Box 1
Impact of the Reduction in the Terms of Trade on Investment

The shocks to commodity prices and their impact on the terms of trade (TT) are a relevant uncertainty factor with regards to the economic cycles in countries that export commodities, in particular when they have to do with products from extraction occupations such as mining and oil drilling. The international literature on the subject is abundant and, among other items, it analyzes the channels through which the shocks are transmitted to the TT and to the internal and external adjustment processes. The case of Colombia arouses interest, and it is often included within the sample of countries for which this phenomenon is studied – for recent works related to this, see Aslam et al. (2016); Roch (2017); Adler et al. (2017); Grigoli et al. (2017); Fornero (2016).

Boxes were included in recent issues of this *Report* that examined the following topics: 1) the channels of influence the petroleum shock had on the Colombian economy (March, 2015); 2) the comparison with the economies of Chile and Peru, which have been affected by similar shocks (July 2016); and 3) the Colombian economy's process of adjustment to the petroleum shock (July 2017). Based on the international literature, these boxes and the macro-analysis included in recent reports coincided in their indications that certain characteristics of the Colombian economy such as the exchange rate flexibility, the fiscal regulations, the soundness of the financial system, and the high level of international reserves contributed to cushioning the effects of the shock to the TT. The response of monetary policy also played a foundational role in this process. Therefore, at the beginning of 2018, the current account deficit has returned to a level similar to the one it had before the shock, inflation is approaching its target, and economic activity is beginning to rebound.

However, other consequences that are more persistent than the shock to the TT have not yet been overcome. One of the most remarkable is the investment slowdown, which has been especially strong when it is compared to the performance it registered during the period of favorable TT

that contributed to reducing the country's risk premium, eased restrictions on foreign indebtedness, and attracted high volumes of foreign direct investment.
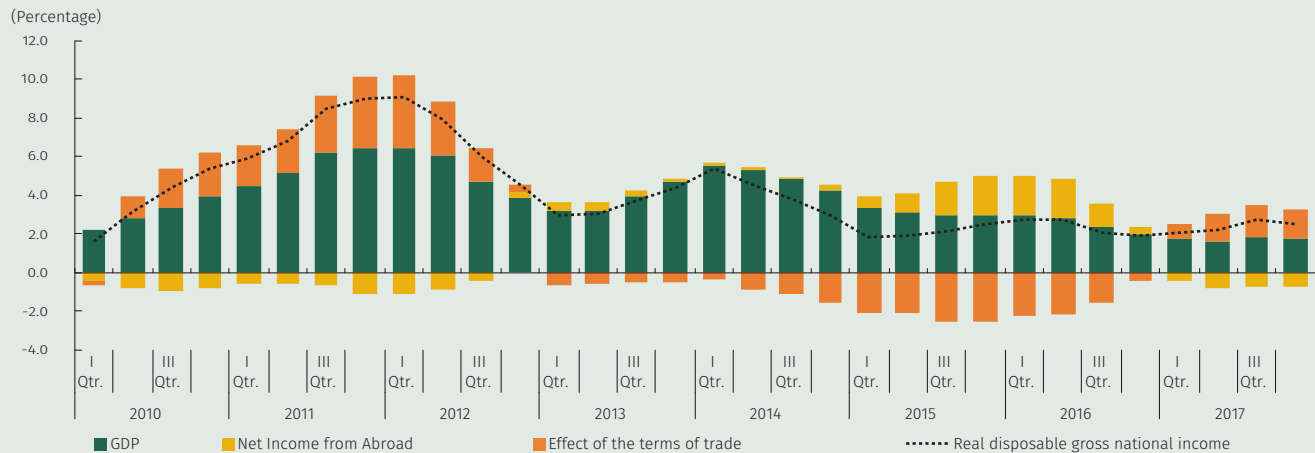
The analysis of the investment performance makes it possible to get a perspective on the medium-term effects of the shock to the TT. A recent study done by researchers at the International Monetary Fund (IMF) (Aslam et al., 2016) shows that the response of the investment and its effect on capital stock with respect to TT variations is the main channel that has an influence on the potential growth of the GDP. The latter is a variable that is central to monetary policy decision-making (Williams, 2017). A smaller expansion of the potential GDP implies a lower growth of the per capita output in the future, which could not be relieved by just countercyclical policies.

There are different mechanisms by means of which a shock to the TT impacts the investment. First of all, the effects of this shock have extended to the aggregate investment as a result of the widespread adjustment of domestic demand in response to the downturn in the available national income caused by the decline of the TT (Graphs B1.1 and B1.2). Added to the above are the lower expectations of economic growth (Graph B1.3), which are partially explained by the persistence of the shock, which is a factor that the literature has found relevant for determining the implications of these types of external disruptions for the economy (Kent and Cashin, 2003; Andrews and Rees, 2009). In addition, the reduction of TT also affects public investment (Bems and Li, 2015). As detailed below, the decrease in fiscal revenue associated with crude oil curtails the capability of the public sector to make investments.

