3. External Adjustment to Terms-of-Trade Shifts

External adjustment in Latin America is ongoing in the wake of large and persistent shifts in the region's terms of trade. In the past, external adjustment to negative terms-of-trade shocks typically took place through a weakening of domestic demand and import compression (negative income effects) rather than stronger supply growth and export recovery, despite a real depreciation. In contrast, the ongoing adjustment reflects the increased use of exchange rate flexibility as a shock absorber. The real depreciation has led to a small boost to exports and a stronger reduction in imports than in the past, with demand shifting toward locally produced goods. Altogether, although the income effect still appears to be strong, the expenditure-switching effect seems to have become more relevant. These effects have alleviated the burden on domestic demand, thereby reducing the "sacrifice ratio" of external adjustment for flexible exchange rate regimes in Latin America. Moreover, with flexible regimes becoming more widespread, the cost associated with exchange rate rigidity has increased in the region, as common shocks have led to multilateral appreciation for less flexible currencies. The aggregate responsiveness of exports to real depreciation also masks differences within and across countries. In terms of global shares, export performance responds more significantly to changing relative prices for noncommodity products and for exporters that trade manufactured goods more heavily. Exchange rate flexibility can thus support structural policies aimed at shifting resources to noncommodity sectors.

Slowing global trade has affected all regions since 2012, as documented in the October 2016 *World Economic Outlook* (Figure 3.1, panel 1). The slowdown has coincided with the end of the commodity super-cycle that—starting in the early 2000s and peaking in 2011—benefited Latin America's commodity exporters. For these economies, the fall in export values has been large, declining by between 20 and 35 percent for some countries, including a substantial drop in noncommodity exports (Figure 3.1, panel 2).

This chapter was prepared by Yan Carrière-Swallow, Nicolas E. Magud, and Juan Yépez, with contributions from Sergi Lanau and excellent research assistance from Steve Brito.

The slowdown in exports, in turn, is linked to the deterioration in the region's terms of trade. The latter has been large, ranging from 5 percent in Mexico to over 65 percent in Venezuela (Figure 3.1, panel 3). From the perspective of each individual country, these declines are among the largest of the past 35 years (Figure 3.2). These are comparable to past episodes of large and persistent busts in the terms of trade that have affected emerging market and developing economies over the past half century.[1]

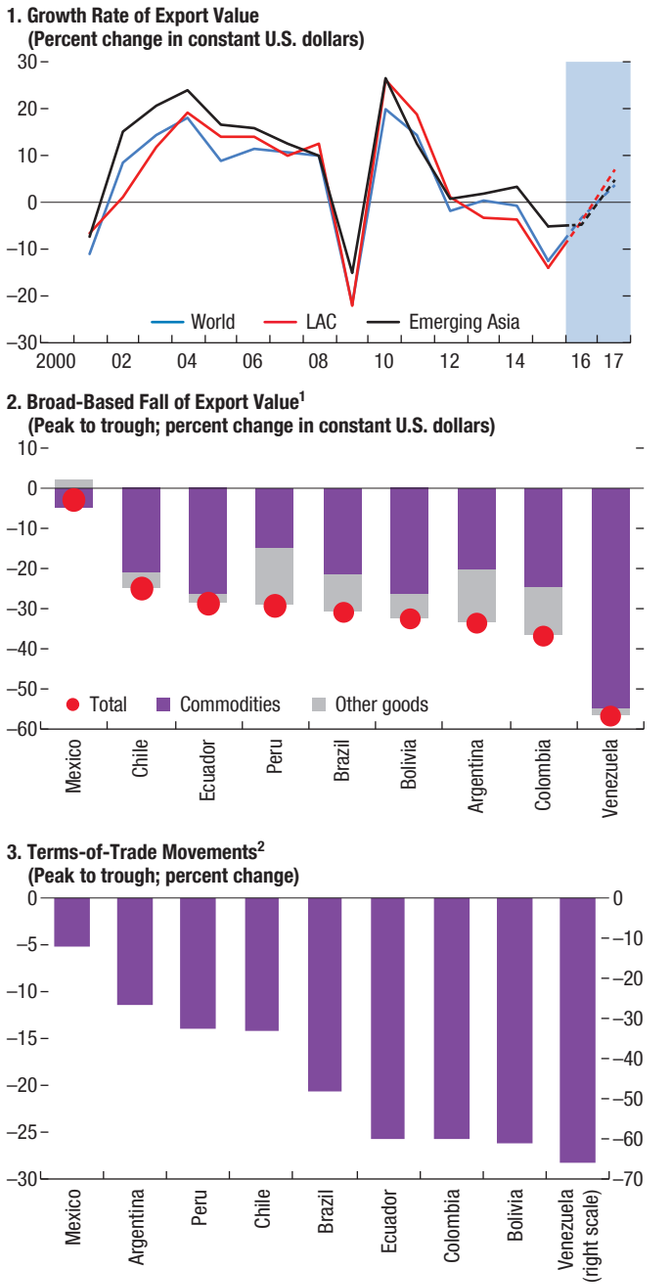
Conceptually, external adjustment to terms-of-trade shocks takes place through both income and expenditure-switching effects. On the one hand, the income effect reflects the reduction in purchasing power associated with weaker terms of trade, leading to a compression of domestic demand and thereby of imports. On the other hand, the relative price change results in an expenditure-switching effect that leads to higher exports and a shift in the composition of domestic consumption away from foreign goods toward domestic goods on the demand side, as well as a shift in resources from the nontradable to the domestic tradable sector on the supply side (Box 3.1).

Exchange rate flexibility is typically viewed as a key shock absorber for small open economies facing these types of real external shocks.[2] In response to weaker terms of trade, and despite large exchange rate depreciations in some cases, external adjustment in Latin America has largely taken place through import compression, with

[1]Adler, Magud, and Werner (2017), covering 150 countries during 1960–2015, document that periods of strong terms of trade last about 19 years on average, while weak periods last about 11 years, with terms of trade being about 50–60 percent higher during the strong phase of the cycle.

[2]See Graham and Whittlesley (1934) and Friedman (1953). Intuitively, as nominal prices tend to be sticky, exchange rate flexibility enables a faster accommodation of relative prices, helping to mitigate the real effects of external shocks, and thus facilitating the process of external adjustment.

Figure 3.1. Global Export Deceleration while Latin America's Terms of Trade Deteriorate Sharply



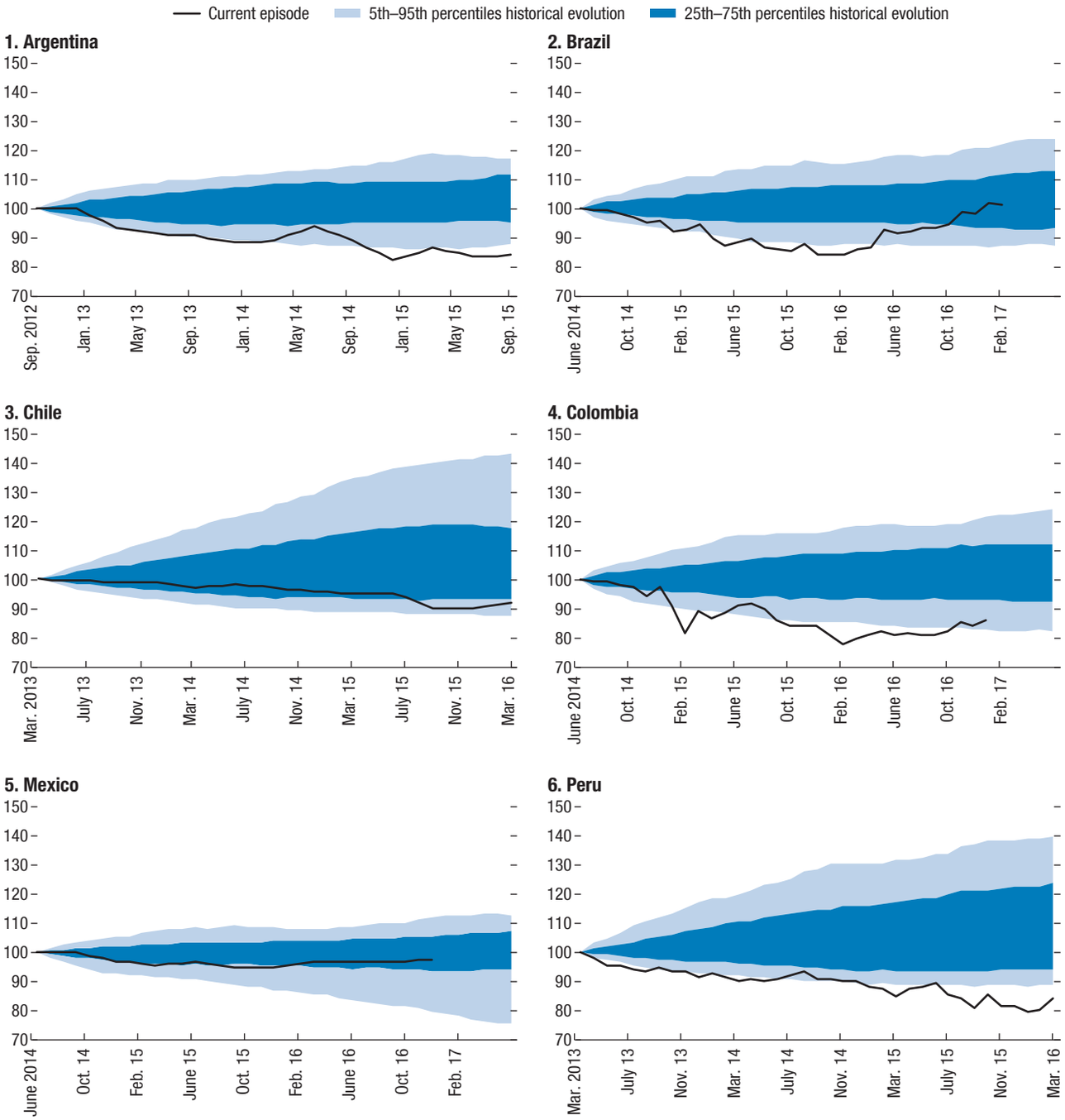
Sources: IMF, World Economic Outlook database; UN Comtrade; U.S. Bureau of Labor Statistics; and IMF staff calculations.
Note: Trade values in constant U.S. dollars have been deflated by the U.S. Consumer Price Index for all urban consumers (all Items). LAC = Latin America and the Caribbean.
[1]Peak and trough are defined using annual data for 2010–15. For export values the peak to trough years for Argentina, Brazil, and Chile correspond to 2011 to 2015; for Colombia, Peru, and Venezuela to 2012 to 2015; for Ecuador to 2013 to 2015; and for Bolivia and Mexico to 2014 to 2015.
[2]Peak and trough are defined using annual data for 2010–16. For terms of trade the peak to trough years for Bolivia, Colombia, and Venezuela correspond to 2012 to 2016; for Ecuador and Peru to 2011 to 2016; for Brazil to 2011 to 2015; for Chile to 2010 to 2016; for Argentina to 2014 to 2015; and for Mexico to 2013 to 2015.

exports performing sluggishly (Figure 2.5 in Chapter 2), as has historically been the case in emerging markets. At face value, this would suggest that part of the link between the real exchange rate and external adjustment remains weak. Indeed, the growth of global value chains, inelastic supply curves and related rigidities, and balance sheet effects have all been put forward as reasons why external adjustment may be becoming increasingly disconnected from exchange rate dynamics. This chapter seeks to quantify the role of the exchange rate regime in the adjustment process, to get a better sense of the strength of expenditure-switching effects during the recent adjustment in the region. Findings imply that exchange rate flexibility has, to some extent, lowered the output cost of external adjustment to terms-of-trade shocks.

