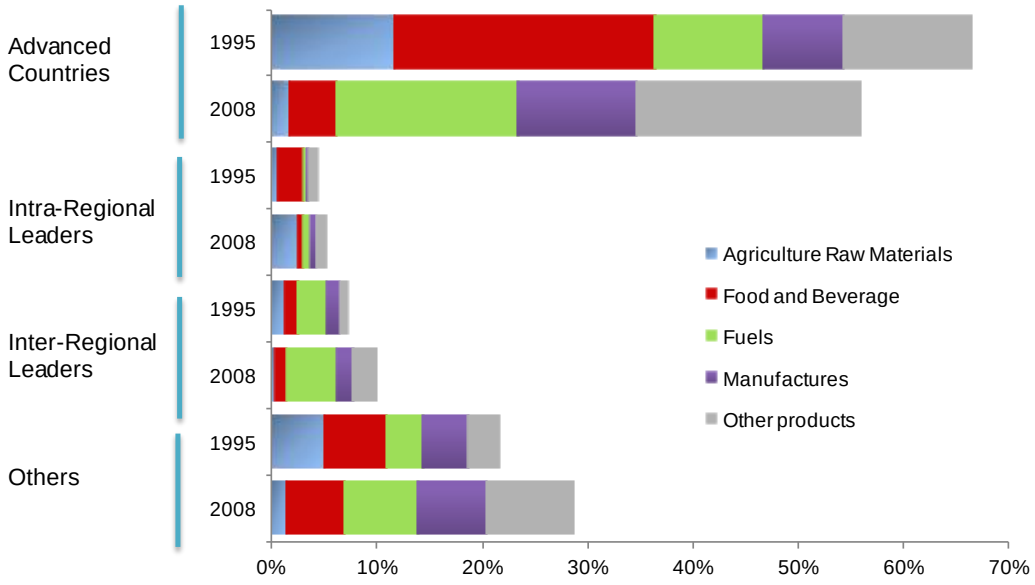
Table 7. Robustness check: global variables (panel regression, post-1995)

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

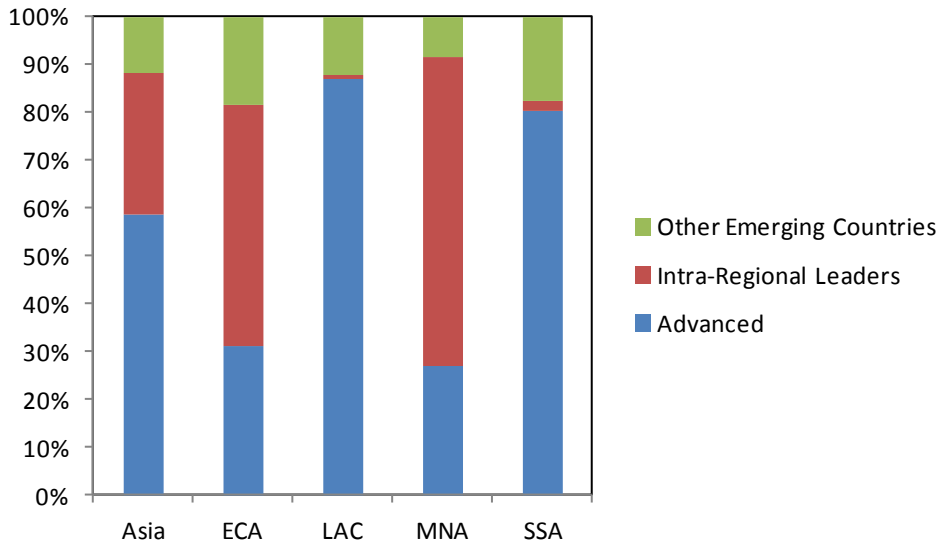
*** p<0.01, ** p<0.05, * p<0.1

Figure 1. Export shares for all LICs, by product and destination income group



Source: UN Comtrade database; authors' calculations.
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.

Figure 2. 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.

