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Investment in Brazil: From Crisis to Recovery

by Ivo Krznar and Troy Matheson

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Investment in Brazil: From Crisis to Recovery

Prepared by Ivo Krznar and Troy Matheson

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Abstract

While Brazil's deep recession has been broad based, it has been marked by a particularly large fall in investment. Real investment fell by around 30 percent between the beginning of 2014 and the beginning of 2017. This paper finds that a variety of factors contributed to the investment decline, including a deterioration in Brazil's medium-term growth prospects, rising real interest rates, falling terms of trade, rising uncertainty related to economic policy, rising levels of corporate leverage and lower cash flow. Some of the factors that have weighed on investment over recent years have begun to normalize providing some impetus for a recovery. However, still-high levels of corporate leverage and the prospect of continued uncertainty related to economic policy settings suggest a turnaround in investment is likely to be subdued.

JEL Classification Numbers: E22, E32

Keywords: Investment, Recession

Author's E-Mail Address: ikrznar@imf.org; tmatheson@imf.org

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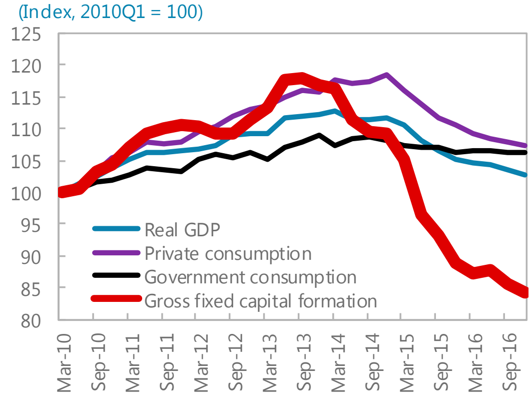
I. INTRODUCTION

Brazil's deep recession has been broad based with a particularly large fall in investment. Real investment recovered strongly following the global financial crisis amid rising terms of trade, low interest rates, rapidly expanding consumption, and widespread optimism about Brazilian growth prospects. However, the expansion proved short lived as the favorable factors that supported the recovery began to wane and economic and policy uncertainty began to rise. Since the beginning of 2014, real investment has contracted by around 30 percent, far weaker investment than most other emerging markets experienced over this time.

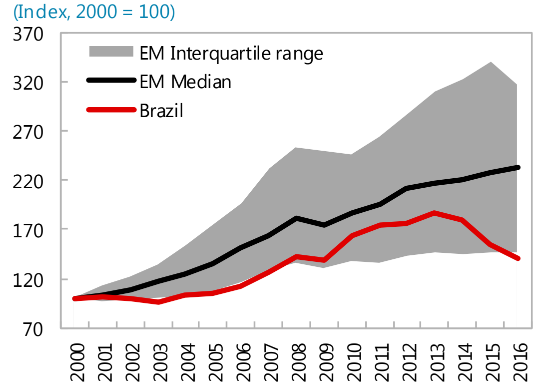
Brazil: National Accounts Components
(Index, 2010Q1 = 100)



Source: Haver Analytics.

Some of the factors that are hampering investment might soon support a recovery, but other factors—such as high levels of corporate leverage and policy uncertainty—suggest the recovery might be more prolonged (Figure 1). The central bank has begun an easing cycle and real interest rates are expected to fall significantly over the coming year, and, after trending down for several years, Brazil's terms of trade stabilized and improved in early 2016. By reducing funding costs and increasing profitability, both factors should help to support a recovery in investment. However, these developments come against the backdrop of a prolonged recession that has damaged Brazil's long-term growth prospects and led to higher levels of corporate leverage; prospects of weaker growth in the future hurts expected returns and discourages investment while higher leverage reduces the demand and supply of investment funding. Moreover, following a dramatic deterioration in the fiscal position and the impeachment of President Rousseff, the government has embarked on an ambitious fiscal reform agenda that is subject to implementation challenges, contributing to heightened policy uncertainty that could weigh on firms' willingness invest.

