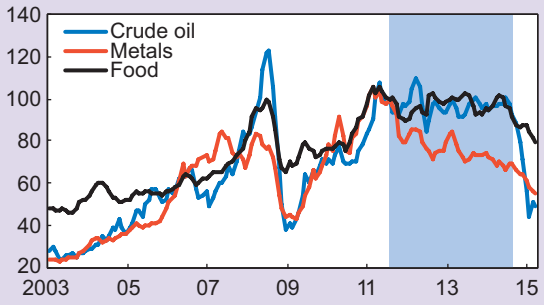
3. The Commodity Price Bust: Fiscal and External Implications for Latin America

The impact of the recent sharp drop in commodity prices on Latin America's major economies will have important implications for their fiscal and external positions going forward. Several commodity exporters in the region will likely experience a significant and persistent drop in fiscal revenues, requiring some deliberate deficit reduction efforts. Regarding external positions, historical evidence suggests that the deterioration in trade balances will be relatively moderate and short lived. Unfortunately, external adjustment typically does not appear to be driven by a rise in noncommodity exports, but rather by acute import compression, especially in countries with more rigid exchange rate regimes and low export diversification.

Figure 3.1
Commodity Prices
(Index: July 2011 = 100)



Source: IMF, World Economic Outlook database.
Note: The shaded area corresponds to the plateau period referred to in the text.

The end of the upswing in commodity prices has been affecting Latin America ever since prices peaked in mid-2011. More recently, commodity markets received wider global attention when prices seemed to go into free fall during the second half of 2014. The most notable mover by far was crude oil, owing to both demand and supply factors.[1] Oil prices dropped by half between July 2014 and December 2014, and have edged down further since (Figure 3.1). Prices of other commodity categories also declined, albeit by less. Metal prices are down 20 percent since mid-2014 (although the price of iron ore has fallen by more than 40 percent), and food prices decreased 17 percent during the same period.

Not all the news has been bad for every Latin American commodity exporter. First, some commodities held up well (the price of beef, for instance, actually rose by 15 percent between July and November). Second, many oil-importing countries stand to benefit from cheaper oil. Nevertheless, given Latin America's high dependence on commodities, such a swift change in prices is bound to necessitate a sizable macroeconomic adjustment in many economies of the region.[2]

But how much have the terms of trade worsened across individual commodity exporters in Latin America? Is the shock temporary or permanent? What is the likely impact on fiscal accounts and trade balances, and how are countries likely to adjust? This chapter takes stock of the situation, and attempts to shed light on the impending adjustment.

To set the scene, we examine recent developments in commodity terms of trade (CTOT) across the region, and assess the probability of recovering the lost ground over the next two years.[3] We then use a set of econometric models to investigate how fiscal and external variables have adjusted to past commodity price shocks across Latin America's main commodity exporters. Finally, we use these

Note: Prepared by Carlos Caceres and Bertrand Gruss, with excellent research assistance from Genevieve Lindow. See Caceres and Gruss (forthcoming) for technical details.

[1] See Chapter 1 in the April 2015 *World Economic Outlook* for a discussion on the drivers of the recent change in commodity prices.

[2] See Adler and Sosa (2011) for a discussion on Latin America's exposure to commodity-related risks.

[3] See Annex 3.1 for a definition of CTOT indices.

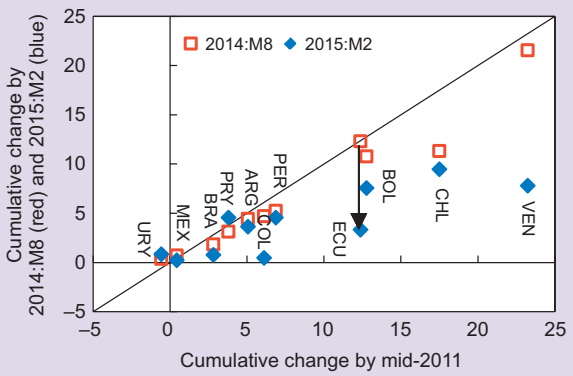
model estimates, combined with current commodity price forecasts, to project the likely adjustment path for individual economies.

The Commodity Price Cycle: Where Do We Stand Now?

To understand what has happened since mid-2014, it is useful to take a step back and recall the evolution of commodity terms of trade since the early 2000s.

Commodity prices soared during the 2000s, increasing by more than threefold between 2003 and 2011. The associated terms-of-trade gains were truly exceptional for most commodity exporters in Latin America.[4] Figure 3.2 displays the cumulative change in CTOT from their average levels in 2002 (that is, just before the boom period) for a sample of 11 Latin American commodity exporters. The figure combines data for different reference points: the horizontal axis shows the cumulative change up to the peak of the boom (that is, mid-2011), while the vertical axis shows the cumulative change through mid-2014 (red squares) and February 2015 (blue diamonds), respectively. Thus, markers further below the diagonal line indicate a larger recent decline in CTOT from the mid-2011 peak. Focusing initially on the horizontal axis, Figure 3.2 shows that by mid-2011, CTOT had increased on average by about 8 percentage points of GDP—and by almost three times as much in the case of Venezuela.[5]

Figure 3.2
Commodity Terms of Trade, 2003–15
(Cumulative change in CTOT indices from average levels in 2002; percentage points of GDP)



Sources: IMF, World Economic Outlook database; UN Comtrade; and IMF staff calculations.
Note: CTOT = commodity terms of trade. For country name abbreviations, see page 79.