Secondly, the companies that earn profits from mining and oil drilling have been directly affected. The lower level of income and profits these firms earned reduced their ability to generate their own resources which, coupled with the reduction in the profitability of the projects, led to a decrease in their investment and that of their parent companies in this extraction business (Graph B1.4). The direct relationship between investment in the mining sector and the international prices of these raw materials has also been seen in other countries, such as Australia, Canada, Chile, Peru, and South Africa (Fornero et al., 2016).

Another pertinent channel has been the variation in relative prices associated with currency depreciation. In general, different studies have shown that exchange rate flexibility allows for better absorption of TT shocks (Broda, 2004). With regard to investment, this channel has a positive effect in the medium term to the extent it generates incentives for investment on the part of the economic sectors that produce and export tradable goods and services. However, in the short term, depreciation makes investment more expensive due to the increase in the costs of foreign financing and the imports of capital goods when denominated in local currency (Graphs B1.5 and B1.6).

Graph B1.1
Contribution to the change in the gross national disposable income by Components
(accumulated over four quarters)

(Percentage)

| GDP | Net Income from Abroad | Effect of the terms of trade | ······· Real disposable gross national income |

Source: DANE, calculations by *Banco de la República.*

Graph B1.2
Gross national disposable income, domestic demand, and GDP, cumulative over four quarters
(annual change)

(Percentage)

| —— Gross national disposable income | —— GDP | —— Domestic demand |
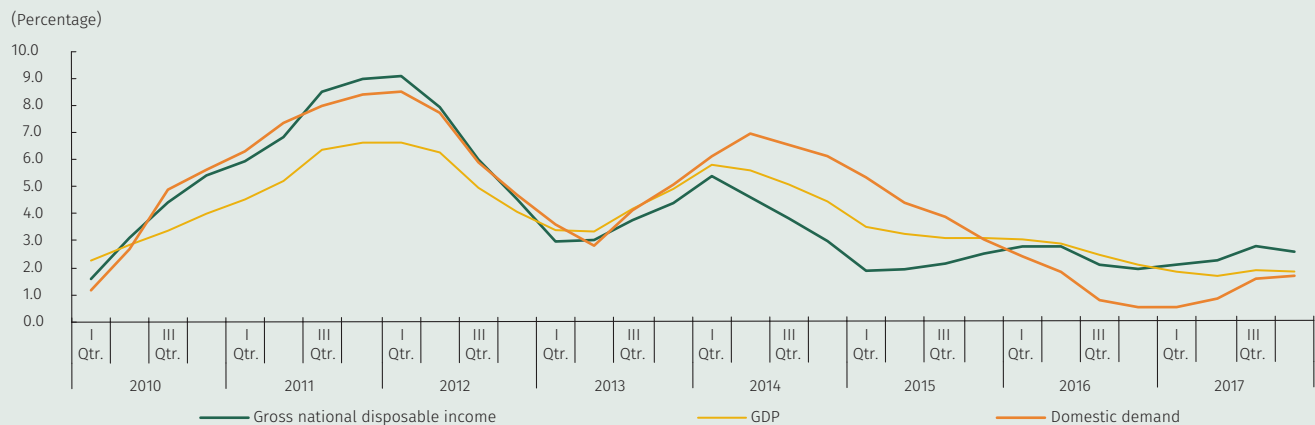
Source: DANE, calculations by *Banco de la República.*

Graph B1.3
Analysts' Consensus on the Forecast of Real Growth of
Colombia's GDP
(annual change)

(Percentage)

| — Forecasts for 2017 | — Forecasts for 2018 | — Forecasts for 2019 |
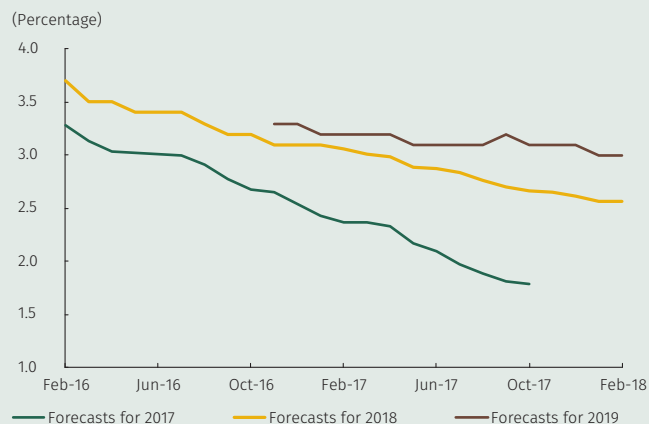
Source: Focus Economics.