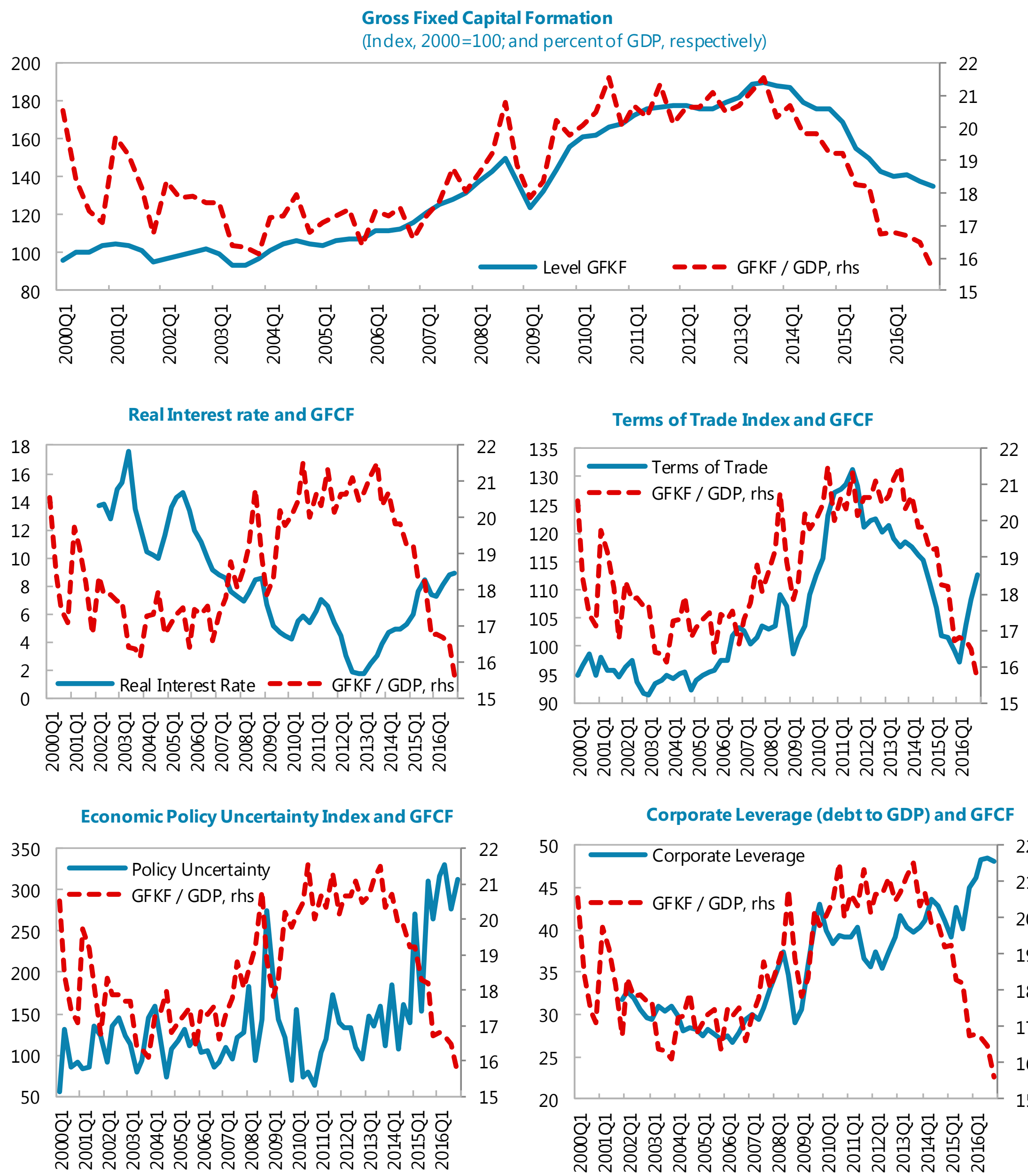
Brazil and EMs: Real Gross Fixed Capital Formation
(Index, 2000 = 100)



Source: World Economic Outlook.

This paper examines the proximate causes of dramatic fall in investment in Brazil and the prospects for investment going forward. Section II provides an analysis and discussion of Brazil's investment using aggregate data. Firm-level data are examined and discussed in Section III. The paper concludes with a discussion of the prospects for a recovery in investment.

Figure 1. Brazil: Gross Fixed Capital Formation and Other Key Variables



Source: Staff estimates and Haver Analytics.