The composition of external adjustment under way in Latin America suggests that the income effect has been stronger than the expenditure-switching effect, as in the past. But there is a difference. Recent real exchange rate depreciations in countries with flexible exchange rate regimes have supported the adjustment in the external account. Real depreciation has provided some boost to exports despite weak external demand and has helped shift demand from imports to domestic goods. This has lowered the cost of adjustment in terms of the compression of domestic demand, while helping boost domestic production.

Given the limited aggregate response of exports, to better understand the determinants of export elasticities this chapter uses granular trade data to document a wide variation in sensitivity across products. To some extent, a country's export elasticity depends on the product composition of its exports. The analysis finds that the response of manufactures and textiles has been stronger than that of commodities, and that exchange rate flexibility can facilitate the re-allocation of exports toward noncommodity products. In much of Latin America, where the starting point is an export basket that is concentrated in commodities, exchange rate flexibility tends

Figure 3.2. Recent Terms-of-Trade Movements in Historical Perspective
(Index; episode start date = 100)



Sources: Haver Analytics; IMF, World Economic Outlook database; and IMF staff calculations.
Note: The bands report the empirical distribution of changes in the terms-of-trade index since January 1980, based on 36-month trajectories. The recent episode starts in September 2012 for Argentina; June 2014 for Brazil, Colombia, and Mexico; and March 2013 for Chile and Peru. For Argentina, the period before 1986 is interpolated annual data, while the period after 1986 is interpolated quarterly data. For Chile, the period before 1996 is interpolated annual data while the period after 1996 is interpolated quarterly data. For Peru, the period before 1996 is interpolated annual data.

to spur diversification and may support other structural policies with this objective.

This chapter begins by documenting the nature of the shock and subsequent adjustment in the region from a historical perspective. Next, it quantifies the relative importance of income and expenditure-switching effects, the shock-absorbing benefits of flexible exchange rates, and the increasing cost of currency rigidity. The chapter then explores product-level export performance in response to real depreciations, and how the response varies by product type. The final section puts forth policy implications.

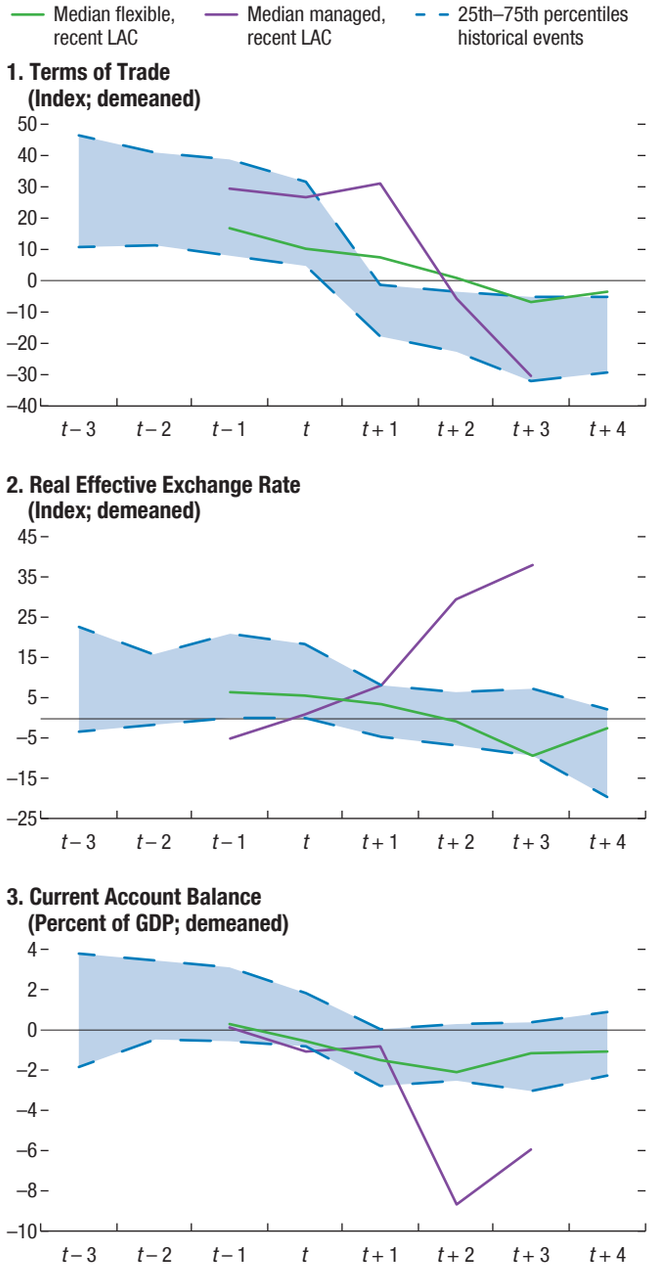
The Ongoing External Adjustment to Terms-of-Trade Shifts: A Historical Perspective

How did emerging market and developing economies adjust in the past in response to large declines in the terms of trade?[3] Based on the experience of 150 countries over the past half century, external current accounts deteriorate on impact. Then, as the real exchange rate depreciates, current accounts revert to their initial levels over a period of three to four years (Figure 3.3). In the most recent terms-of-trade bust, external adjustment in Latin American countries with flexible exchange rate regimes has proceeded in line with historical patterns. Countries with more rigid exchange rate regimes, however, have deviated from these patterns, with large real currency appreciations, widening current account deficits, and substantial reserve losses (Figure 3.4).[4]

[3]This section is based on Adler, Magud, and Werner 2017. Episodes are identified using a Markov regime-switching methodology, which only identifies statistically large and persistent terms-of-trade busts. The method identifies 59 episodes of terms-of-trade busts over the period 1960–2016. Historical inter-quartile ranges for managed and flexible regimes are similar to the full sample of emerging market and developing economies.

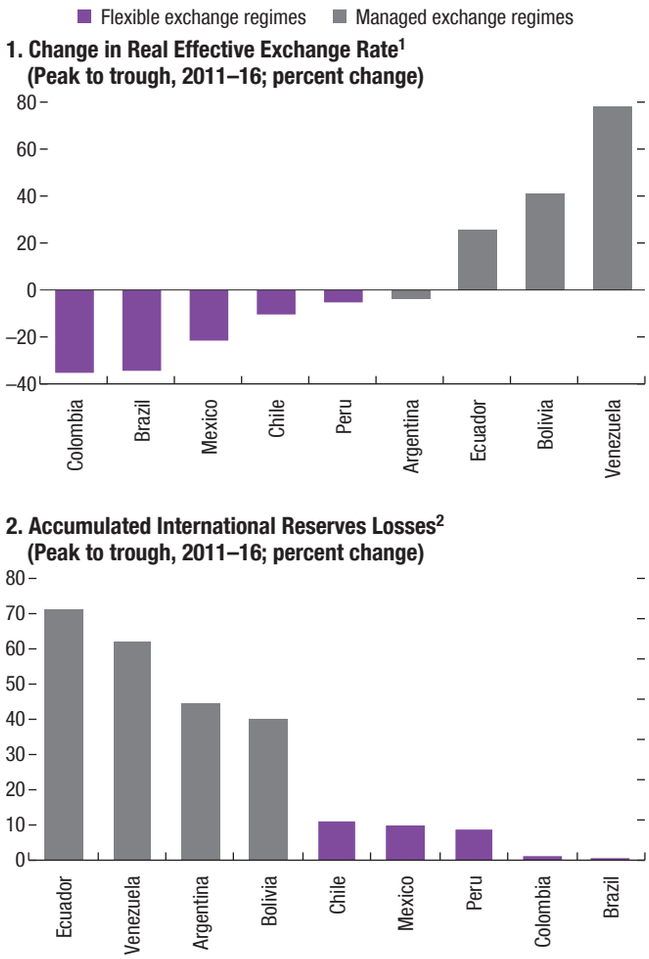
[4]The real appreciation occurred because of these currencies moving in sync with a strengthening U.S. dollar while the currencies of trading partners and competitors depreciated, and in some cases on the back of high domestic inflation.

Figure 3.3. External Adjustment during Terms-of-Trade Busts in Historical Context



Sources: Adler, Magud, and Werner 2017; IMF, World Economic Outlook database; and IMF staff calculations.
Note: Flexible exchange rate regimes include Brazil, Chile, Colombia, Mexico, and Peru; managed exchange rate regimes refer to a diverse set of countries with more limited exchange rate flexibility and include Argentina prior to 2016, Bolivia, Ecuador, and Venezuela. Argentina was reclassified as a floating exchange rate arrangement in December 2015. Interquartile bands correspond to a large sample of emerging market and developing economies. Period *t* denotes the year in which the terms of trade begin to fall for each event. Observations are demeaned by event. LAC = Latin America and the Caribbean.

Figure 3.4. Exchange Rate Regimes and Change in International Reserves



Sources: IMF, Information Notice System database; IMF, World Economic Outlook database; and IMF staff calculations.
[1]The peak for Argentina is 2012:Q3; for Bolivia 2013:Q1; for Brazil 2011:Q3; for Chile 211:Q1; for Colombia 2011:Q4; for Ecuador 2012:Q1; for Mexico 2011:Q2; for Peru 2011:Q3; and for Venezuela 2014:Q2. For Venezuela commodity terms of trade from Gruss (2014) were used to identify the peak and trough.
[2]Argentina was reclassified as a floating exchange rate arrangement in December 2015. The peak year for Argentina correspond to 2011; for Chile and Venezuela to 2012; for Brazil, Ecuador, and Peru to 2013; for Bolivia, Colombia, and Mexico to 2014.