Graph B1.4
Profits of Foreign Mining and Petroleum Companies Measured as a
Percentage of the GDP

(Percentage)
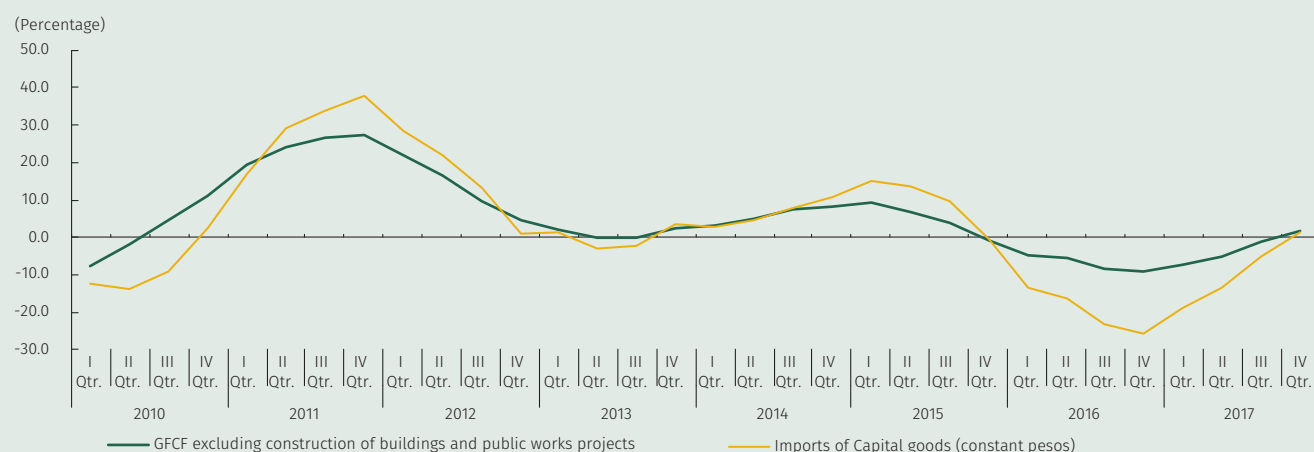

Source: *Banco de la República.*

Graph B1.5
Index of Peso-denominated Import Prices
(base 2005 = 100)

(Index)

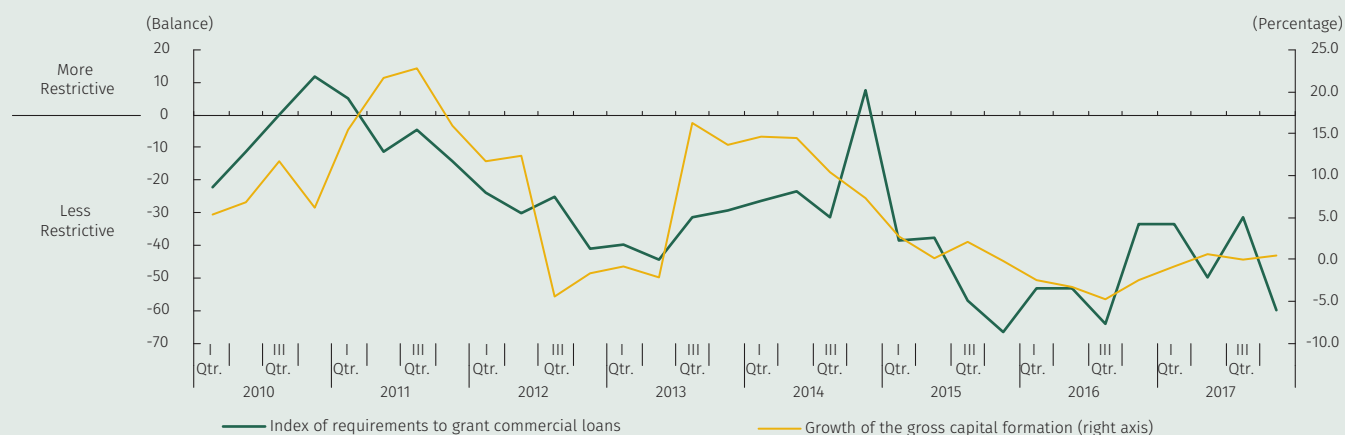Source: *Banco de la República.*

Moreover, the downturn of the economy, in this case related to the decline in the TT, has implications for the credit cycle and the access firms have to financing for their investment programs (Lown and Morgan, 2006). Indeed, note that the banks have been increasing their requirements for granting commercial loans since 2014 and, in the case of the aggregate during 2017, these requirements were similar to those registered on average in 2009 (Graph B1.7). The interest rates for these types of loans, in turn, rose temporarily after the shock to the TT although they have been decreasing in line with the decline in *Banco de la República's* benchmark interest rate. Likewise, the risk premia of a country tends to increase when there is a reduction in the TT (Hamann *et al.*, 2015), and this affects the cost of foreign financing (Graph B1.8).