II. Aggregate Empirical Analysis

Medium-term growth and investment are linked. Current levels of investment increase the economy's capital stock and enhance future labor productivity and growth. At the same time, firms' expectations of medium-term growth help to determine expected returns to investment and investment levels themselves. As such, the empirical specification is chosen to allow for feedback effects from growth expectations and investment and for the impact of other variables that influence investment decisions, including input costs (regulated prices and unit labor costs), funding costs (the real interest rate), profitability (terms of trade), leverage, and economic policy uncertainty.[1]

Two equations are jointly estimated to describe the behavior of quarterly real investment growth. The first equation determines the part of medium-term growth expectations (3-years-ahead) that cannot be explained by current economic conditions and the second equation determines real investment growth. Medium-term growth expectations (3-years-ahead) Z_t are assumed to be determined by annual real GDP (y_t) growth, annual regulated-price (p_t) inflation, annual changes in the terms of trade (t_t) and the real interest rate (r_t), and annual growth in equity prices (s_t) and unit labor costs (l_t) (see table for data sources and definitions):[2]

Data, Sources and Transforms

Label	Variable	Source	Units
Z_t	Real GDP Growth Expectations (3-years ahead)	BCB	Level, %
i_t	Real Gross Fixed Capital Formation	IBGE	Level, log
y_t	Real GDP	IBGE	Level, log
p_t	Regulated Prices, IPCA	IBGE	Level, log
t_t	Term of Trade	Haver	Level, log
r_t	Real Interest Rate (Selic - 12-month-ahead inflation expectations)	BCB	Level, log
s_t	Equity Price Index	Haver	Level, log
l_t	Unit Labor Costs, $R	BCB	Level, log
L_t	Corporate Leverage (corporate debt to GDP)	IMF	Level, %GDP
U_t	Economic Policy Uncertainty	Haver	Level, log

$$Z_t = \alpha_1 \Delta^4 y_t + \alpha_2 \Delta^4 p_t + \alpha_3 \Delta^4 t_t + \alpha_4 \Delta^4 r_t + \alpha_5 \Delta^4 s_t + \alpha_6 \Delta^4 l_t + \epsilon_t^Z \qquad (1)$$

where Δ^4 represents the annual change in each variable and ϵ_t^Z is the part of medium-term growth expectations that represents other factors unrelated to current economic conditions. These factors represent an autonomous reassessment of medium-term growth, above and beyond the impact of contemporaneous (short term) economic developments. Quarterly investment growth is assumed to be driven by the same variables as growth expectations, in addition to the estimated residual from equation (1) and lags of corporate leverage (measured as total corporate debt over GDP) L_t and an index of economic policy uncertainty U_t:[3]

$$\Delta i_t = \beta_1 \Delta p_{t-1} + \beta_2 \Delta t_t + \beta_2 \Delta r_{t-1} + \beta_3 \Delta s_{t-1} + \beta_4 \Delta l_{t-1} + \beta_5 \epsilon_{t-1}^Z + + \sum_{i=1}^{4} \beta_i^L L_{t-i} + \sum_{i=1}^{4} \beta_i^U U_{t-i} + \epsilon_t^{\Delta i} \qquad (2)$$

where Δ represents the quarterly change in each variable. The estimation sample ranges from 2000Q1 to 2016Q1.

The estimated model provides a good description of behavior of investment over history. Three different variants of the model are estimated using Seemingly Unrelated Regressions (the estimation results are displayed in Appendix I, Section B). The preferred model specification

[1] Economic policy uncertainty is measured using the Economic Policy Uncertainty (EPU) Index for Brazil in the same manner as the newspaper-based EPU Index for the United States, following the methods in "Measuring Economic Policy Uncertainty" by Baker, Bloom and Davis (see policyuncertainty.com and Appendix I, Section A for more details).

[2] The estimates of medium-term growth expectations are described in Appendix I, Section B.

[3] Note, variants of the model that include leverage and policy uncertainty in equation 1 were also estimated but leverage and policy uncertainty were not found to be statistically significant.

(model 3) fits quarterly investment growth very well considering the volatility of the series (the adjusted R-squared statistic is around 0.7). Moreover, the signs of the coefficients in the investment equation are intuitive. Specifically, the estimated parameters suggest:

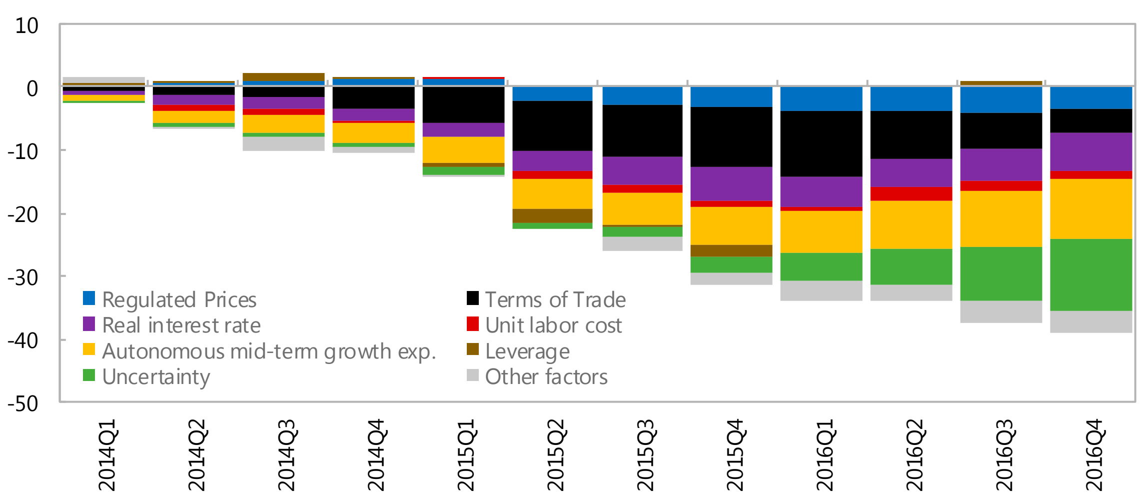
- *Investment increases* with higher autonomous growth expectations for the future and higher terms of trade;

- *Investment decreases* with higher real interest rates, unit labor costs, regulated prices, leverage, and policy uncertainty.

What explains the rapid drop in investment since 2014? Estimates suggest that developments hampering investment over this period include a rise in costs (chiefly a sharp increase in regulated prices, such as energy prices, but also unit labor costs), falling terms of trade—impacting prospects for commodity exporters—and higher interest rates (Figure 2). The "autonomous" part of the deterioration in the medium-term outlook for growth and heightened policy uncertainty have been the most significant drags on investment over this time, with each factor reducing investment by around 10 percent since beginning of 2014. Higher leverage contributed to fall in investment primarily during the period when it was rising fast (2015).

Figure 2. Brazil: Decomposition of Gross Fixed Capital Formation Growth

(Quarter-on-quarter growth accumulated since 2014Q1, deviations from avg, all variables demeaned)



Source: IMF staff estimates.

III. A Closer Look at Investment at the Firm Level

As in Magud and Sosa (2015) and Li and others (2015), a panel regression model that relates each firm's investment-to-capital ratio to several determinants of firms' investment decisions was estimated to study factors driving investment at the individual firm level. The macroeconomic determinants of investment studied in the previous section are assumed to affect investment via firms' balance sheets. The model differentiates between fundamental factors that drive investment decisions (factors that capture the marginal productivity of capital) and financial factors that can also affect investment (factors that capture financing constraints). The investment-to-capital ratio is assumed to be driven by:

Fundamentals:

- The change in sales to proxy for demand and expected future growth (as in the standard accelerator model of investment);

- Tobin's Q to capture the expected marginal return on investment.

Financial Factors:

- Leverage, cash flow, the change in debt, and debt repayment capacity.

The only other control variable included is a measure of political uncertainty; this variable is less likely to be endogenous to the firm-level variables than other macroeconomic variables such as interest rates, GDP, and the terms of trade.[4]

Leverage, cash flow, and changes in debt capture the relevance of each firm's financial structure for access to investment finance. High leverage may constrain firms' ability to obtain external financing for new investment; high leverage provides less investment incentives to controlling shareholders as a larger share of the gains will necessarily accrue to debtholders. Cash flow is commonly used in investment models as an indicator for internally available funds (see Hubbard, 1998) and the severity of financial constraints—tighter financial constraints increase reliance on internal funding for investment. While higher leverage is expected to be negatively associated with investment, the flow of debt is expected to be positively related to capital expenditures because financing investment is one of the main reasons to incur new debt. Tighter debt repayment capacity, on the other hand, is expected to be associated with lower investment.