Figure 3. Impact of external shocks on LICs growth (annual VAR)
(Cumulative response, in percentage points, to one standard deviation shock)

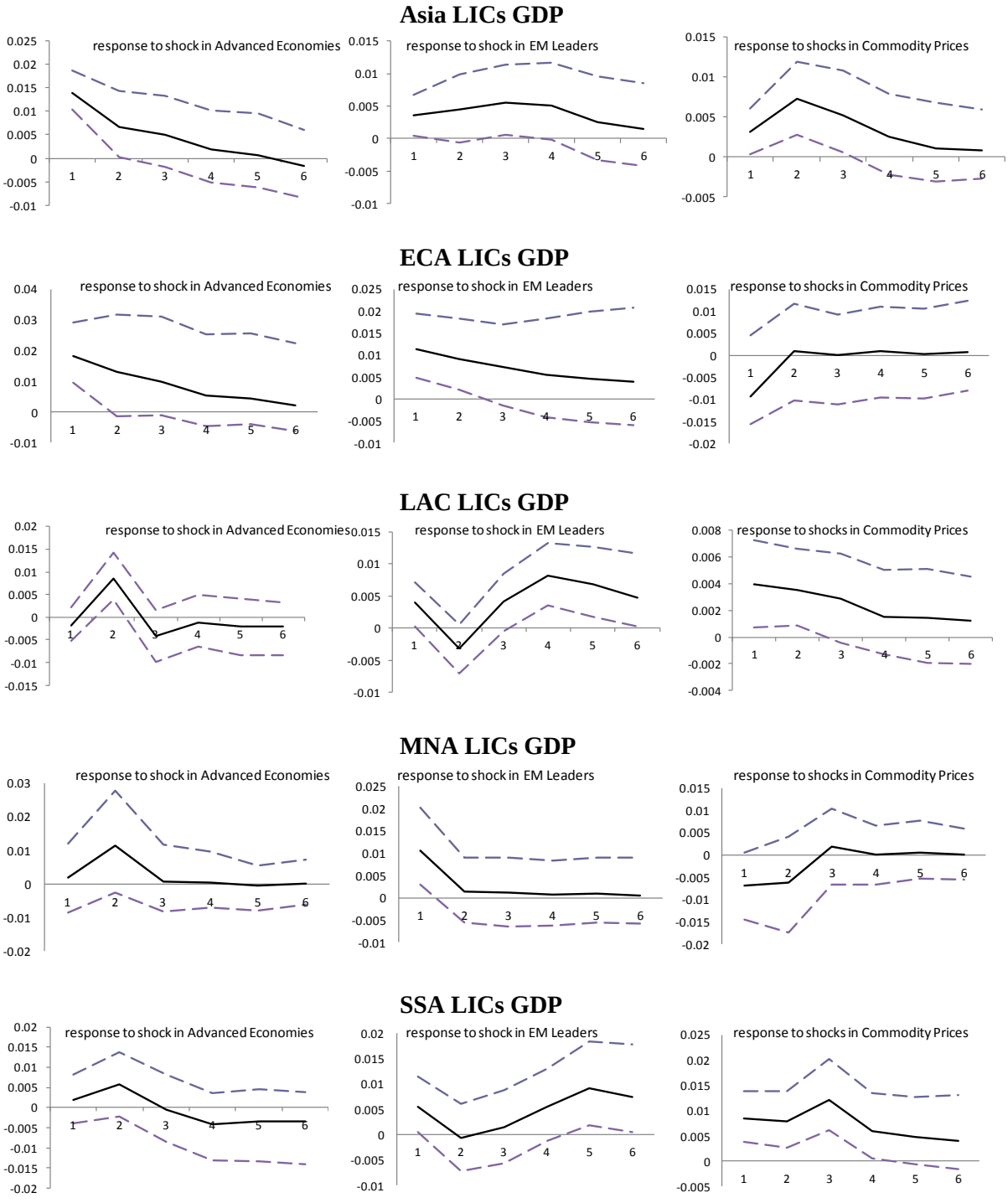
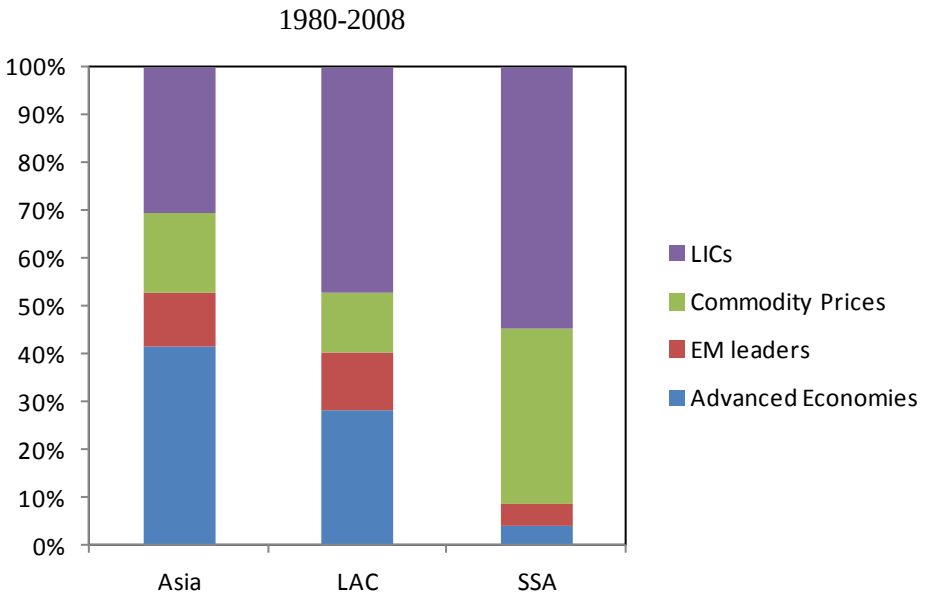