The boom was followed by a period—from mid-2011 to mid-2014—in which commodity prices were broadly stable (oil, most agricultural products) or started weakening (notably metals but also a few agricultural products). Reflecting their specific commodity exposures, some countries had already lost an important fraction of their previous CTOT gains during this *plateau* period (as evidenced by the vertical distance of the red squares from the diagonal line in Figure 3.2). Brazil and Chile, for instance, had lost about one-third of their boom-period CTOT gains by mid-2014. Colombia and Peru, in turn, had lost about one-fourth of their earlier gains, while Bolivia, Ecuador, and Venezuela were relatively unscathed, because of the resilience of oil markets up to that point.

However, this *plateau* period of relatively low price volatility was followed by a phase of sharp declines in commodity prices starting in mid-2014. Given that this latest commodity market rout has been led by oil, it implies a differentiated picture in terms of CTOT movements across the region. Major oil exporters such as Colombia, Ecuador, and Venezuela experienced substantial CTOT losses in a short period (about 4¼ percent of GDP, 9 percent of GDP, and 14 percent of

[4] Chapter 4 of the October 2011 *Regional Economic Outlook: Western Hemisphere* and Gruss (2014) show that the terms-of-trade gains during the recent boom stand out in a historical perspective.

[5] The CTOT is a chained price index. It is constructed by weighting changes in prices of individual commodities by their (net) export value, normalized by GDP (see Annex 3.1). A given increase (drop) in CTOT can then be interpreted as an approximate gain (loss) in GDP terms. Compared to traditional terms-of-trade measures, this CTOT metric presents a number of advantages: it is not affected by noncommodity prices, its variation is exogenous at the country level, and, crucially, it does not weigh export and import prices equally but proportionally to their relative trade magnitudes.

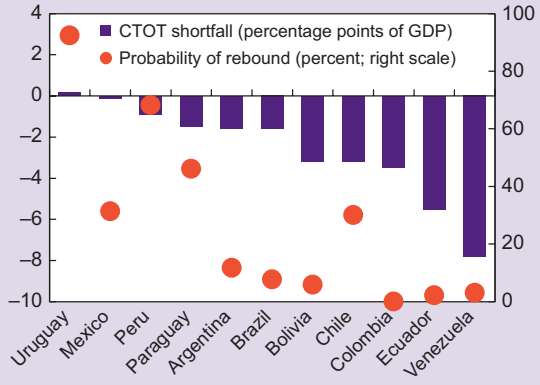
GDP, respectively, between August 2014 and February 2015; see Figure 3.2). In the case of Colombia, moreover, these losses have eroded almost all of the net gains of the previous decade. Bolivia, Brazil, and Chile suffered more moderate CTOT losses, ranging from 1 percent of GDP to 3 percent of GDP. For Peru, in turn, the CTOT loss was even smaller (⅔ percent of GDP), as the drop in oil prices largely offset the decline in metal prices; Paraguay and Uruguay even saw a slight improvement of their CTOT.[6]

A Temporary or Permanent Shock?

Assessing whether the most recent correction in commodity prices is temporary or likely to persist is a daunting task. That said, we present some indicative evidence from two alternative approaches suggesting that the observed correction contains a large permanent—or at least highly persistent—component.

Our specific goal is to gauge the likelihood that CTOT will revert to the levels of the *plateau* period (that is, the average price observed between mid-2011 and mid-2014).[7] To this end, we first compute projected country-specific CTOT using prices of commodity futures. According to these financial market data, by end-2016 the CTOT of commodity exporters in Latin America would still be, on average, 2½ percentage points of GDP below their *plateau* levels (Figure 3.3). The remaining shortfall is particularly large in the case of Colombia, Ecuador, and Venezuela (3½ percentage points of GDP, 5½ percentage points of GDP, and 8 percentage points of GDP, respectively), as markets expect only a partial and gradual recovery of oil prices over the coming years.

Figure 3.3
Projected Commodity Terms of Trade, End-2016
(Comparison of CTOT indices in the future and their observed levels during the plateau period)



Sources: IMF, World Economic Outlook database; UN Comtrade; and IMF staff calculations.
Note: CTOT = commodity terms of trade. The bars denote the difference between the projected CTOT by end-2016, based on the prices of commodity futures prevailing at end-February 2015, and the average levels observed during the *plateau* period (between mid-2011 and mid-2014). The red dots denote the probability for each country's CTOT of reaching or exceeding by end-2016 the average level observed during the *plateau* period, based on stochastic simulations using the Geometric Brownian Motion model of Caceres and Medina (forthcoming). See Annex 3.1 for details.