Graph B1.6
Imports of Capital Goods (in constant pesos) and Gross Fixed Capital Formation, Cumulative Four Quarters
(annual change)

(Percentage)

— GFCF excluding construction of buildings and public works projects   — Imports of Capital goods (constant pesos)

Source: DANE, calculations by *Banco de la República.*

Graph B1.7
Change in the Requirements for Granting New Commercial and Investment Loans
(balance, annual change)

(Balance)   (Percentage)

— Index of requirements to grant commercial loans   — Growth of the gross capital formation (right axis)

Source: Survey of the loan situation in Colombia, December 2017, calculations by *Banco de la República.*

Graph B1.8
Credit default swaps 5 years ahead

(Basis points)

Source: Bloomberg.

The combination of all the factors mentioned above has been mirrored by the deterioration of the investment indicators in Colombia. Gross capital formation (GCF) registered an average rate of variation in real terms of -0.7% between 2015 and 2017 after it experienced an average growth of 10.3% between 2011 and 2014 (Table B1.1). The less favorable performance of the GCF led to a downturn in the real rate of investment, measured as the ratio between GCF and GDP in pesos at constant 2005 prices. This indicator hit record highs in June 2014, a few months before the TT shock, when investment reached 30.1% of GDP. After almost three years of adjustment, the impact of the TT reduction resulted in a downswing of almost 3 percentage

points (pp) in the investment rate within a context of a GDP slowdown. A decline of similar magnitude also took place for the nominal rate of return (Graphs B1.9 and B1.10). This indicator also declined in the countries in the region that were affected by the TT shock (Graph B1.11) and which have not recovered to the levels they had prior to the shock.

In particular, the drop in investment between 2015 and 2017 was the result of what happened in the areas of transportation equipment as well as machinery and equipment with respect to Gross Fixed Capital Formation (GFCF). These areas registered significant adjustments after the shock to the TT due to the fact that they are the components of investment in which imports have a high share. These declines, in turn, translated into a drop in the real rate of investment in tradable capital goods,[1] which declined by about 20% (Graph B1.12) between the second quarter of 2014 and the fourth quarter of 2017.

In contrast, the GFCF for construction of new buildings maintained a positive variation until 2016 due in part to the low-income housing programs fostered by the NCG. However, the information available for 2017 as a whole shows a decline of 11.3% in this area.

Furthermore, between 2014 and 2017 the GFCF for public works showed a better performance than that of the aggregate GDP (Table B1.1). In principle, progress in the implementation of different infrastructure and tertiary road projects by regional and local governments contributed to

Table B1.1
Real Annual Growth of Investment by Type of Expenditure
(percentage)

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | | | | 2017 |
							I Qtr.	II Qtr.	III Qtr.	IV Qtr.	
Gross Capital Formation	18.9	4.3	6.3	11.6	1.2	-3.3	-0.9	0.7	0.0	0.5	0.1
Gross Fixed Capital Formation	19.0	4.7	6.8	9.8	1.8	-2.7	-1.7	1.5	0.3	0.3	0.1
Agriculture, Forestry, Hunting, and Fishing	9.5	-12.9	-5.4	1.5	-0.7	6.0	1.9	-4.9	-2.2	3.4	-0.5
Machinery and Equipment	23.2	13.3	0.2	7.6	-4.1	-8.2	-0.9	4.3	6.7	4.5	3.6
Transportation equipment	64.0	-9.6	-1.7	9.6	0.1	-31.3	-3.6	-2.1	-0.2	-13.1	-5.0
Construction and Buildings	5.2	5.1	11.1	7.7	2.6	6.4	-8.0	-8.2	-15.9	-13.1	-11.3
Public works	18.3	4.8	10.8	14.0	5.3	-0.4	3.5	7.2	9.1	8.7	7.1
Services	7.4	7.2	4.1	10.2	2.8	-2.7	-3.1	1.4	0.9	4.2	0.8
GDP	6.6	4.0	4.9	4.4	3.1	2.0	1.5	1.7	2.3	1.6	1.8

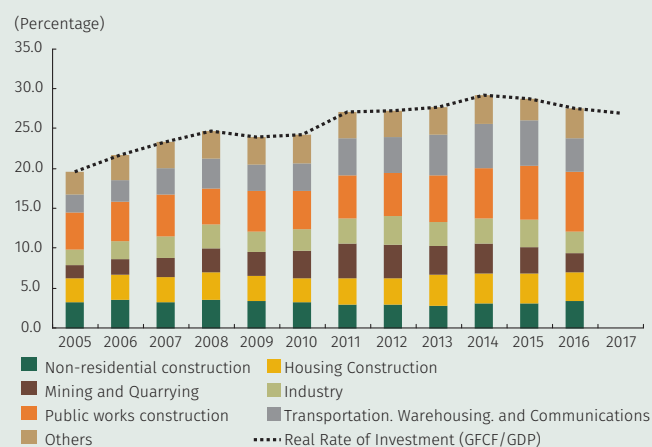Source: DANE, calculations by *Banco de la República*.