As the terms of trade weakened, the main source of the shock in emerging market economies had been a decline in export prices rather than an increase in import prices. However, quantity adjustment materialized through import compression rather than rising exports (Figure 3.5). This suggests that negative income effects had dominated expenditure-switching effects, which appear to have been weak despite significant real exchange rate depreciation.[5] The current episode is similar to past episodes in that the terms-of-trade shock has been largely driven by a large fall in export prices. With regard to the adjustment, export volume growth has been in line with historical experience for Latin American countries with flexible exchange rates, but lower than in past episodes for those with more rigid exchange rates. At the same time, import compressions have been large for both, but somewhat larger for countries with more rigid exchange rates.[6]

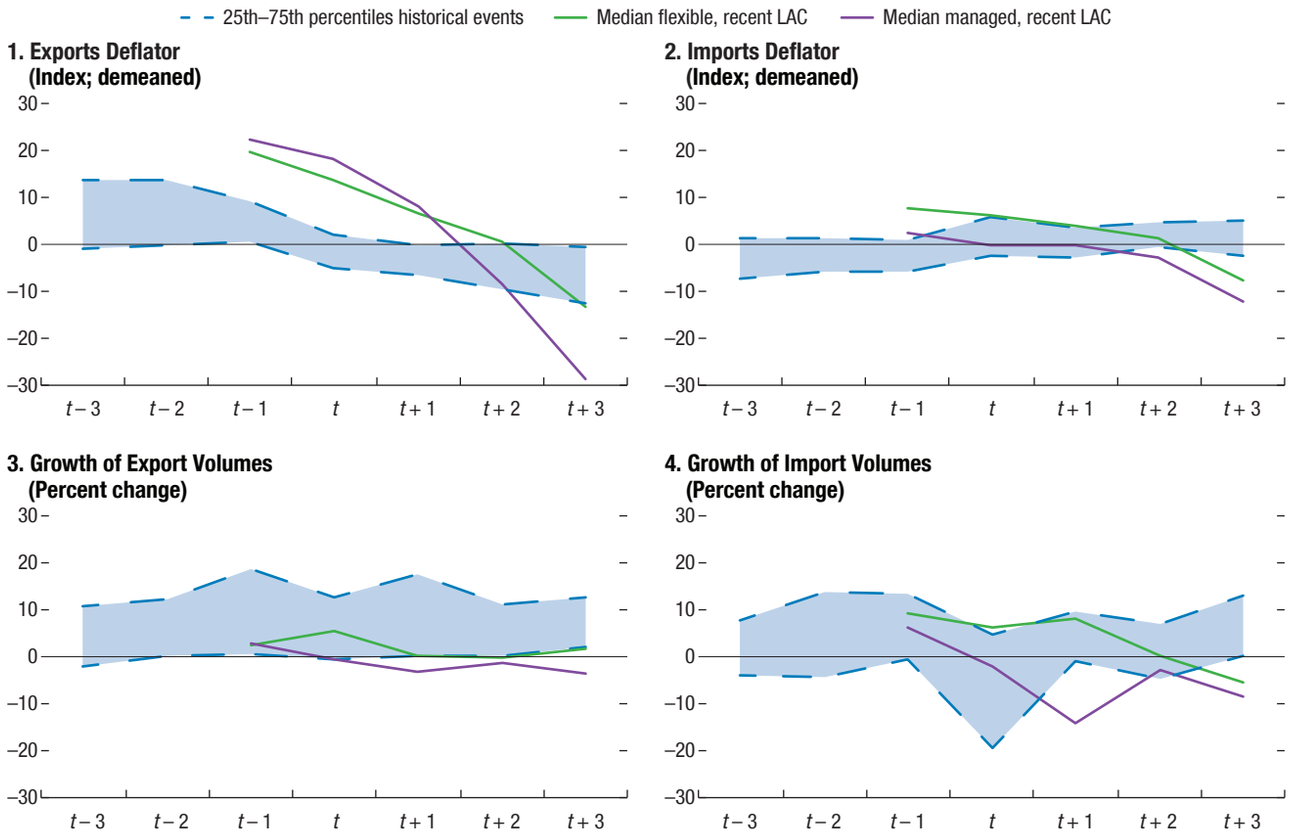
Differences in the exchange rate regime have led to differences in the composition of external adjustment in the most recent episode. Despite the negative income shock, Latin American economies with more flexible exchange rate regimes have experienced smaller reductions in output than those that are more rigid (see Chapter 2). The next section explores and quantifies the external adjustment mechanisms behind this finding.

Adjustment of the Current Account to Terms-of-Trade Shifts: Income Effect, Expenditure Switching, or Both?

The analysis above suggests that countries with flexible exchange rates have fared better following the recent terms-of-trade bust than those with more rigid exchange rate regimes. This could be a result of the presence of some expenditure-switching offsetting the negative income effect from the collapse in the terms of trade. To quantify the relative importance of these two effects in the recent adjustment process, this section computes a "sacrifice ratio" metric, which gauges the burden of external adjustment on domestic demand and the importance of exchange rate flexibility.

[5]Adler, Magud, and Werner (2017) documents this systematically.
[6]Casas and others (2016) also find that expenditure switching operates mostly through import compression rather than export expansion, owing to the predominance of the U.S. dollar in the invoicing of international trade.

Figure 3.5. Export and Import Volumes and Prices in Historical Perspective: Export Price Shock, but Import Volume Adjustment



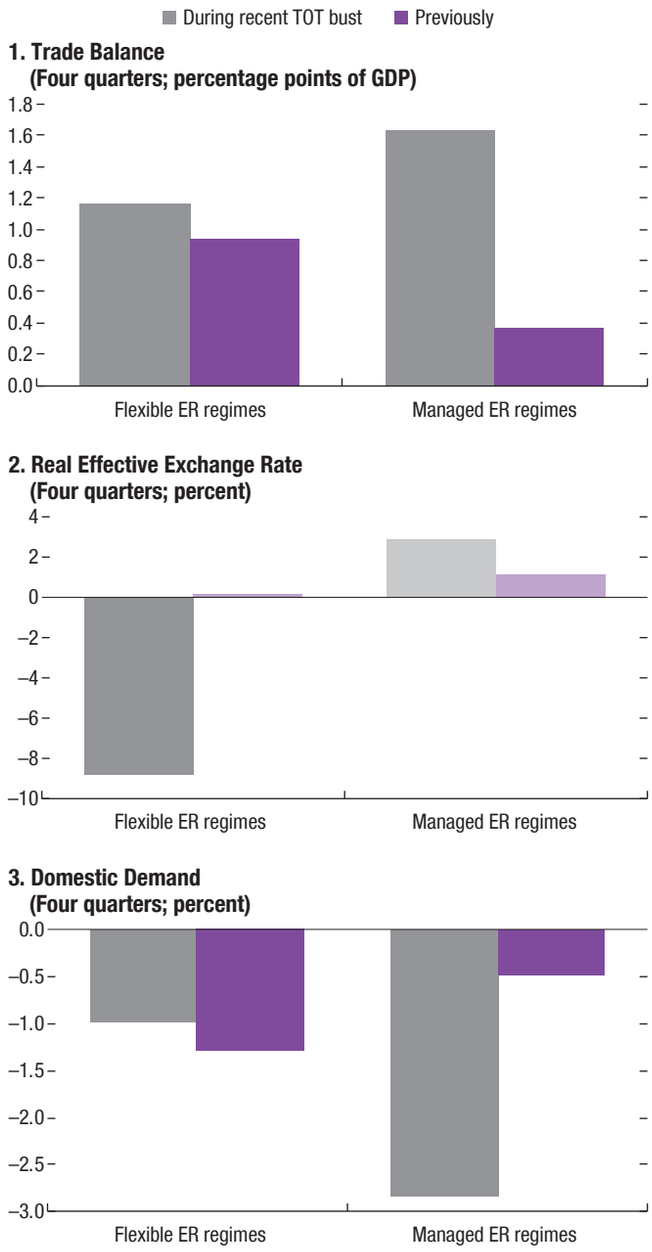
Sources: Adler, Magud, and Werner 2017; IMF, World Economic Outlook database; and IMF staff calculations.
Note: Flexible exchange rate regimes include Brazil, Chile, Colombia, Mexico, and Peru; managed exchange rate regimes refer to a diverse set of countries with more limited exchange rate flexibility and include Argentina prior to 2016, Bolivia, Ecuador, and Venezuela. Argentina was reclassified as a floating exchange rate arrangement in December 2015. Interquartile bands correspond to a large sample of emerging market and developing economies. Period *t* denotes the year in which the terms of trade begin to fall for each event. Observations are demeaned by event. LAC = Latin America and the Caribbean.

The mechanics of external adjustment are captured using a panel vector auto-regression framework. This framework allows the dynamic relationship between changes in the trade balance, changes in domestic demand, and changes in the real effective exchange rate to terms-of-trade shocks (controlling for external demand conditions) to be estimated in a panel of 38 economies. The analysis in this section presents the response of Latin American economies to a terms-of-trade shock of the same magnitude in two periods, 2000–10 and 2010–16.[7] The relative importance of the expenditure-switching mechanism is estimated by computing a counterfactual scenario to a terms-of-trade shock in which the response in the real effective exchange rate is fixed at zero at all forecast horizons. Comparing the unconstrained responses of the trade balance (and its components) with this counterfactual scenario isolates the contribution from expenditure switching in the region's external adjustment process.[8]

[7]The sample is divided in these two periods (using an interaction term) to account for possible differences in exchange rate and demand elasticities arising from the strengthening of policy frameworks across the region. For example, the April 2016 *Regional Economic Outlook: Western Hemisphere* estimates that the exchange rate pass-through to inflation has significantly decreased in Latin America. This smaller pass-through in turn would allow for larger currency depreciations in real terms (Box 3.3).

[8]See Annex 3.1 for the data and the model's details.

Figure 3.6. Cumulative Response of Latin American Economies to a 10 Percent Reduction in the Terms of Trade, 2000–16



Sources: Haver Analytics; IMF, World Economic Outlook database; and IMF staff calculations.
Note: Lighter colors denote results that are not statistically significant. ER = exchange rate; TOT = terms of trade.

Results confirm that the composition of external adjustment varies with the exchange rate regime. In response to a 10 percent fall in the terms of trade, there were large and significant trade balance improvements after one year across exchange rate regimes. In flexible regimes, currencies depreciated in real terms, boosting exports and reducing imports, suggesting the presence of the expenditure-switching effect.[9] This lowered the burden of the adjustment process on domestic demand, which is estimated to have contracted about two and a half times less in economies with more flexible exchange rates (Figure 3.6).

The counterfactual analysis described above suggests that the contribution of the real exchange rate to the narrowing of the trade balance increased in recent years. In the past, most of the external adjustment in countries with flexible currencies was driven by the (negative) income effect. Recently, however, the income and expenditure-switching effects have been acting jointly (Figure 3.7).[10] The larger role of expenditure switching can be observed in the performance of exports and imports. Exports have responded positively to real depreciation as a result of a terms-of-trade shock in the recent episode, but this effect remains weak. In fact, a 10 percent reduction in the relative price of exports increased real exports by only 2 percent in one year but lowered real imports by close to 7 percent.