Second, we model the distribution of CTOT based on their historical trend and volatility, and generate stochastic simulations of their possible future paths (see Annex 3.1 for more details). Based on these simulations, we generate confidence intervals and the probability of country-specific CTOT remaining below their *plateau* level by the end of 2016. Figure 3.3 (red dots) shows that, except for Paraguay, Peru, and Uruguay, the probability of CTOT reverting to—or exceeding—those levels is less than one in three.

In sum, while the uncertainty involved in forecasting commodity prices is large, it seems unlikely that CTOT will revert to their *plateau* levels anytime soon.

[6] Our CTOT indices do not include precious metals, and thus do not account for changes in, for instance, gold and silver prices, which are important for some countries in the region (notably Bolivia, Peru, and, to a lesser extent, Colombia). The inclusion of these precious metals, however, would not affect significantly the relative magnitude of the correction in CTOT since mid-2011 shown in Figure 3.3 (gold and silver prices in February 2015 were, on average, 39 percent lower than in mid-2011, comparable to the 41 percent and 50 percent decline in the price of copper and oil, respectively).

[7] Although some commodity prices, notably certain metals, exhibited a slight downward trend between mid-2011 and mid-2014, the *plateau* was a sufficiently long period of low CTOT variability (compared to the preceding years) to serve as a useful reference point.

Adjusting to Commodity Price Shocks—Historical Evidence

What does a less favorable outlook imply for commodity exporters in Latin America? To examine this issue, we first explore the historical response of public finances and external accounts to commodity price shocks. More precisely, we estimate a set of country-specific vector autoregressive models for nine Latin American countries, using quarterly data since the mid-1990s.[8] All models include a country-specific CTOT index (expressed in terms of deviations from its trend, which we denote CTOT "gap" hereafter) as an exogenous variable and a set of endogenous variables comprising the output gap, the real effective exchange rate (REER), and, depending on the question, a fiscal or external aggregate (expressed in percent of GDP).[9] We base our quantitative analysis on the models' impulse response functions of the fiscal and external variables, in reaction to a shock to the country-specific CTOT gap.[10]

Fiscal Dynamics

Regarding public finances, we focus our analysis mainly on the response of fiscal revenues, which are likely to better reflect the exogenous effect of the commodity price shock.[11] The overall fiscal balance, in contrast, will also be strongly influenced by discretionary spending adjustments in response to the commodity price shock.[12] This policy reaction would likely depend on specific circumstances and could deviate significantly from historical patterns. That said, we also report results for vector autoregressive models where the revenue-to-GDP ratio is replaced by the fiscal balance (Figure 3.4).

In terms of fiscal revenues, Bolivia and Ecuador stand out in our sample as exhibiting the largest responses: about 0.8 percentage point of GDP—in response to a one standard deviation shock to their CTOT, roughly equivalent to a 13 percent decline in the price of natural gas for Bolivia and a 16 percent drop in oil prices for Ecuador (Figure 3.4).[13] Chile comes next, with a decline in revenue of about ½ percentage point of GDP (following a shock to its CTOT roughly equivalent to a 12 percent decline in copper prices). The revenue ratio reacts somewhat less in Mexico and Peru (less than ⅓ percentage point of GDP), while

[8] The sample comprises Bolivia, Brazil, Chile, Colombia, Ecuador, Mexico, Paraguay, Peru, and Uruguay. Overall, individual vector autoregressive sample periods were mainly dictated by data availability, with individual samples starting between 1990:Q3 and 2001:Q2. Argentina and Venezuela were removed from the sample based on data availability issues.

[9] We assume the period of the commodity price cycle to be 20 years for the computation of CTOT gaps, which is in line with the literature on commodity super-cycles (for example, Erten and Ocampo 2013; Jacks 2013). To account for possible changes in seasonality of fiscal aggregates, we use four-quarter-cumulative values to compute ratios to GDP.

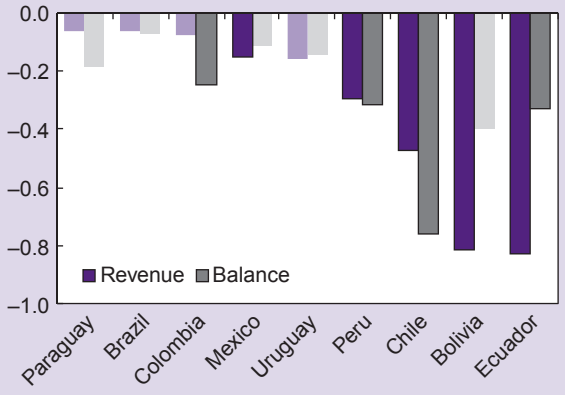
[10] Table A3.1 in Annex 3.1 shows the percent change in CTOT equivalent to a one standard deviation shock to the index gap. It also shows, as an illustration, the percent variation in each country's main commodity export that would result in a commensurate change in the CTOT gap.