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1   Investment related to machinery and equipment, transportation equipment, inventories, capital goods for agriculture, and services associated with the improvement of capital assets.

Graph B1.9
Nominal and Real Investment Rates in Colombia
(nominal and real GFC/GDP, base 2005)

(Percentage)

— Rate of investment (real)   — Rate of investment (nominal)
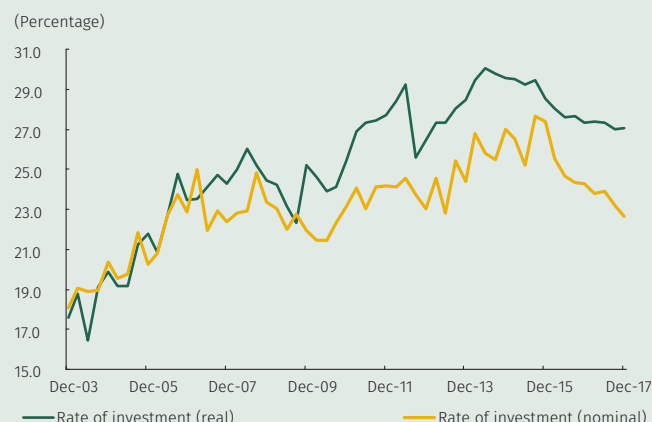
Source: DANE, calculations by *Banco de la República.*

Graph B1.10
Productive Sectors that Invested in the Colombian Economy: Real
Investment Rate by Sector (GFCF/GDP)

(Percentage)

■ Non-residential construction ■ Housing Construction
■ Mining and Quarrying ■ Industry
■ Public works construction ■ Transportation. Warehousing. and Communications
■ Others ⋯⋯ Real Rate of Investment (GFCF/GDP)

Source: DANE, calculations by *Banco de la República.*

Graph B1.11
Real Rates of Investment in Colombia, Chile, and Peru (periods
after the shock to the TT)

(Index)

— Chile^a/   — Peru^a/   — Colombia^b/
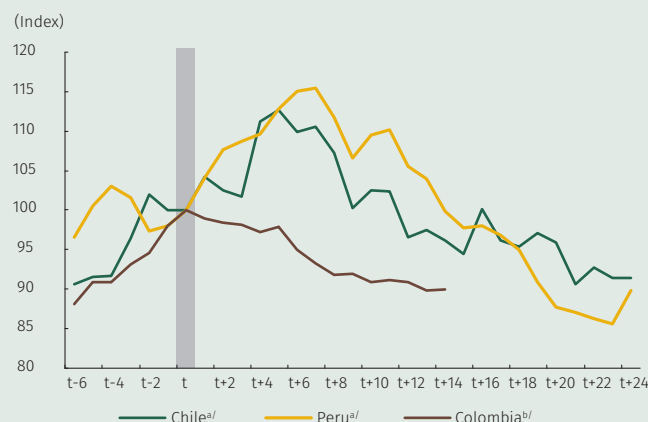
a/ Base September 2011 = 100.
b/ Base January 2014=100.
Sources: Official statistics offices of each country and DANE, calculations by *Banco de la
República.*

this. The latter compensated for the drop registered in the area
of public works for mining (Graph B1.13), which was the result of
the decrease in exploration and development of mines or oil
wells given the low international prices for commodities. Based
on the indicator of investment in public works (IIPW) published
by DANE, while the component associated with mining fell close
to 20% between 2014 and 2017, the other components regis-
tered an expansion of about 40%, and this contributed to the
growth of the investment aggregate in public works. That being
the case, the rate of investment in non-tradable capital goods
(construction of buildings and public works) did not show re-
ductions for the above-mentioned period (Graph B1.12).

Given the above, it becomes relevant to explain in further de-
tail how the adjustment of the investment in the Colombian
economy took place.[2] On one hand, the analysis done by in-
stitutional agents using annual figures available up to 2016

Graph B1.12
Adjustment of the Real Investment Rates in Colombia
(total, tradable and non-tradable, base June 2014 = 100)

(Index)