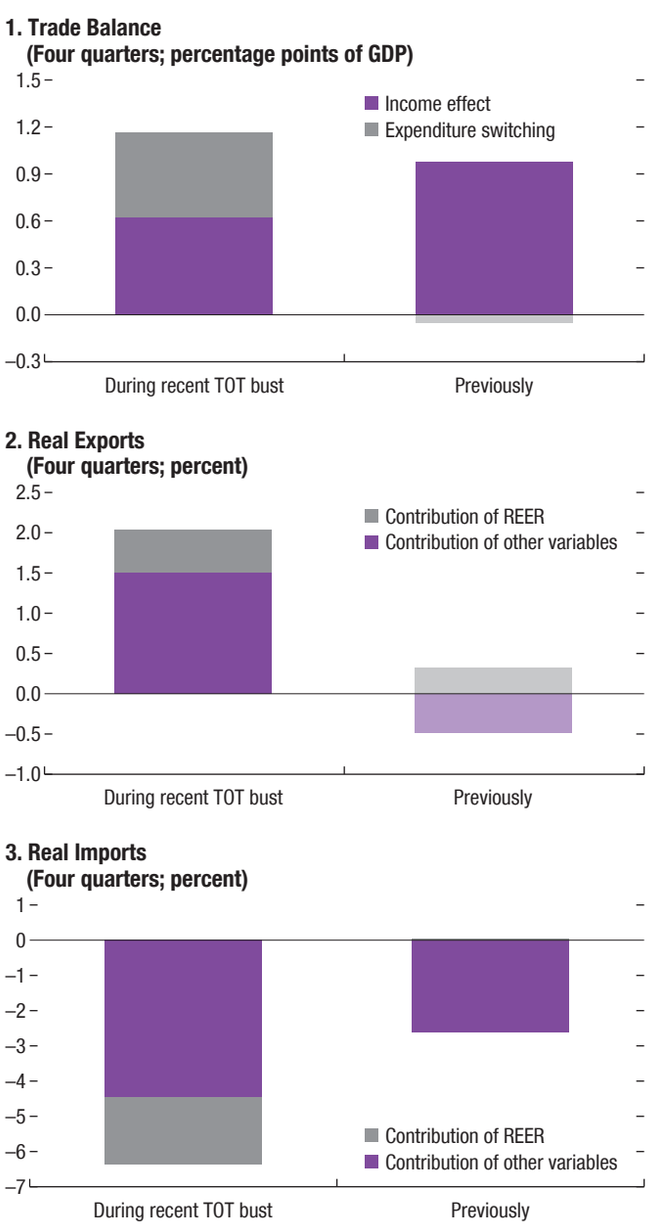
These findings can also be summarized in terms of a *sacrifice ratio of external adjustment*—defined as the extent to which domestic demand must compress for the trade balance to improve by 1 percentage point of GDP.[11] Following the

[9]The response of real exports and imports is obtained from estimating the same panel vector auto-regression specification described above and in Annex 3.1 but with real exports and imports (in log first differences) in lieu of the trade balance.

[10]Based on the counterfactual analysis described above, the real exchange rate explains close to 50 percent of the response of the trade balance in economies with flexible exchange rate regimes, while playing a negligible role in countries with fixed exchange rate regimes. Interestingly, the real exchange rate does not appear to have played an important role among flexible regimes between 2000 and 2010, because terms-of-trade busts during the 2008–09 global financial crisis were short-lived.

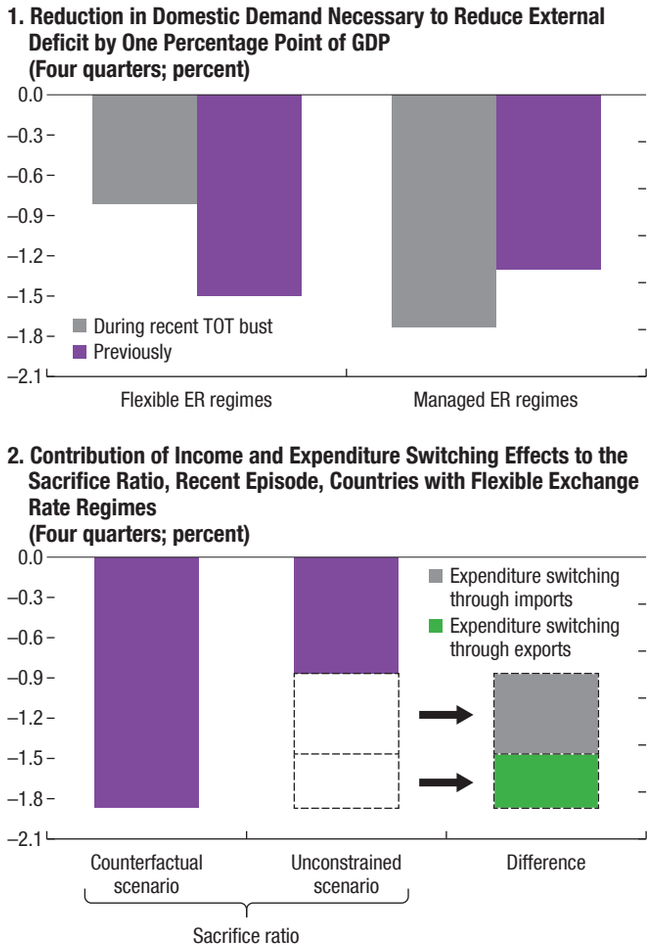
[11]Computed as the share of the cumulative response of domestic demand to the cumulative response of the trade balance to the terms-of-trade shock.

Figure 3.7. Decomposition of Responses to a 10 Percent Reduction in the Terms of Trade among Latin American Economies with Flexible Exchange Rate Regimes, 2000–16



Sources: Haver Analytics; IMF, World Economic Outlook database; and IMF staff calculations.
Note: Lighter colors denote results that are not statistically significant. REER = real effective exchange rate; TOT = terms of trade.

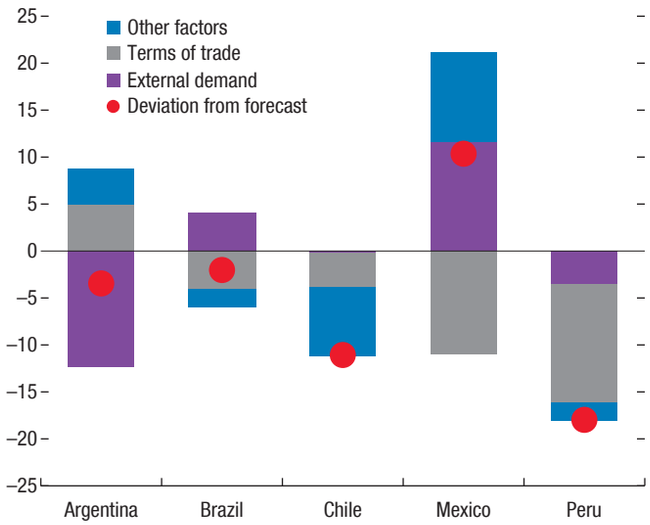
Figure 3.8. Exchange Rate Flexibility Reduces the Domestic Sacrifice Ratio of Adjustment in Latin America



Sources: Haver Analytics; IMF, World Economic Outlook database; and IMF staff calculations.
Note: ER = exchange rate; TOT = terms of trade.

recent shock, the sacrifice ratio for economies with flexible exchange rate regimes is about half the ratio observed during previous episodes (Figure 3.8). At the same time, exchange rate rigidity has become costlier for economies in Latin America (Box 3.2 contrasts the cases of Bolivia, Brazil, Chile, Colombia, and Ecuador). External adjustment to exogenous shocks now requires a larger domestic demand compression in more rigid currencies as a result of the real appreciations of their currencies against major trading partners and, in particular, regional competitors (Box 3.3). Altogether, the cost of exchange rate inflexibility has increased, possibly owing to the migration of regional and global competitors to more flexible exchange rate frameworks.

Figure 3.9. Historical Decomposition of Real Exports During Recent Terms-of-Trade Bust: Sizable Unexplained Factors Behind Real Export Performance
(Percent; cumulative)



Sources: Haver Analytics; and IMF staff calculations.
Note: For Argentina the period corresponds to 2012:Q3 to 2015:Q3; for Brazil from 2014:Q2 to 2015:Q4; for Chile and Peru from 2013:Q1 to 2015:Q4; and for Mexico from 2014:Q2 to 2015:Q4.

The composition of adjustment, mainly through import compression and despite large currency depreciations, raises the question of whether real export growth has been underperforming in recent years. Historical decompositions of real exports show that, not surprisingly, external demand and terms-of-trade shocks have been the main driving forces behind recent export performance in the region. However, except for Mexico and Argentina, exports appear to be underperforming, as suggested by the unexplained component in the model's forecast errors (Figure 3.9).

The results presented in this section highlight the role of the exchange rate as a shock absorber. Despite the large negative income effect during a terms-of-trade bust episode, exchange rate flexibility enables the expenditure-switching effect to take place, easing the burden of the adjustment process in terms of domestic demand and output growth. Although real depreciation has reduced the sacrifice ratio, most of the adjustment has come through import compression rather than export expansion.

To shed light on whether the limited response of aggregate real exports to currency depreciations is masking sector and product-specific export dynamics, the next section analyzes export reactions to real depreciation shocks by region and product groupings.

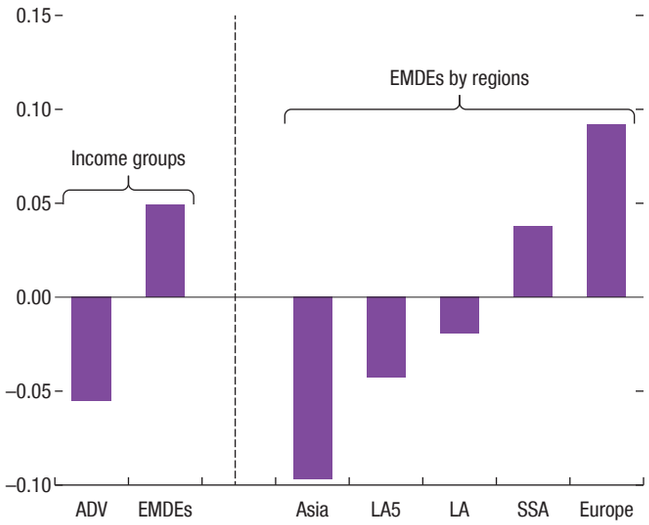
Do Depreciations Boost Short-Term Export Performance? Going Granular

The analysis in the previous section finds that the link between the real exchange rate and exports is significant, but nevertheless relatively small. Understanding how export performance is affected by changes in relative prices requires a more granular perspective, since demand and supply elasticities vary a great deal across sectors and goods, and along the global value chain (GVC). For instance, a producer may gain a competitive advantage following a real depreciation of the local currency, but this is unlikely to boost exports if its productive capacity is fixed in the short term, or if foreign buyers are largely indifferent to the relative price of the good. Likewise, exporters that use imported inputs in production will see their costs rise, reducing the gains to competitiveness (Box 3.4).

To gain a better understanding of the connection between the real effective exchange rate and exports, this section makes use of product-level trade data. Specifically, this section estimates the elasticity of a country's share in global exports of each product with respect to movements in its real effective exchange rate.[12] The average country-product responds strongly following depreciations,

[12]See Annex 3.2 for details. A difficulty in empirical studies of trade elasticities is the need to obtain a measure of prices to infer the quantities being traded, with results depending on the deflators used in the analysis. Unfortunately, the procedures used to construct border price indices vary considerably across countries, complicating cross-country analysis (Burstein and Gopinath 2014). To circumvent this difficulty, the strategy used here focuses on global market shares for four-digit products, which are assumed to have a single world price.