[11] The coverage of fiscal variables is at the nonfinancial public sector level for Bolivia, Colombia, and Uruguay. For Mexico, the consolidation includes federal government, public enterprises under budgetary control (including Pemex), and social security. For the rest, the coverage is at the central government level. Even in these countries, however, the bulk of commodity-related revenues are collected by the central government, notwithstanding possible subsequent transfers to subnational governments.

[12] The response of fiscal variables arguably reflects both the direct effect of commodity price shocks and the historical policy response. In the case of revenues, however, the bulk of the response is likely to reflect the former. Indeed, revenue-side policies and outturns, such as changes in tax rates or the introduction of new taxes, tend to materialize with a lag, owing to implementation and institutional constraints.

[13] Venezuela is not included in this exercise, but given the size of commodity-related revenues (about 20 percent of GDP in 2004–09; see Rodriguez, Morales, and Monaldi 2012), its response is likely to be almost twice as large as in Bolivia and Ecuador.

Figure 3.4
Response of Fiscal Revenue and Overall Balance to a Negative CTOT Shock
(Peak response; percentage points of GDP)



Source: IMF staff calculations.
Note: CTOT = commodity terms of trade. Peak response of fiscal-revenue-to-GDP and fiscal-balance-to-GDP ratios to a negative one standard deviation shock to each country's CTOT gap. In most countries, the peak response is observed about one year after the shock. Solid bars denote that the response is statistically significant at the 5 percent confidence level. Table A3.1 in Annex 3.1 shows the magnitude of the one standard deviation shocks considered here.

for all other countries the response is relatively small and statistically insignificant.[14,15]

Turning to fiscal balances, Chile shows the largest response (close to ¾ percentage point of GDP), followed by Bolivia and Ecuador (close to ⅓ percentage point). The fact that Chile's fiscal balance shows a larger response compared to that of Bolivia and Ecuador—while it was the opposite for their fiscal revenue responses—suggests that Chile was able to adopt countercyclical fiscal policies in the past. This ability is likely to have been supported by Chile's fiscal rule, which prescribes that a significant share of commodity-related windfalls be saved during good times. Bolivia and Ecuador, in turn, experienced a faster expansion of public spending during the boom years, and had virtually no access to international funding to smooth the effects of the sharp drop in commodity prices in late 2008.

Which macroeconomic fundamentals help to further explain the differences in fiscal responses across countries? A natural candidate is the size of the commodity sector relative to the overall economy. A country that is highly dependent on commodities is likely to have a larger share of revenues directly linked to the commodity sector, as well as a larger sensitivity of total output to commodity price shocks.[16] Another potential candidate is the extent of exchange rate flexibility. If the nominal exchange rate depreciates significantly in response to a negative CTOT shock, commodity-related revenues expressed in local currency would drop by less than would have been the case otherwise. In addition, a (real) depreciation would help boost noncommodity exports, aggregate demand, and, eventually, fiscal revenues.[17]

With only nine countries to exploit cross-sectional variation, we limit the analysis to exploring bivariate relationships between the magnitude of the responses to CTOT shocks and a few "fundamentals" for which it is relatively easy to quantify the extent of cross-country heterogeneity: the degree of de facto nominal exchange rate flexibility, the size of the commodity sector (proxied by the ratio of commodity exports to GDP), and the degree of export diversification

[14] In the case of Colombia, the magnitude of the response could be somewhat underestimated from historical data as oil production rose significantly over the sample period.

[15] Arguably, a given CTOT change could have different effects on fiscal accounts depending on whether it is driven by a change in commodity export or import prices. As a robustness exercise, we substituted the CTOT variable with an index based only on export prices, but the responses do not differ significantly from the ones reported here.

[16] Our analysis shows that output gaps in all countries in the sample tend to fall (that is, indicate a decline of actual output relative to potential) following a negative shock to their CTOT. The responses (not reported here owing to space constraints) are particularly large and significant for Chile, Colombia, Ecuador, and Peru, where commodity exports account for a large share of GDP.

[17] Our results show that the REER depreciates in all countries in response to a negative CTOT shock, but the response is particularly large (and statistically significant) for Bolivia, Brazil, Chile, Colombia, and Mexico.

Table 3.1. Relationship Between Macroeconomic Responses to CTOT Shocks and Fundamentals
(Significance level)

	Share of Commodity Exports	Export Diversification	Exchange Rate Flexibility
Revenue	0.022	0.035	0.000
Fiscal balance	0.026	0.125	0.337
Exports	0.005	0.000	0.108
Imports	0.003	0.005	0.062
Trade balance	0.471	0.540	0.809

Source: IMF staff calculations.
Note: The numbers denote the statistical significance (*p* values) of the bivariate correlation between, on the one hand, the responses of fiscal or external variables to a commodity terms of trade (CTOT) shock, and on the other hand, country-specific fundamentals (green denotes significance at the 10 percent level; yellow between 10 percent and 15 percent; and orange beyond the 15 percent level). All relationships exhibit the expected sign. Country-specific fundamentals include the ratio of commodity exports to GDP; a diversification index, derived from merchandise export data and following the methodology of IMF (2014a and 2014b); and a measure of de facto exchange rate flexibility, proposed by Aizenman, Chinn, and Ito (2008).