— Real Rate of Investment   — Real Rate of Investment tradable
— Real Rate of Investment non tradable
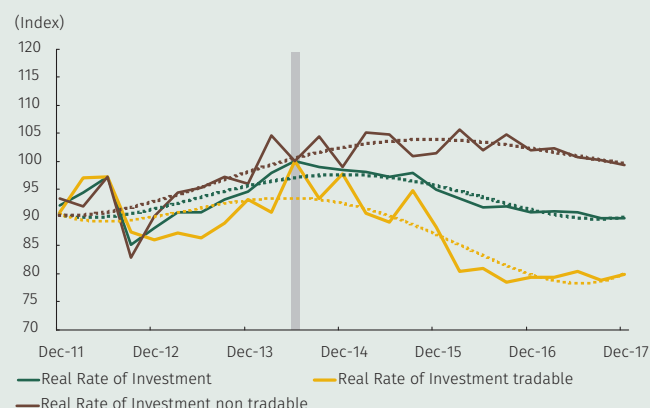
Source: DANE, calculations by *Banco de la República.*

Graph B1.13
Indicator of Investment in Public Works (IIPW) seasonally adjusted
(June 2014 base = 100)

(Index)

— Total IIPW   — IIPW construction for mining
— IIPW excluding construction for mining
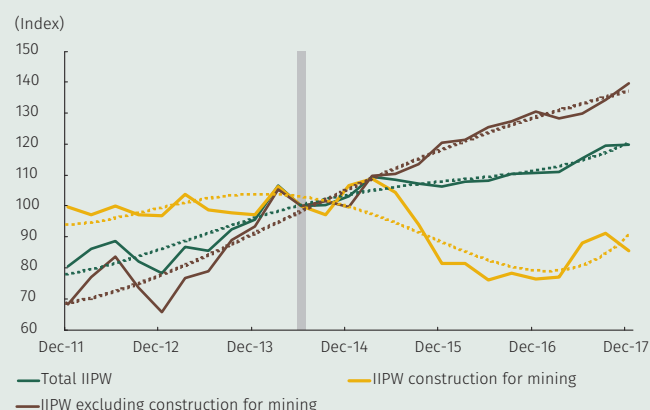
Source: DANE, calculations by *Banco de la República.*

2   Estimates made by the technical team at *Banco de la República* based on
     information from the annual national accounts published by DANE.

shows that the reduction of the investment rate was particularly noticeable in the private sector (households and firms), while the public sector (government and not-for-profit entities) did not share significantly in this adjustment. Estimates done by the technical team at *Banco de la República* show that, in the first case, the real rate of investment went from 25.5% in 2014 to 23.6% in 2016, while for the public sector this rate varied from 4.3% to 4.1% in the same period (Graph B1.14).

On the other hand, when the annual information available up to 2016 is broken down by the economic sectors where the investment was made, it is clear that, as expected, the sector of mining and quarrying was the most affected as a result of the direct impact of the TT shock on its economic activity (Graph B1.15). The effects of this shock have also been registered in the industrial, transportation, warehousing and communications as well as the social, community and business services sectors since 2015 (Graph B1.16).

With regard to the investment made in the construction sector, for both public works and buildings, the estimates show the fact that it took longer for the drop in the TT to affect these areas. As has already been mentioned, the investment made in these pursuits was stimulated by the allocation of public funds associated with the development of different infrastructure projects and the programs to subsidize the interest rate for housing purchases.

The investment trends described throughout this box have partially reflected the characteristics of the shock to the TT registered during the second half of 2014, one which was not anticipated, was considerable in magnitude, and persisted over time (Toro et al., 2015). This external disruption took place in a context of high TT levels that unleashed effects of specific magnitudes and patterns on the investment. In order to measure this last characteristic of the shock, a non-linear model of autoregressive vectors by thresholds (TVAR) was implemented that makes it possible to differentiate the asymmetric effects on the investment caused by the decline in the TT when this occurs in either a scenario of high or low TTs.

Graph B1.17 shows the responses of the available national income (panel A), the real exchange rate (panel B), the real interest rate (panel C), and the rates of tradable and non-tradable investment (panels D and E) with respect to a temporary drop in the TT.[3] The results of this exercise suggest that a negative temporary shock to the TT generates a reduction in the national revenue and a depreciation of the currency. This, when the channels previously described are taken into account, brings about a cutback in both the tradable and non-tradable investment rates. This response becomes much more persistent when said

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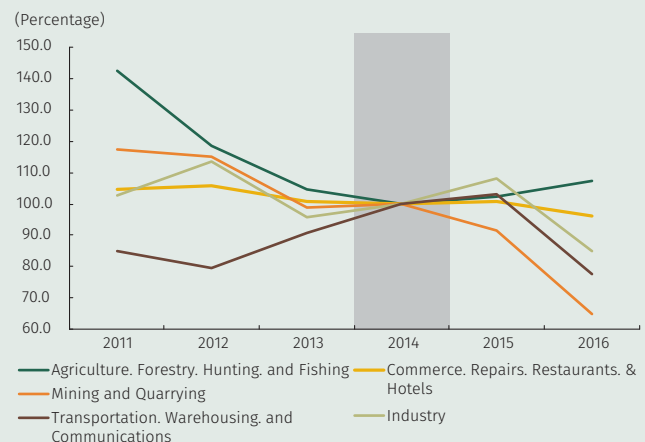[3] These series were included without taking their trend into account. The sample has quarterly data for the1996-2017 period.