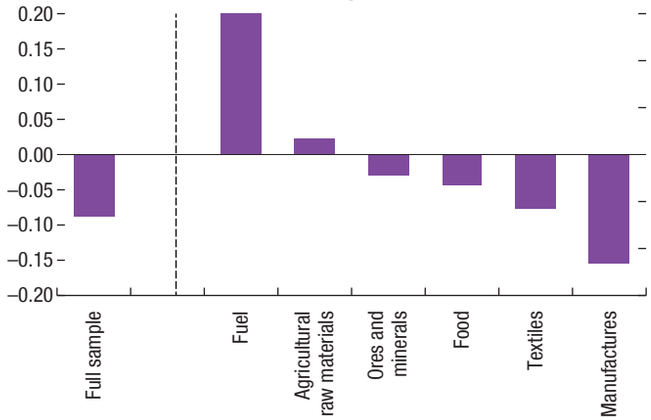
Figure 3.10. Pooled Real Effective Exchange Rate Elasticities of Export Market Shares, by Country Groups
(Elasticity)



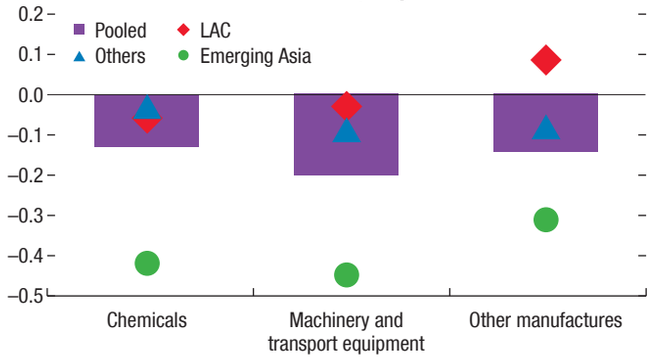
Sources: IMF, Information Notice System database; UN Comtrade; and IMF staff calculations.
Note: The bars show the sum of the coefficients for the pooled elasticity and the interaction term for each region. ADV = advanced economies; EMDEs = emerging market and developing economies; LA5 = Brazil, Chile, Colombia, Mexico, Peru; LA = Latin America; SSA = sub-Saharan Africa.

Figure 3.11. Pooled Real Effective Exchange Rate Elasticity of Export Market Shares, by Product Groups
(Elasticity)

1. By World Bank WITS Product Category



2. Subcomponents of Manufactures by Region



Sources: IMF, Information Notice System database; UN Comtrade; and IMF staff calculations.
Note: The bars show the sum of the coefficients for the pooled elasticity and the interaction term for each category. LAC = Latin America and the Caribbean; WITS = World Integrated Trade Solution.

with an elasticity of about –0.13.[13] This means that a 10 percent real depreciation increases the average country-product export share by about 1.3 percent with respect to its starting point.[14]

Elasticities, however, vary greatly across regions in the sample of 134 countries. On average, emerging market economies display less responsiveness to real depreciations than advanced economies (Figure 3.10). Latin America and emerging Asia, as well as advanced economies, stand out as having statistically significant responsiveness, whereas other emerging market and developing economies display a relative disconnect. Notably, emerging Asia's estimated elasticity is about twice as large as that of the LA5[15]—which is, in turn, larger than the rest of Latin America.

While the average product displays an elasticity of about –0.1, elasticities vary substantially over the 764 products in the sample. For about two-thirds of these products, a depreciation boosts the country's export share of that product, while for most of the others the impact is statistically indistinguishable from zero. This variation in elasticities can be broadly mapped to categories of products (Figure 3.11). Manufactures and textiles display higher market share responsiveness than

[13]Weighted least squares estimates are reported throughout, with country-product pairs weighted according to their relative trade value in the panel dimension of interest.

[14]An increase in the real effective exchange rate indicates appreciation. Thus, a negative elasticity implies that export shares increase when the real exchange rate depreciates.

[15]Brazil, Chile, Colombia, Mexico, and Peru.

commodities, which respond little to real exchange rate movements.[16] The responsiveness of manufactures is broad-based across more granular categories (such as chemicals, machinery and transport equipment, and other manufactures).

Putting this together, the degree to which depreciations boost exports is influenced by the composition of a country's exports.[17] Those economies that specialize in commodities generally observe a weaker response to a real depreciation than those that concentrate their production in manufactured goods. The response in emerging Asia is larger than that in Latin America, in part owing to the larger share of manufactures in total exports in the former (Figures 3.10 and 3.11). While exports of manufactures have consistently made up approximately 40 percent of total exports in Latin America and the Caribbean since 1990, their share in emerging Asia's total exports has risen to 80 percent over the same period. However, there is more to the story. Even within narrow categories of manufactures, emerging Asian economies display much larger responsiveness than other regions, including Latin America. Underlying structural factors may be behind this finding, including supply-side bottlenecks related to infrastructure gaps as documented in the April 2016 *Regional Economic Outlook: Western Hemisphere*.[18]

The extent to which depreciations boost gross exports is likely to depend on the extent to which a country is integrated into GVCs. While the effect of GVC integration on trade elasticities can be positive or negative according to a country's location along the supply chain, Ahmed, Appendino, and Ruta (2016) estimate that participation in GVCs reduces the real effective exchange rate elasticity of manufacturing exports by 22 percent on average. As the April 2015 *Regional Economic Outlook: Asia and Pacific* documents, Asia's emerging economies have become deeply embedded into GVCs, and are generally located downstream within these chains (that is, closer to final demand), such that the expansionary impact of depreciations is mitigated by the rising cost of imported inputs. In turn, the October 2015 *Regional Economic Outlook: Western Hemisphere* documents that the economies of Latin America and the Caribbean are less integrated into GVCs, with commodity exporters in the region positioned upstream (that is, further from final demand). On the other hand, Leigh and others (2017) show that there is limited evidence that participation in GVCs has significantly changed that exchange rate-trade relationship over time. These findings suggest that, all else being equal, observed participation in GVCs would tend to *raise* the relative export sensitivity of Latin America and the Caribbean with respect to emerging Asia, and are thus unlikely to account for the findings reported here.

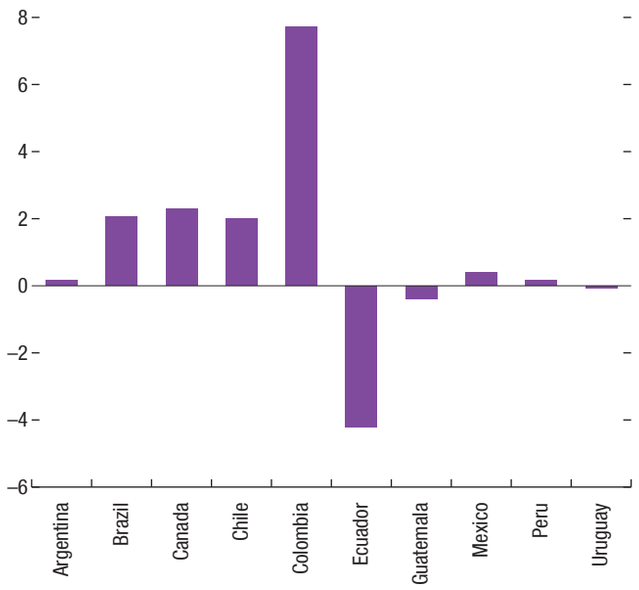
Results still show that recent real depreciations have boosted exports in many Latin American economies, once global demand conditions are controlled for. Figure 3.12 reports the boost that real effective exchange rates have provided to exports since 2013, expressed in terms of total exports in 2012. While the effects are modest in most cases, they are by no means negligible. For instance, the real depreciation of the Colombian peso over this period has boosted exports by 7.5 percentage points since 2012. This result compares with the fall of nearly 40 percent in export value that has been observed over this period, making clear that the boost—while substantial—has far from fully offset the external shock. In contrast, a similar counterfactual analysis suggests that Ecuador's real appreciation has placed a drag on exports of more than 4 percentage points since 2013.

[16]One possible interpretation is that short-term supply curves for commodities tend to be relatively inelastic in the presence of substantial fixed investment costs. It may also be that production of commodities relies more on imported capital inputs, and hence depreciations raise production costs along with revenue in local currency.

[17]Other factors no doubt affect this relationship, including the availability of credit (Paravisini and others 2015), and a battery of product- or sector-specific "real rigidities" that affect disaggregated real exchange rates (see Burstein and Gopinath 2014 for a survey).

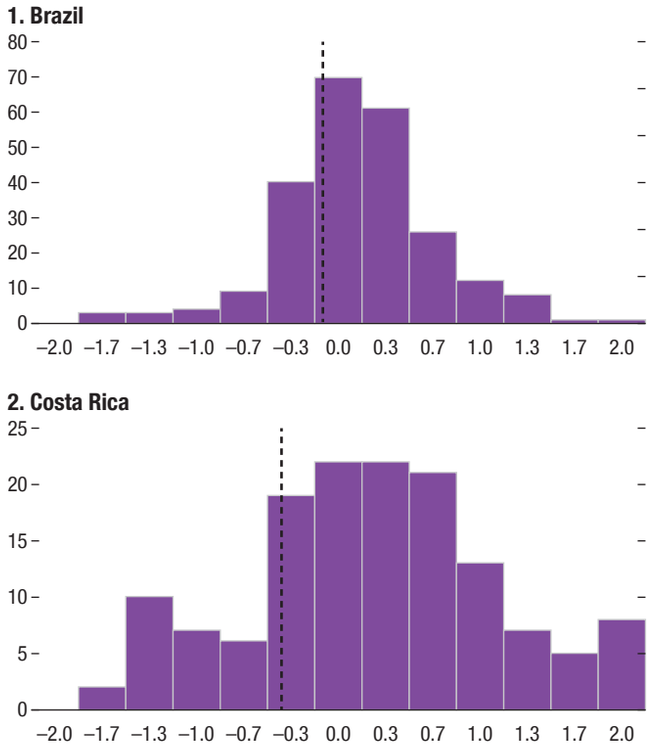
[18]Raissi and Tulin (2015) find that, in India, binding supply-side bottlenecks limit the response of exports to short-run real depreciations.

Figure 3.12. Estimated Contribution of Real Effective Exchange Rate to Export Values, 2014–16
(Percent of 2012 export value; constant U.S. dollars)



Sources: IMF, Information Notice System database; UN Comtrade; and IMF staff calculations.
Note: The figure shows the total estimated contribution of movements in the real effective exchange rate during 2013–15 to export values in 2014–16. Pooled product-level elastiticities are used, with countries varying according to the relative importance of each product in their export baskets and the variation in their real effective exchange rate.

Figure 3.13. Within-Country Variation of Export Elasticities across Products
(Number of four-digit SITC products)



Sources: IMF, Information Notice System database; UN Comtrade; and IMF staff calculations.
Note: Dashed lines correspond to the estimated pooled elasticity at the country level. SITC = Standard International Trade Classification.

Finally, even in countries whose aggregate exports appear disconnected from the real effective exchange rate, depreciations still lead to intersectoral reallocations. As an example, note that in Brazil, where aggregate export performance is relatively inelastic with respect to the real exchange rate, depreciations lead to larger market shares of many export products, just as they do in Costa Rica (Figure 3.13). This finding suggests that the disconnect at the macro level may hide substantial potential reallocation of resources across products and sectors, including within each country.[19] This result is supported by the analysis in Box 3.4, which shows that real depreciations affect the production of value added differently across sectors in Latin America, and provide a particularly strong boost to exporting sectors outside commodity production.