(based on the indicator presented in Chapter 5). Naturally, even after accounting for the size of the commodity sector and exchange rate flexibility, fiscal responses would also depend on other "institutional" characteristics, such as the ownership structure of the commodity sector and the specific fiscal regime used to tax natural resource rents (see Box 3.1). These aspects are, however, harder to capture with a simple metric.

Notwithstanding the limitations of this simple approach, Table 3.1 indicates a number of interesting findings with respect to the bivariate relationship between the estimated fiscal responses and country-specific fundamentals (with 10 percent representing a typical benchmark for statistical significance of the relationship). As expected, the magnitude of the response of fiscal revenues and fiscal balances is strongly related to the size of the commodity sector: the larger the commodity sector, the more its fiscal position deteriorates as a result of a negative CTOT shock. The relationship with the degree of export diversification also appears to be significant, with fiscal accounts deteriorating less in countries that have a more diversified export base.

Turning to the exchange rate regime, our basic correlation analysis suggests that greater exchange rate flexibility helps to buffer the effect of commodity price shocks on public finances. The deterioration of both fiscal revenue and overall balance following a negative CTOT shock is smaller for countries that have higher de facto exchange rate flexibility, owing mainly to a smaller drop in local-currency-denominated revenues. This relationship is strongly significant for fiscal revenue, but not for the overall balance (Table 3.1).

External Adjustment

The reaction of trade balances to a negative CTOT shock looks, at a first glance, less unequivocal than that of fiscal aggregates.[18] While in most countries the trade balance tends to deteriorate right after the shock, in many cases it then bounces back and after three years has typically converged back to the original level or even exceeded it (Figure 3.5).[19] For instance, the trade balances of Chile and Peru worsen by about ½–⅔ percentage point of GDP in response to a negative CTOT shock. But after three years, the balances are found to be about ¼ percentage point *above* the initial level.

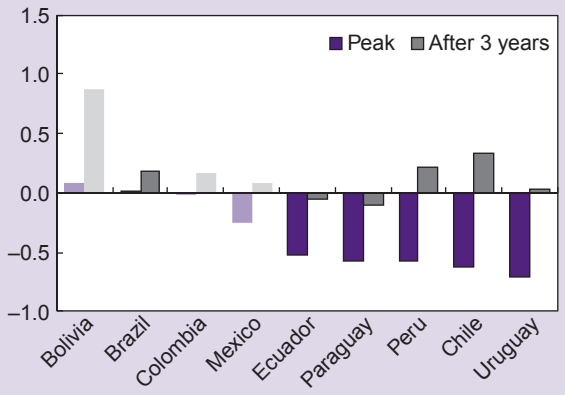
This limited deterioration and relatively quick reversal of the trade balance would be consistent with a scenario where noncommodity exports increase markedly in response to the real depreciation triggered by the negative CTOT shock. However, it could also reflect a less benign dynamic whereby most of the adjustment occurs through a sharp contraction in imports, amid weak domestic demand.

To better understand what is behind the trade balance dynamics, we explore the responses of

[18] Trade variables throughout the chapter refer to trade in both goods and services.

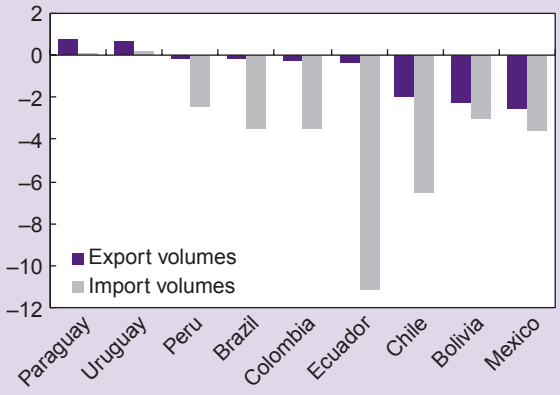
[19] These results are in line with the *S-shaped* lead and lag correlation between the trade balance and terms of trade documented by Backus, Kehoe, and Kydland (1994) for a set of Organisation for Economic Co-operation and Development countries and Senhadji (1998) for developing countries.

Figure 3.5
Response of the Trade Balance to a Negative CTOT Shock
(Percentage points of GDP)



Source: IMF staff calculations.
Note: CTOT = commodity terms of trade. Response of the trade-balance-to-GDP ratio to a negative one standard deviation shock to each country's CTOT gap. Solid bars denote that the response is statistically significant at the 5 percent confidence level. Table A3.1 in Annex 3.1 shows the magnitude of the one standard deviation shocks considered here.

Figure 3.6
Response of Export and Import Volumes to a Negative CTOT Shock
(Peak response; percentage points)



Source: IMF staff calculations.
Note: CTOT = commodity terms of trade. Peak deviation from baseline in response to a negative one standard deviation shock to each country's CTOT index, obtained from country-specific vector error correction models that include, besides the country's CTOT, four domestic variables: real exports, real imports, real effective exchange rate, and real GDP.

exports and imports separately, using a set of additional models.[20] Our findings suggest that the limited deterioration of the trade balance and, ultimately, its reversal are explained by a sharp compression in imports—rather than a rebound in exports.