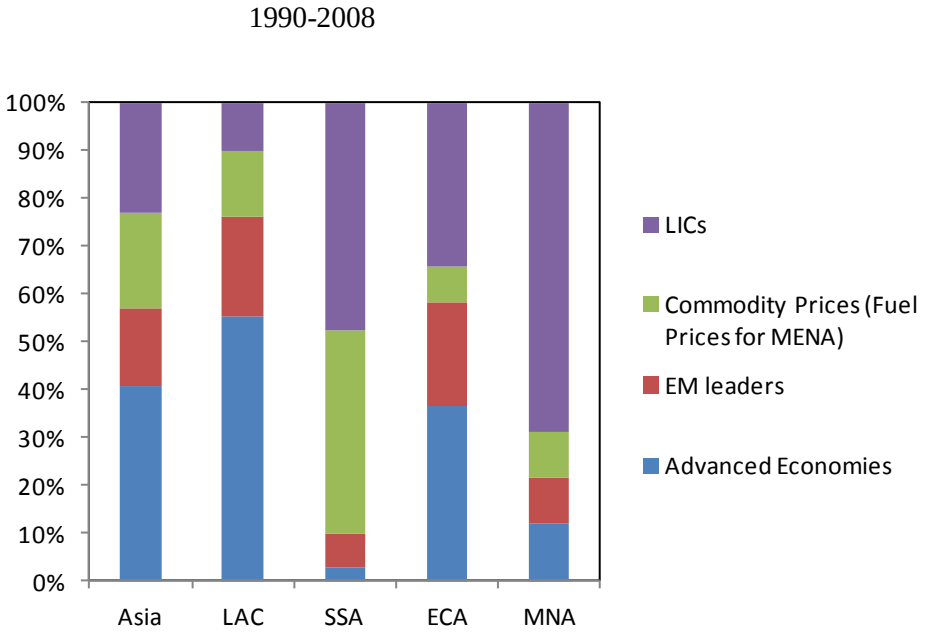


Figure 4. Contributions to variations in growth in LIC regions (Forecast Error Variance Decomposition, 3 years ahead, in percent)





Appendix: 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