Graph B1.14
Real Investment Rate (GCF/GDP) by institutional sector: public and private

(Percentage)

■ Private Rate of Investment ■ Public Rate of Investment
···· Real Rate of Investment (GCF/GDP)
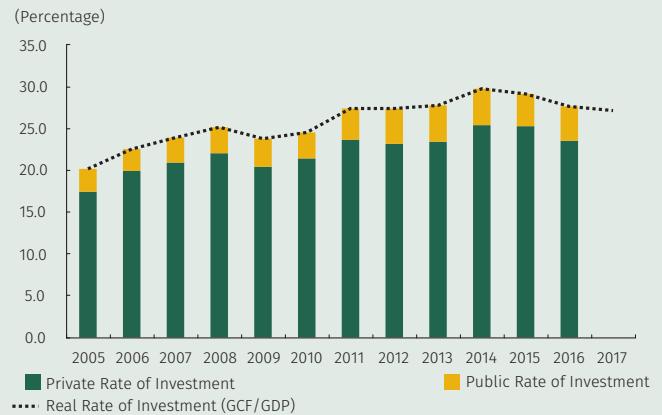
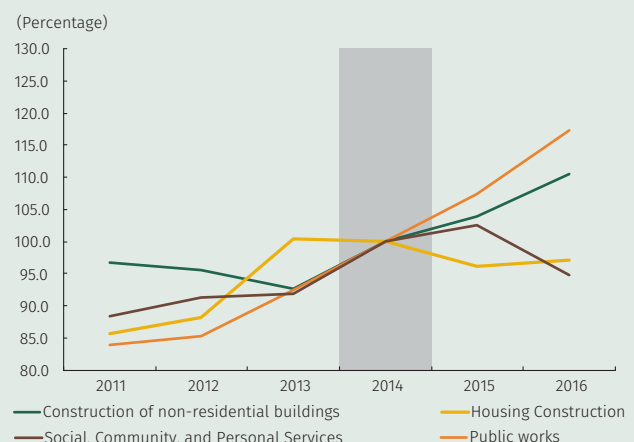Source: DANE, calculations by *Banco de la República.*

Graph B1.15
Adjustment of Investment Rates for Productive Sectors of Tradable Goods and Services: Real Investment Rate by Sector (GFCF/GDP, base 2014 = 100)

(Percentage)

— Agriculture. Forestry. Hunting. and Fishing — Commerce. Repairs. Restaurants. & Hotels
— Mining and Quarrying
— Transportation. Warehousing. and Communications — Industry

Source: DANE, calculations by *Banco de la República.*

Graph B1.16
Adjustment of Investment Rates for Productive Sectors of Non-tradable Goods and Services: Real Investment Rate by Sector (GFCF/GDP, base 2014 = 100)

(Percentage)

— Construction of non-residential buildings — Housing Construction
— Social. Community. and Personal Services — Public works

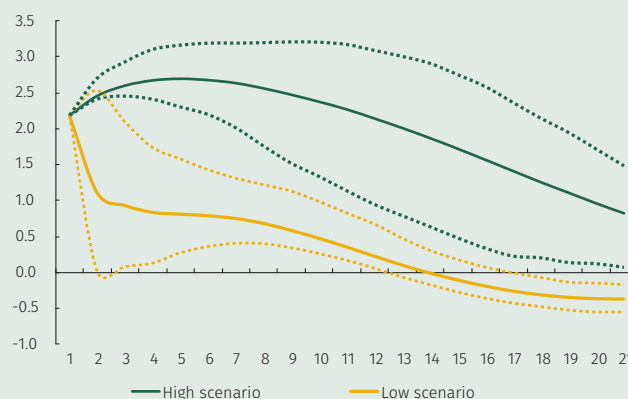Source: DANE, calculations by *Banco de la República.*