Overall export volumes initially fall in all countries except Paraguay and Uruguay, suggesting a rather muted response in noncommodity tradables sectors to the exchange rate depreciation triggered by the commodity price shock. Considering again the cases of Chile and Peru, the drop in import volumes after a negative CTOT shock is larger by 2½ percentage points and 4½ percentage points, respectively, than that of export volumes (Figure 3.6). The pattern is broadly similar for the other commodity exporters: most of the medium-term improvements in trade balances seem to be due to import compression rather than export expansion.[21]

While the import compression pattern is common across the region, there is still considerable heterogeneity in terms of the external sector adjustment. This heterogeneity in the response of trade variables also appears linked to some country fundamentals.

As before, we find that flexible exchange rates play a stabilizing role: the drop in exports is smaller in countries that have greater exchange rate flexibility. However, the relationship is only marginally significant at conventional levels, probably reflecting the low degree of export diversification in the region (see Chapter 5). Import compression is also larger in countries that have a more rigid exchange rate regime (and the relationship is highly statistically significant). The stronger import compression in countries with less exchange rate

[20] For this purpose, we estimate country-specific vector error correction models. These include the CTOT index as an exogenous variable, and real exports, real imports, REER, and real GDP (all in log levels) as endogenous variables.

[21] The strong import compression could be reflecting a sharp contraction in corporate investment across sectors (both commodity and noncommodity), as suggested by the findings in Chapter 4.

flexibility may appear surprising at first glance, as a smaller change in relative prices (foreign goods becoming more expensive relative to domestic goods when the REER falls) reduces the so-called expenditure switching effects (domestic buyers shifting from imported to domestic goods). The result suggests that income effects—from a deep domestic downturn that reduces spending across the board—are more important in the import adjustment. Finally, the relationship between exchange rate flexibility and the response of the overall trade balance has the expected sign, but is not statistically significant.

As expected, the drop in total exports in response to a CTOT shock is larger in countries that are more dependent on commodities. It is also larger in countries that show a lower degree of export diversification, as fewer sectors can benefit from the exchange rate depreciation triggered by the CTOT shock.[22] In both cases, the relationship is statistically significant. Interestingly, the degree of import compression is also larger in these countries, reinforcing the notion that income effects play a key role in the adjustment. The relationships for the trade balance go in the same direction—but are not statistically significant.

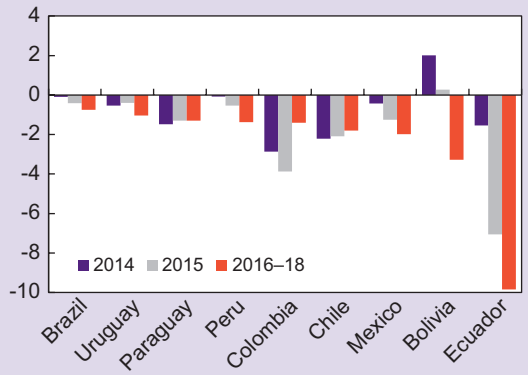
Looking Ahead: Outlook for Trade and Fiscal Balances

Building on the analysis presented thus far, conditional out-of-sample forecasts for fiscal and external variables can be constructed using commodity futures. In terms of methodology, the analysis of the previous section presented the dynamic adjustment of an economy that is assumed to be *in equilibrium* when hit by a commodity price shock of historically "normal" size. In this section, instead, the economy is assumed to start from its *current* position (typically the third quarter of 2014, based on data availability) and face the path for commodity prices actually implied by futures markets.

Figure 3.7

Out-of-Sample Forecast: Fiscal Revenue

(Difference between projected revenue-to-GDP ratio and maximum revenue-to-GDP ratio attained between mid-2011 and mid-2014; percentage points)



Source: IMF staff calculations.
Note: Values for 2014 are based on actual data up to 2014:Q2 or 2014:Q3 and out-of-sample forecast for the rest of the year, except for Mexico and Peru, for which there is actual data up to 2014:Q4.

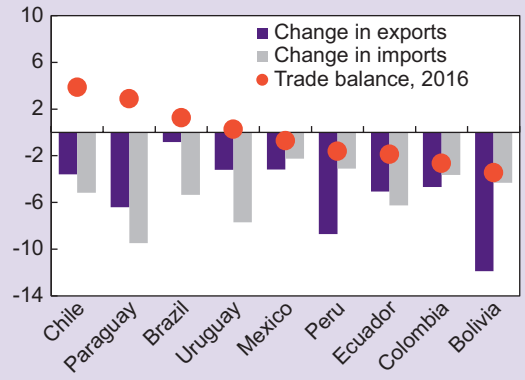
Figure 3.7 reports the difference between fiscal revenue-to-GDP ratios in 2014–18 vis-à-vis the peak levels attained during the *plateau* period. In 2014, fiscal revenues in some countries (for example, Chile and Colombia) were already noticeably lower than the record levels reached a few years earlier. Except for Chile and Paraguay, the simulations suggest that revenue ratios would drop further going forward, especially in hydrocarbon-producing countries.[23] Indeed, the medium-term revenue loss would be large for Bolivia and Ecuador.