Policy Implications

The analysis in this chapter has three main policy implications for Latin American economies facing the end of the commodity super-cycle. First, exchange rate flexibility reduces the sacrifice ratio of external adjustment. Where currencies have depreciated in real effective terms, adjustment has benefited from somewhat stronger exports and output growth, as well as the redirection of consumer spending from imports to domestically produced goods, reducing the burden on domestic demand compression and thus supporting output.

[19]This result is in line with the finding in Freund and Pierola (2012), that real depreciations in developing countries stimulate exports in large part through entry into new export products and new markets.

Second, the cost of exchange rate rigidity has risen in Latin America. As exchange rate flexibility has become more widespread in the region, common external shocks have resulted in a greater loss of competitiveness for countries whose currencies move in sync with the U.S. dollar and strengthen against regional partners' currencies. The sacrifice ratio has increased for these countries, implying that external adjustment would impose larger output costs through a sharper compression of domestic demand.

Third, exchange rate flexibility can support structural policies aimed at shifting resources to the noncommodity sector, since depreciations boost exports of manufactures more than for other goods, especially in regions with a higher concentration of manufactures and adequate infrastructure. With regard to improving resilience to external shocks, a corollary of this result is that the closing of infrastructure gaps that support a dynamic manufacturing sector would reduce the sacrifice ratio of external adjustment going forward.

Box 3.1. Expenditure-Switching versus Income Effects

A permanent (or highly persistent) negative terms-of-trade shock—that is, a change in the relative price of exports and imports—could be driven by (1) a decrease in the price of exports; (2) an increase in the price of imports; or (3) both price shifts.[1]

Regardless of the nature of the relative price change, a permanent negative terms-of-trade shock implies *a negative income effect*; that is, the economy is poorer than before the shock. In equilibrium, its real exchange rate (the purchasing power of its basket of goods and services in terms of a foreign basket of goods and services) is expected to decrease, enabling the correction of external imbalances.

In turn, the relative price change makes exports relatively cheaper for the rest of the world. All else equal, then, external demand for the country's domestic goods—exports—would increase.

The composition of the domestic basket of goods and services of a representative consumer would also change as the relative price changes. As the relative price of foreign goods increases while the relative price of domestic goods decreases, imports would decrease while the demand for nontradable goods and for domestic tradable goods would increase (assuming that prices of domestic tradable goods increase less than the prices of foreign goods).

Overall, the relative price change would be expected to increase exports while shifting domestic demand to nontradable goods and to domestic tradable goods to substitute for imported goods. The change in the composition of the domestic basket of consumption and the increase in exports is typically referred to as the *expenditure-switching effect*.

Note that the negative income shock implies a reduction in the overall level of consumption, regardless of the change in the composition of the consumption basket.

If the expenditure-switching effect offsets the negative income shock, real depreciation would be expansionary. If, however, the income effect dominates, the expenditure switching would, at best, partially offset the contraction of overall consumption ensuing from the decline in income.[2]

This box was prepared by Nicolas E. Magud.

[1]Bems and Di Giovanni (2016), using evidence from Latvia, document the existence of an expenditure-switching effect even with no relative price changes. A negative income effect persuades consumers to switch from expensive foreign goods to cheaper domestic goods.

[2]This description ignores additional contractionary effects of real depreciations, such as balance sheet effects owing to liability dollarization, among others.

Box 3.2. A Comparative Analysis of External Adjustment in South America

Many economies in the region have been under pressure as a result of large terms-of-trade busts, tepid global demand, and idiosyncratic domestic shocks. These factors have translated into a significant deterioration of external and internal imbalances. This box looks at the experience of adjusting to these imbalances in countries that differ across two main dimensions: exchange rate flexibility and the extent of available fiscal space and fiscal buffers.

Although most of the adjustment has been taking place at the expense of import compression, the mechanics of the adjustment have differed greatly across the region. In countries with more flexible exchange rate regimes, expenditure switching has contributed significantly to external adjustment. In countries with less flexible exchange rate regimes or large negative output gaps (or both), expenditure reduction has been the main mechanism of adjustment. At the same time, some countries have used existing buffers or tapped international capital markets to smooth the shock. Growth performance in the region has varied depending on the nature of adjustment.

Chile and *Colombia* experienced a significant deterioration in their terms of trade, although of different magnitudes, in 2012 and 2014, respectively. As a result of the collapse in commodity prices, *Colombia*'s oil exports and *Chile*'s copper exports declined markedly (Figure 3.2.1, panel 1). Both economies allowed the exchange rate to absorb the shock, with currencies depreciating in real effective terms by 10 percent in *Chile* and 30 percent in *Colombia* in a two-year window from the onset of the shock (Figure 3.2.1, panel 4). Exchange rate flexibility provided a boost for nonmineral exports in *Chile* (Figure 3.2.1, panel 2) and so far has allowed for reallocation of consumer spending from imported to domestic goods in *Colombia* (Figure 3.2.1, panel 3). The presence of expenditure-switching effects in both economies lowered the burden of external adjustment on domestic demand (Figure 3.2.1, panel 5) and supported growth (Figure 3.2.1, panel 6).

In *Brazil* and *Ecuador*, economies that have experienced recessions, the narrowing of imbalances has come as a result of deep contractions in domestic demand (Figure 3.2.1, panels 5 and 6). In *Brazil*, although the deterioration in the terms of trade was a precursor to the external adjustment process, the adjustment was primarily driven by domestic factors and a large negative output gap. However, most of the improvement in the current account is likely to be durable, given the projected increase in public savings (see Chapter 2).

In *Ecuador*, dollarization coupled with limited access to external financing forced the adjustment to come primarily through fiscal consolidation and tighter import restrictions. Hence, as the economy recovers, output gaps will narrow, unwinding a part of the adjustment that has occurred so far.

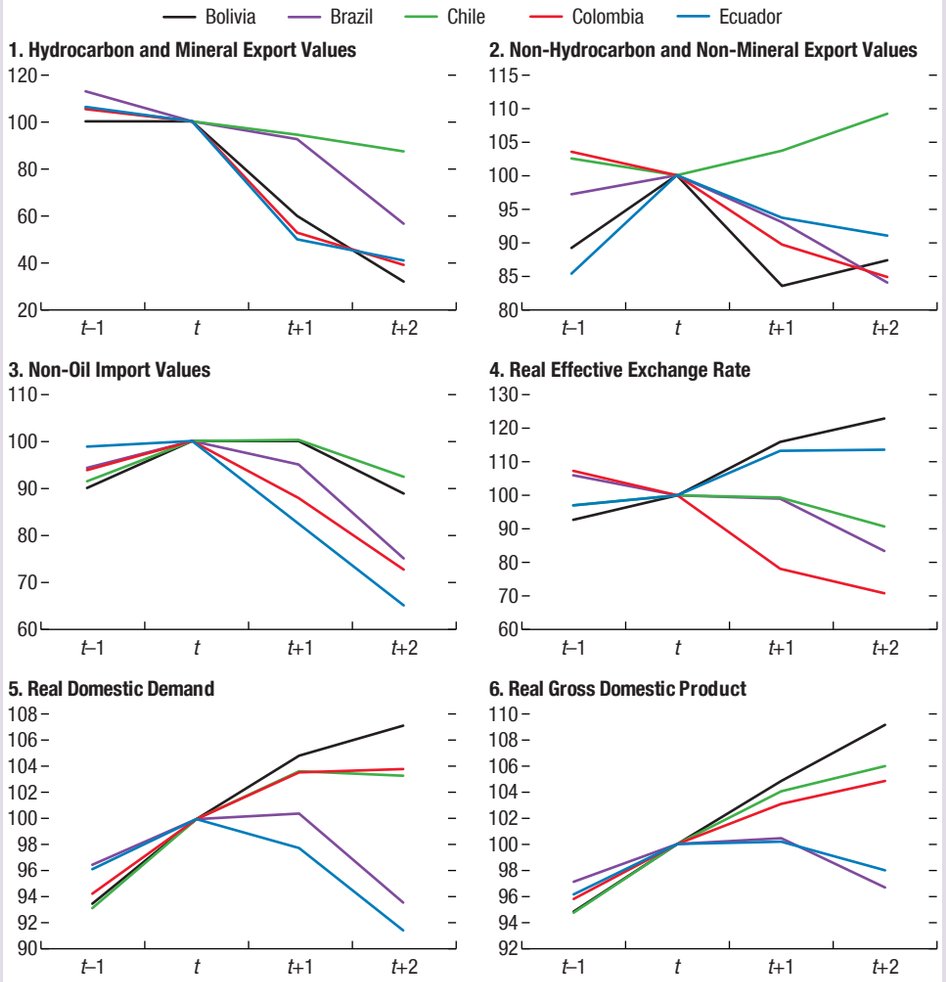
Bolivia's external balances deteriorated sharply, given that accommodative fiscal policy and rapid credit growth smoothed out the collapse in export prices. However, some external adjustment has started to take place through import compression (Figure 3.2.1, panel 3). These countercyclical policies have eroded the country's sizable buffers, but reserves remain adequate. The limited external adjustment observed to date (either through expenditure switching or expenditure reduction), coupled with still-low commodity prices, could exacerbate external imbalances and further erode policy buffers.

These country experiences show that the extent of the necessary adjustment depends not only on the size of the shock but also on the exchange rate regime, the degree of access to international markets, and the availability of fiscal space and fiscal buffers. In particular, when comparing the countries that have been hit the hardest by the commodity shock (*Bolivia, Colombia, and Ecuador*), it is evident that the adjustment has been harsher in *Ecuador* than in *Colombia* (where the effect was cushioned by exchange rate flexibility) and in *Bolivia* (where the adjustment is being smoothed by drawing on past buffers).

This box was prepared by Juan Yépez.

Box 3.2 *(continued)*

Figure 3.2.1. Adjustment to Terms-of-Trade Shock in Selected South American Countries
(Index: t = 100)



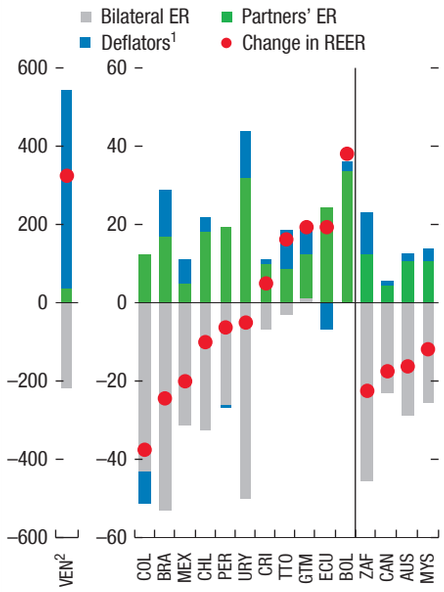
Sources: Haver Analytics; and IMF staff calculations
Note: Period *t* denotes the year in which the terms of trade begin to fall for each country. *t* = 2012 for Chile, 2013 for Brazil, and 2014 for Bolivia, Colombia, and Ecuador. Hydrocarbon exports are for Bolivia, Colombia, and Ecuador; minerals exports are for Chile; and for Brazil exports are hydrocarbon and minerals. Non-hydrocarbon exports are for Bolivia, Colombia, and Ecuador; non-minerals exports are for Chile; and for Brazil exports are non-hydrocarbon and non-minerals.