Graph B1.17
Generalized Impulse-Response of each Variable with Respect to a Negative Shock to the Terms of Trade
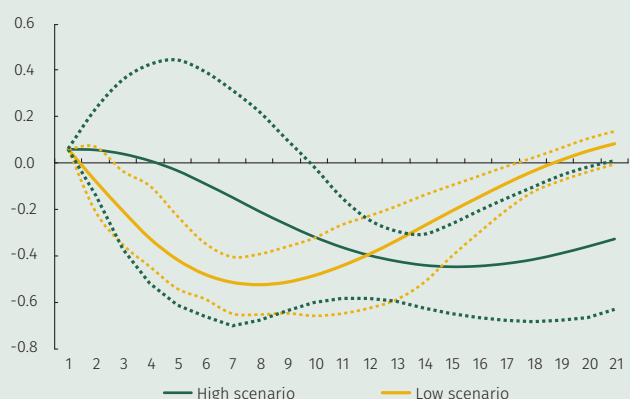
A.   Response of the Gross National Disposable Income
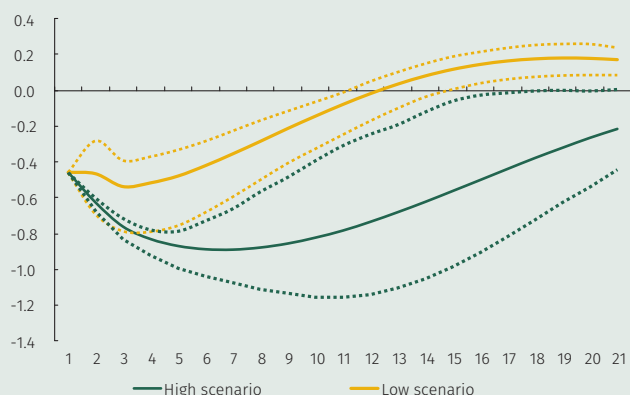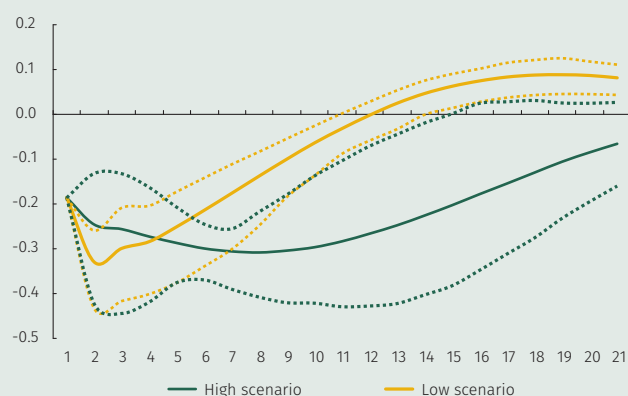
B.   Response of the Real Exchange Rate
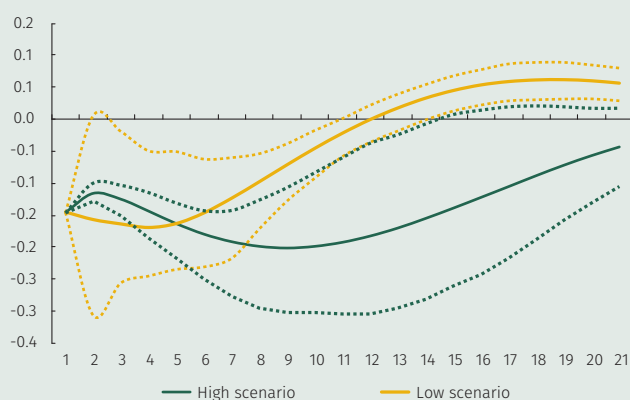
C.   Response of the Real Interest Rate

D.   Response of the Rate of Investment in Tradable Capital Goods

E.   Response of the Rate of Investment in Non-tradable Capital Goods

Source: estimates by *Banco de la República.*

shock occurs at a time of high TT levels than when it occurs in a scenario of low TT levels. In the same context, the monetary policy response is initially contractionary to control the effects of the shock on inflation but after that, it is followed by a decrease in the real interest rate in line with a monetary policy stance that seeks to boost the growth of the economy.

It should be noted that the results derived from using the non-linear model of autoregressive vectors reveal the adjustment of the economy in the presence of a shock to the TT that is transitory rather than permanent as was the actual case since mid-2014. This shock, as it became more persistent over time, would imply slower adjustments in the future and the possibility that the main macroeconomic variables would converge at different levels in the long term.

As explained in chapter 2 of this *Report*, the results of the economic growth for 2017 suggest that the process of adjusting the economy to the sharp TT shock that occurred during the second half of 2014 may have already come to

an end. Likewise, the chapter presents forecasts that imply a recovery of the economic growth rate in 2018 which, even though it will probably still be below its potential level, would mark a turning point in comparison to what was registered in previous years during the shock.

The changes expected in GCF play an important role in these forecasts. First of all, the investment in public works would again contribute to the expansion of domestic demand due to an increase in the expenditure of funds allocated for infrastructure by regional governments, positive trends in the exploration and development of the mining sector, and a greater contribution from building tertiary and 4G roads. Secondly, the areas of industrial machinery and transportation equipment will probably exhibit increases in 2018. This would be the result, to a large extent, of the tax benefits for investment included in the tax reform as well as the greater accumulation of capital goods on the part of the tradable sectors of the economy. The consolidation of this scenario and a recovery of the potential GDP through a contribution coming from the investments made during these periods are expected in the future.

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