Turning to the external side, our simulations suggest that trade balances across the countries in our sample will be noticeably lower than during the boom (Figure 3.8). In the case of Chile, and conditioning on its current trade balance and the expected path for its CTOT, the model projections

[22] The relationship is also highly statistically significant if, instead of diversity, we use the indicator of export complexity used in Chapter 5.

[23] In the case of Mexico, the projections do not take into account the possibility that derivative positions built up before the recent oil price decline might offer temporary protection for oil-related fiscal revenue.

Figure 3.8
Out-of-Sample Forecast: External Variables
(Percentage points of GDP)



Source: IMF staff calculations.
Note: The change in exports (imports) denotes the difference between the average projected exports (imports)-to-GDP ratio in 2015–16 and the maximum ratio reached between mid-2011 and mid-2014.

indicate a 4 percent of GDP trade surplus in 2016. This would be much lower than the 8 percent of GDP surplus observed on average during 2003–11, but still remarkably strong. At the other end of the spectrum, Bolivia is projected to post a sizable trade deficit of about 3½ percent of GDP, compared to an average surplus of above 5 percent during 2003–11. In absolute levels, however, the projected trade deficit in most countries looks manageable.

Nevertheless, and in line with the results in the previous section, our simulations also suggest that significant import compression—rather than a rebound in noncommodity exports—is responsible for a large share of the adjustment. Figure 3.8 shows the projected change in the ratios of exports and imports to GDP over the next two years relative to their highs at the peak of the recent boom. The import ratio is projected to decline sharply and, in many cases, by more than the export ratio (for example, in Brazil, Chile, Ecuador, Paraguay, and Uruguay). In principle, cutting back on imports is a natural way of preserving external sustainability after an adverse shock. Yet, this adjustment would still be rather painful if, as suggested by the historical pattern for the region, it mainly reflects a contraction in domestic demand.

These projections, as well as the responses reported in the previous section, are naturally subject to some caveats. By relying on historical patterns and assuming stable relationships over time, they do not (fully) take into account more recent changes in relevant economic attributes, such as changes in policy frameworks. Many Latin American countries have indeed significantly strengthened their policy frameworks in recent years (for instance, by allowing greater exchange rate flexibility and adopting fiscal policy rules). In addition, the importance of commodity exports for some countries may have evolved considerably during our sample period (for example, it has increased in Colombia but decreased in Mexico). Finally, the projections are obtained by conditioning only on one external factor (that is, the expected path for CTOT) and do not take into account new policy measures that may yet be taken. All this could naturally introduce a bias in the projections.

Conclusions and Policy Implications

The analysis in this chapter shows that most commodity exporters in Latin America have suffered a substantial deterioration of their commodity terms of trade over the last 3½ years. This situation has become particularly acute since mid-2014. In addition, the probability of a swift recovery in the terms of trade is low for most countries.

In this context, the analysis suggests that some countries will probably need to cope with a sizable and protracted fall in fiscal revenues over the next two to four years. This pressure on public finances will typically require fiscal restraint to avoid a destabilizing rise in deficits. The buildup of fiscal space over the boom years and the ability to borrow at still-low funding costs will allow some countries to smooth this necessary adjustment, for instance, by preserving capital spending in key areas that are crucial to alleviate existing supply-side bottlenecks. Several other countries, however, have essentially no buffers left, and thus

will need to rein in deficits over the near term, in an unfortunate reminder of the region's historical policy procyclicality.

In terms of external sector adjustment, our analysis suggests a somewhat muted impact on external balances. However, in the past this has been the result of sizable import compression rather than a rebound in exports.

Exchange rate flexibility appears to be an important safety mechanism, facilitating a smoother fiscal and external adjustment following a commodity price shock.

Box 3.1

Commodity Sector Activity and Fiscal Revenue—Direct Links

The sensitivity of fiscal revenue to commodity prices depends on country characteristics, including the size and nature of the commodity sector, ownership structures, and, importantly, the specifics of the existing tax regime. Fiscal revenue may be particularly sensitive to commodity price changes where commodity rents (that is, profits above and beyond the normal return on capital) are sizable and part of the tax base. Implementing mechanisms that effectively tax such rents (for instance, progressive gross income–based taxes that allow for a rising tax take as firms' operational margins increase) tends to be easier when production is concentrated in a small number of large firms—as is common in the mining and energy sectors—than when ownership is spread among a large number of atomistic producers whose individual cost structures and revenues are more difficult to monitor—as is typically the case in the agricultural sector. The exposure of fiscal revenue to commodity price volatility also tends to be heightened when the commodity sector is (fully or partly) owned by state enterprises that not only pay taxes and royalties but also distribute dividends to the state—a model that is found across many Latin American countries, notably in the mining and energy sectors.[1]