Box 3.3. The Exchange Rate and External Competitiveness

The spread of flexible exchange rates in Latin America has changed the relationship between the bilateral and effective exchange rates following a common external shock in two ways. Figure 3.3.1 shows changes in the real effective exchange rates (REERs) for selected Latin American and Caribbean economies from March 2013 through March 2016, during which many of these countries suffered major deteriorations in their terms of trade.

First, large bilateral depreciations against the U.S. dollar have translated into proportionally smaller multilateral depreciations. For example, the 32 percent depreciation of the Chilean peso against the U.S. dollar translated into a real effective depreciation of about 10 percent over this period. Second, efforts to maintain a stable nominal exchange rate against the dollar have not led to a stable real exchange rate, but rather to substantial appreciation.

Figure 3.3.1. Decomposition of Recent Real Effective Exchange Rate Movements
(Percent change from March 2013 to March 2016)



Sources: IMF, Information Notice System database; and IMF staff calculations.
Note: For International Organization for Standardization (ISO) country codes used in data labels, see page 137. ER = nominal exchange rate versus the U.S. dollar; REER = real effective exchange rate.
[1]Captures the relative change in price deflators with respect to trading partners.
[2]For Venezuela, the bilateral exchange rate is the weighted average of the multitier exchange rate system.

To understand these developments, recall that the REER is measured as a weighted average of bilateral real exchange rates:

$$Q_i = \Pi_j \left(\frac{P_i E_i}{P_j E_j}\right)^{w_{ij}}, \quad (3.3.1)$$

where E_i is the nominal exchange rate of country i versus the U.S. dollar, P_i the consumer price index (or some other price deflator), and w_{ij} is the weight of trading partner j for country i. By rearranging equation (3.3.1), variation in the real exchange rate comes from three sources:

$$\dot{q}_i = \dot{e}_i - \Sigma_j w_{ij}\dot{e}_j + \Sigma_j w_{ij}(\dot{p}_i - \dot{p}_j), \quad (3.3.2)$$

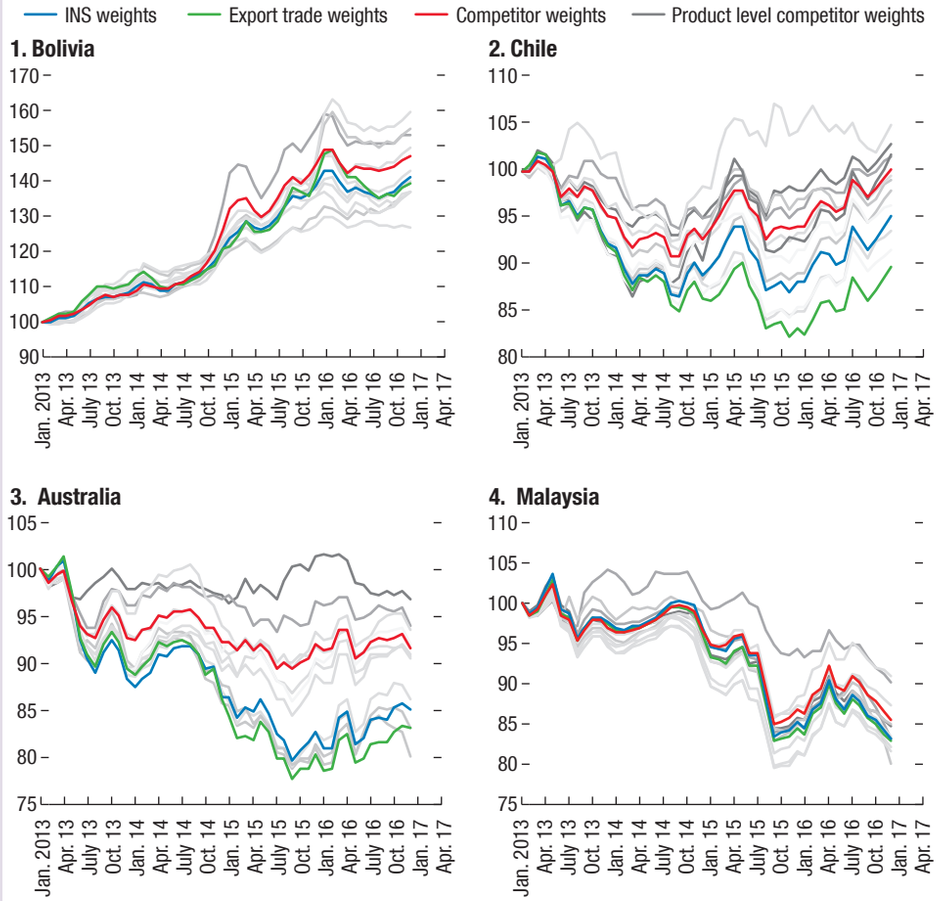
where lower-case variables are natural logarithms, and dots denote rates of change. The first term, $\dot{e}_i$, corresponds to the change in the country's own currency versus the U.S. dollar, and largely reflects domestic exchange rate policy decisions. The second term corresponds to the evolution of trading partners' exchange rates versus the U.S. dollar, and thus relates to *their* exchange rate policy decisions. Finally, the third term reflects changes in inflation dynamics with respect to partners.

Figure 3.3.1 shows the contributions of these three components to the overall change in the REER during this period, according to IMF methodology. Gray bars display the large bilateral depreciations against the U.S. dollar observed in countries with flexible exchange rate regimes and the stability of countries that have kept their bilateral rates relatively unchanged. Green bars show the appreciating pressures on real exchange rates that stem from trading partners that have made widespread use of exchange rate flexibility. Finally, blue bars display the secondary role played by relative inflation rates in most countries, reflecting limited

This box was prepared by Yan Carrière-Swallow.

Box 3.3 *(continued)*

Figure 3.3.2. Alternative Measures of the Real Effective Exchange Rate



Sources: IMF, Information Notice System (INS) database; UN Comtrade; and IMF staff calculations.
Note: Gray lines denote country's top ten export products.

exchange rate pass-through. A notable exception is Venezuela, where inflation explains an overwhelming share of the country's REER appreciation.

For countries facing large negative external shocks, pressure from trading partners—both destinations and competitors—is reframing the link between exchange rate policy and competitiveness, marking a break from the past, when most trading partners used less exchange rate flexibility. In countries that have allowed for very large nominal depreciations, this factor is largely responsible for the more tapered response of real exchange rates and has contributed to a relatively muted export response. Meanwhile, for countries that have maintained stable bilateral exchange rates, the result has been very large real appreciations and decreased competitiveness.

Box 3.3 *(continued)*

In assessing external competitiveness, many relative prices are relevant and can motivate alternative choices of weights w_{ij}. The first is the relative price of exports with respect to goods that are produced in the destination country, a concept that is approximated by weights equal to the shares of each partner j in country i's total exports. Another is the relative price of exports with respect to those of competing exporters that sell the same products, with which country i may or may not trade directly. The trade weights w_{ij} used to compute the REER indices disseminated in the IMF's Information Notice System (INS) incorporate information along both dimensions to provide a comprehensive metric of a country's competitiveness.[1]

Figure 3.3.2 shows the evolution of REERs constructed for selected economies using the standard INS weights (blue lines), direct export trade weights (green lines), and competitor-based weights (red lines).[2] As IDB (2017) highlights, Latin America's real exchange rates have depreciated further with respect to direct trading partners than they have with respect to indirect trade competitors, suggesting that the region's competitiveness may be evolving less favorably than is commonly assumed. For instance, Chile's real effective depreciation has generally been only half the magnitude when computed with respect to competitors of Chilean exports, rather than with respect to the export destinations to which Chile sells its goods. Focusing on some of the country's top export products, the real value of the Chilean peso has appreciated slightly with respect to competitors since 2013 (gray lines).

The divergence between the evolution of direct trading partners and competitors is also observed in advanced commodity-exporting economies, such as Australia. In contrast, while some East Asian exporters have also received appreciating pressures from their trading partners, they have seen less divergence between the evolution of relative prices with respect to direct partners and competitors, as in Malaysia.

[1]See Zanello and Desruelle (1997) for details on the construction of the Information Notice System REER indices.

[2]All bilateral exchange rates are deflated by the Consumer Price Index. See Ahn, Mano, and Zhou (2017) for a discussion of the contrast with REER measures that are deflated by unit labor costs.

Box 3.4. The Impact of Depreciations on Sectoral Growth

The section discussing the relationship between real depreciation and export shares shows that real exchange rate depreciations have heterogeneous effects on export performance across sectors and countries. This box addresses a related question: do real exchange rate depreciations have differentiated effects on real growth across sectors? The analysis focuses on three channels through which the real exchange rate could affect sectoral growth:

- An export channel: Depreciations make domestic products more competitive in international markets and could increase growth through higher exports.
- A cost channel: Depreciations make imported inputs more expensive, potentially reducing growth.
- An import-penetration channel: Depreciations make imported final demand more expensive. If consumers substitute domestically produced products for costly imported varieties, domestic industries could grow faster.

The analysis tests the existence and magnitude of the three channels in a panel of country-sector-year observations using a difference-in-difference methodology. The analysis is based on annual data from the Organisation for Economic Co-operation and Development for 61 countries and 33 sectors for the period 1995–2011. The sample includes Argentina, Brazil, Chile, Colombia, and Costa Rica among the Latin American countries.

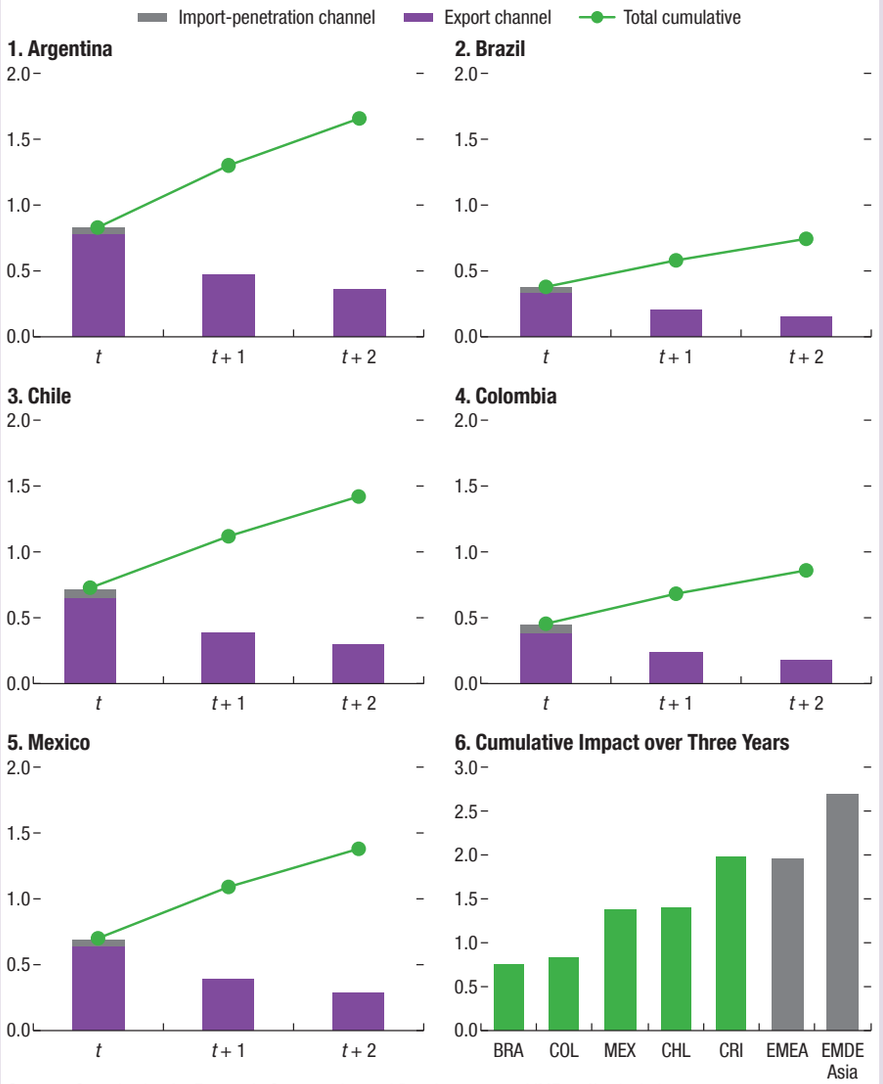
There are three identifying assumptions, linked to each of the channels above. Following a real depreciation, all else equal: (1) sectors that export relatively more should grow relatively faster; (2) sectors that import relatively more should grow relatively slower; and (3) sectors in which import penetration is relatively higher should grow relatively faster. Any remaining effects of the real exchange rate on growth that do not operate through these three channels are subsumed into a set of country-year fixed effects (which also capture the impact of factors such as real GDP growth and real global growth). Differences in growth rates due to country- or sector-specific factors, such as infrastructure, are captured by a set of country-sector fixed effects.

The results show the export channel is at work and quantitatively important for the nontraditional sector—that is, noncommodities (Figure 3.4.1). Evidence on the cost channel is inconclusive. The import-penetration channel is statistically significant but small in magnitude. A 10 percent real depreciation would increase growth of nontraditional sectors by 0.6 to 2 percentage points over three years (depending on the country), mostly through the export channel. The impact is generally lower than in other regions, but the analysis suggests that real exchange depreciations may help Latin American countries diversify away from commodities and grow in a world of low commodity prices.

This box was prepared by Sergi Lanau.

Box 3.4 *(continued)*

Figure 3.4.1. Effects of a 10 Percent Real Depreciation on Growth of Nontraditional Sectors
(Percent)



Sources: Organisation for Economic Co-operation and Development; and IMF staff calculations.
Note: Time in years. Growth rates are weighted by the size of sectors. The export channel takes into account the domestic value added embedded in exports, hence partially controlling for the cost channel. EMDE = emerging market and developing economies; EMEA = Europe, Middle East, and Africa. For International Organization for Standardization (ISO) country codes used in data labels, see page 137.

Annex 3.1. The Panel Vector Autoregression Model: Data and Methodology

The empirical strategy of the section discussing the mechanics of adjustment is based on a panel vector autoregression (PVAR) framework that captures the dynamic response of the trade balance (as a share of GDP), domestic demand, and the real effective exchange rate to a terms-of-trade shock akin to the one experienced by the region during the past five years.

Simultaneity issues are addressed in the identification of the empirical model by assuming that countries in the chapter's sample take the terms of trade as exogenously given—that is, variations in the terms of trade can be regarded as an exogenous source of aggregate fluctuations. This assumption is commonplace in existing related literature (Schmitt-Grohé and Uribe 2017). The model also controls for external domestic demand growth, also assumed to be block exogenous to the "domestic" variables in the model (that is, the trade balance, the real effective exchange rate, and domestic demand).

As mentioned, the PVAR is augmented to include interaction terms as in Towbin and Weber (2013) to allow the coefficients of the domestic variables to vary deterministically with structural country characteristics (fixed versus flexible exchange rates), regional characteristics (Latin America and the Caribbean versus other economies), and different sample periods (before or after the most recent terms-of-trade bust).

Denoting the vector of domestic variables as y_t and the vector of exogenously given variables as y_t^*, the model can be specified as follows:

$$\begin{pmatrix} y_t^* \\ y_t \end{pmatrix} = \begin{pmatrix} A_{11,i,t}(L) & 0 \\ B_{21,i,t}(L) & B_{22,i,t}(L) \end{pmatrix} \begin{pmatrix} y_t^{*}{}_{-1} \\ y_{t-1} \end{pmatrix} + \begin{pmatrix} 0 & 0 \\ 0 & C_{22} \end{pmatrix} \begin{pmatrix} I_i \\ X_{i,t} \end{pmatrix} + \begin{pmatrix} R_1 & 0 \\ R_2 & R_3 \end{pmatrix} \begin{pmatrix} \varepsilon_{i,t}^* \\ \varepsilon_{i,t} \end{pmatrix}. \quad (3.1)$$

$$B_{pq,i,t} = A_{pq,i,t} + D_{pq,i,t} X_{i,t}. \quad (3.2)$$

The matrix R is computed using a Cholesky factorization of the estimated covariance matrix of reduced-form PVAR residuals. Because the analysis focuses on the effects of terms-of-trade shocks, the ordering of the variables in the domestic variables vector, y_t, in the structural PVAR is immaterial. It is assumed that terms-of-trade innovations would affect external demand with a lag, and results are robust to alternative ordering in the external block (that is, assuming that terms-of-trade shocks affect external demand contemporaneously).

The mechanics of the adjustment to terms-of-trade shocks are illustrated using cumulative, conditional impulse response functions, at an eight-quarter horizon, of the real effective exchange rate (REER), domestic demand, and the trade balance. To capture the relative importance of expenditure switching in the external adjustment process after a terms-of-trade bust, counterfactual scenarios to an unanticipated reduction in the terms of trade were constructed, by holding the REER response fixed at all forecast horizons. Comparing the hypothetical impulse response with the actual response allows the importance of expenditure switching in the external adjustment to unanticipated terms-of-trade shocks to be quantified.

The vector y_t^* is given by

$$y_t^* = \begin{pmatrix} DD_{i,t}^* \\ ToT_{i,t}^* \end{pmatrix}.$$

The variable $DD_{i,t}^*$ denotes the quarter-over-quarter real GDP growth of G7 economies and China (purchasing-power-parity GDP-weighted averages). $ToT_{i,t}$ denotes the log first difference of terms of trade, defined as the relative price of exports in terms of imports.

The vector of domestic variables y_t is given by

$$y_t = \begin{pmatrix} DD_{i,t} \\ REER_{i,t} \\ TB_{i,t} \end{pmatrix}.$$

The variables *DD* and *REER* denote the log first differences of real final domestic demand and the Consumer Price Index (CPI)-based REER for country *i,* respectively. *TB* is the first difference of the real trade balance of country *i* as a share of real GDP.

National accounts data were obtained from Haver Analytics and the CPI-REER measure was obtained from the IMF's Information Notice System. Terms-of-trade data for all countries except Mexico were obtained from Haver Analytics. Terms-of-trade data for Mexico were obtained from the IMF's World Economic Outlook database.

All variables are seasonally adjusted. The panel contains the following 38 countries: Argentina, Australia, Botswana, Brazil, Bulgaria, Canada, Chile, Colombia, Costa Rica, Czech Republic, Ecuador, Egypt, El Salvador, Estonia, Guatemala, Honduras, Hungary, India, Indonesia, Israel, Korea, Lithuania, FYR Macedonia, Mexico, New Zealand, Norway, Peru, Paraguay, Philippines, Poland, Malaysia, Romania, Russia, Singapore, South Africa, Turkey, Thailand, and Venezuela. The panel covers the period 2000–16 at a quarterly frequency. Exchange rate classification is based in the 2015 IMF's Annual Report on Exchange Arrangements and Exchange Restrictions.

Annex 3.2. Export Shares Model

Trade data are from the United Nations Commodity Trade Statistics Database (Comtrade), downloaded with product lines in Standard International Trade Classification (SITC, Revision 2) at the four-digit aggregation level for the period 1995 to 2015. Following the literature, the chapter uses mirrored export data that are reported as imports (cost, insurance, freight [CIF]) by destination countries.

The market share of country i in global exports of four-digit product k during year t is defined as

$$S_{ikt} = \ln \frac{X_{ikt}}{\Sigma_{j \in J} X_{jkt}}.$$

The model estimates the elasticity between the market share and the lagged real effective exchange rate. Product and regional estimates reported in Figures 3.10 and 3.11 use interaction terms to estimate the elasticity for each category C:

$$\Delta S_{ikt} = \alpha_{ik} + \alpha_t + \beta \Delta q_{i,t-1} + \beta_C I_C \Delta q_{i,t-1} + \varepsilon_{ikt}; \forall\, C,$$

where I_C is an indicator variable for regional and product categories C, and q_{it} is the natural log of the real effective exchange rate index reported in the IMF's Information Notice System. This index is a geometric weighted average of bilateral exchange rates, deflated by the consumer price index, where the weights assigned to each trading partner are based on direct trade linkages and indirect competition. See Box 3.3 and Zanello and Desruelle (1997) for descriptions of this index and its properties.

To provide granular elasticities that are consistent with aggregate behavior, weighted-least-squares estimators are weighted by trade values. For instance, to estimate product category elasticities ($\hat{\beta} + \hat{\beta}_C$), the weight assigned to each country-product ik is its average share in global exports of product k between 2009 and 2015. Likewise, regional elasticities are estimated by weighting each country-product ik by its average share in the total exports of country i between 2009 and 2015.

The use of disaggregated product data is crucial to the analysis for two reasons. First, it motivates the assumption that prices in the numerator and denominator of the dependent variable behave similarly, such that the variable can be interpreted as a relative quantity. Second, the export performance of individual products is less likely to influence the country's REER, and thus allows for the assumption that $\Delta q_{i,t-1}$ is an exogenous variable. This exogeneity assumption is further supported by the lagged relationship. Additionally, product-country pairs that make up more than 15 percent of a country's total exports are excluded.

As is common in empirical work with disaggregated trade data, thresholds are imposed to exclude small or highly volatile observations, which may reflect measurement errors and would otherwise introduce noise to the estimations. First, small trade flows are excluded, defined as country-product pairs that are smaller than $500,000 in a given year. Second, highly volatile flows are excluded, defined as country-product pairs for which the growth rate of export values exceeds 1,000 percent or shrinks by more than 95 percent in a given year, or for which the change in global market share fell below the first percentile (–77 percent) or above the 99th percentile (+579 percent) of the distribution. Third, exporting countries with a population of less than 1 million in 2010 are excluded. Finally, country-product pairs for which there are positive export flows for fewer than 15 years between 1995 and 2015 are excluded. These four criteria exclude approximately 10 percent of the available observations and less than 1 percent of total export value. The final estimation sample includes 134 countries and 761 four-digit products, for a total of 716,325 observations over 35,117 country-product groups.

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