Indeed, the prominence of commodity-related revenue—and the sensitivity of total fiscal revenue to commodity price fluctuations documented in this chapter—is larger in hydrocarbon and metal-producing countries than among other commodity exporters in the region. For instance, fiscal revenue from state-owned energy companies represents about 10 percent of GDP in Bolivia and Ecuador. In Colombia, where oil also plays a dominant role and about 60 percent of the sector is state owned, commodity-related revenues are about 5 percent of GDP. Comparable revenue in metal-producing countries is somewhat lower but still sizable. For instance, the importance of the mining sector in Peru is roughly comparable to that of hydrocarbon production in Bolivia, Colombia, and Ecuador (about one-tenth of the economy), yet the associated fiscal revenue in Peru averaged "only" about 2 percentage points of GDP during 2005–13. In Chile, where the sector is somewhat larger (about one-eighth of the economy), commodity-related revenues reached almost 5 percent of GDP. Compared to Peru, the higher revenue seems to reflect the contributions from Codelco, Chile's large state-owned copper company. Specifically, Codelco accounts for one-third of Chile's copper production but as much as 60 percent of total commodity-related revenues.

The estimated revenue responses reported in Figure 3.4 clearly reflect these differences in *direct* linkages between fiscal revenue and the commodity sector. But the model-based estimates also capture a host of additional factors, and thus should be expected to differ from the narrow direct effects discussed in this box.[2] These additional factors include the specific fiscal mechanism used to tax natural resource rents, the extent of interlinkages between the commodity sector and the rest of the economy, the implementation of fiscal rules, and the extent of exchange rate flexibility, among others.

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[1] Needless to say, the long-run level of commodity-related revenue could well turn out to be lower under public ownership if, for instance, the efficiency and profitability of investment is inferior in state-owned enterprises. Exclusive reliance on public capital may also limit the sector's capacity to fully exploit available reserves, constraining potential output and fiscal revenue.

[2] For instance, while staff estimates that the *direct* revenue loss in Ecuador associated with a $10 drop in oil prices is about 0.7–0.8 percentage point of GDP, the vector autoregressive estimates suggest a somewhat higher loss (0.8–0.9 percentage point of GDP).

Annex 3.1. Technical Details

Commodity Terms of Trade

The construction of country-specific CTOT indices follows Gruss (2014). It is computed in (log) levels by iterating on the equation:

$$\Delta \text{Log}\left(\text{CTOT}\right)_{i,t} = \sum_{j=1}^{J} \Delta P_{j,t} \cdot \overbrace{\left\{\left(x_{i,j,\tau-1} - m_{i,j,\tau-1}\right)/\text{GDP}_{i,\tau-1}\right\}}^{\omega_{i,j,\tau-1}},$$

where $P_{j,t}$ is the logarithm of the relative price of commodity j in period t within year τ (in U.S. dollars and divided by the IMF's unit value index for manufactured exports); Δ denotes first differences; $x_{i,j,\tau-1}$ ($m_{i,j,\tau-1}$) denotes the exports (imports) value of commodity j by country i (in U.S. dollars, from UN Comtrade); and $GDP_{i,\tau-1}$ denotes country i's nominal GDP in U.S. dollars, all averaged between years $\tau-1$ and $\tau-3$ (the weights $\omega_{i,j,\tau-1}$ are thus predetermined vis-à-vis the price change in each period, but are allowed to vary over time reflecting changes in the basket of commodities actually traded). We use prices for 45 commodities (from the IMF's International Financial Statistics database).

Stochastic Simulations

The probabilities reported in Figure 3.3 are computed following a two-step process. First, the distribution of each country-specific CTOT index is characterized using the Geometric Brownian Motion model of Caceres and Medina (forthcoming). More precisely, the behavior of each CTOT is assumed to be driven by the following stochastic differential equation:

$$dy_t = \alpha y_t\, dt + y_t\, \sigma\, dB_t$$

where y_t is the log-CTOT index at time t; B_t is a standard Brownian motion (or Wiener process); and α and σ are "drift" (trend) and "volatility" parameters, estimated using maximum likelihood. Second, the probability that each CTOT exceeds a predetermined level at any forecast horizon (for example, by end-2016) is computed from the empirical distribution of possible future CTOT paths, which are in turn generated from stochastic (Monte Carlo) simulations based on model estimates.

Table A3.1. Magnitude of Shocks in VAR Models

(Commodity price drop equivalent to a negative one standard deviation CTOT shock)

Country	Main Export Good	Percent Change in CTOT	Equivalent Percent Change in Price of Main Export
BOL	Natural gas	–1.0	–13.1
BRA	Iron ore	–0.2	–21.2
CHL	Copper	–1.6	–11.8
COL	Crude oil	–0.5	–14.8
ECU	Crude oil	–1.7	–16.4
MEX	Crude oil	–0.2	–13.4
PER	Copper	–0.6	–15.3
PRY	Soybeans	–0.9	–16.2
URY	Beef	–0.3	–10.7

Source: IMF staff calculations.
Note: CTOT = commodity terms of trade; VAR = vector autoregressive. See page 79 for country abbreviations.