The baseline model specification is:

$$\frac{I_{it}}{K_{it-1}} = \beta LEV_{it-1} + \gamma \frac{CF_{it}}{K_{it-1}} + \delta \frac{\Delta DEBT_{it}}{K_{it-1}} + \theta \frac{\Delta SALES_{it}}{K_{it-1}} + \rho TOBIN_{Q_{it}} + \xi ICR_{it} + \varpi UNCER_t + \lambda_t + \nu_i + \varepsilon_{it}$$

where I_{it} is firm i's net investment in period t, K_{it-1} its capital stock at the beginning of the period, LEV_{it} is the firm's leverage, $\Delta DEBT_{it}$ is its change in total debt, $\Delta SALES_{it}$ is the change total sales, $TOBIN\_Q_{it}$ its average Tobin's Q (a proxy for unobservable marginal Q), ICR_{it} is a measure of the firm's interest coverage ratio (a proxy for debt repayment capacity), and

[4] For example, expected GDP growth rate will be reflected in Tobin's Q, terms of trade will affect cash flow, Tobin's Q, sales; interest rates will affect cash flow and the interest coverage ratio. Specifications were examined that included a real interest rate and a nominal interest rate, but the associated coefficients were insignificant.

$UNCER_t$ is the index of political uncertainty used in the previous section.[5,6] To control for unobserved heterogeneity across firms, and other aggregate effects not explicitly modeled here, the model is estimated with firm-specific (ν_i) and time effects (λ_t); firm-specific effects control for systematic differences in the average investment rate across firms and time effects control for a common investment component reflecting other macroeconomic factors that can influence firm-level investment. The final term in the equation is the idiosyncratic error, ε_{it}.[7]

Data from firm-level balance sheets and income statements are sourced from Capital IQ. The sample covers over 4,000 Brazilian firms spanning 1995 to 2016.[8] To adjust for outliers, all firm-specific ratios are winsorized using 1st and 99th percentiles and some additional constraints are imposed.[9] The definition of each variable is provided in Table 1.

Estimation results of the baseline model are consistent with the findings of the analysis at the aggregate level. Table 2 shows the estimated parameters (and their statistical significance) for 7 variations of the model, ranging from a simple model that relates investment to leverage only to the full model specification described above. Robustness checks, including models using the alternative variable definitions displayed in Table 2, are displayed in Appendix I, Section C. The results can be summarized as follows:

- ***Investment increases*** with higher expected future profitability (proxied by Tobin's Q and sales growth), cash flows, and debt flows, as expected;

- ***Investment decreases*** with higher leverage and higher political uncertainty. For example, a 10 percentage point rise in a large firm's leverage is associated with a 1.1–1.4 percentage point fall in the investment-to-capital ratio. This suggests that financial constraints and political uncertainty play an important role in investment decisions and could help to explain the recent large drop in investment at the aggregate level.

[5] The empirical investment literature shows that lagged investment rate might be an important determinant of current investment spending (Gilchrist and Himmelberg, 1995; Eberly and others, 2012). In the case of Brazil, including lagged investment ratio as an explanatory variable did not significantly change the estimation results.

[6] Different interaction terms were also explored such as between leverage and firm size (smaller firms tend to be more dependent on bank financing and have lower spare capacities and a lower ability to access alternative financing options), leverage and uncertainty (firms with relatively higher leverage reduce investment more aggressively in response to higher uncertainty shock), cash flow and uncertainty (higher uncertainty could increase or decrease the marginal propensity to invest out of cash flows). None of these interaction terms were significant probably due to multicollinearity issues.

[7] Leverage enters the equation with a lag whereas, cash flow, debt growth and the interest coverage ratio contemporaneously, as in Magud and Sosa (2015) and Li and others (2015).

[8] While this is potentially a large sample, the data is sparse and concentrated in the period from 2010 to 2016.

[9] The cutoff values are 250 and -50 for investment to capital ratios, 20 and -20 for sales growth ratios and debt growth ratios, 10 and -10 for cash flow ratios, 50 and 0 for Tobin's Q and 100 and 0 for leverage ratios.

Table 1. Brazil: Variable Definitions

Variable	Definition	Robustness check
Investment ratio	Capital expenditure within the year over the capital stock at the beginning of the year (net property, plant and equipment+depreciation and amortization-investment within the year)	
Leverage ratio	Total debt net of cash+cash equivalents over total assets-cash and cash equivalents	Total debt net of cash and cash equivalents over total common equity or EBITDA
Cash flow ratio	Net income+depreciation over the capital stock at the beginning of the year	EBIT over the capital stock at the beginning of the year
Change in debt ratio	Change in total debt over over the capital stock at the beginning of the year	
Change in sales ratio	Change in revenues over the capital stock at the beginning of the year	
Tobin's Q	Market capitalization-total equity+total assets over total assets	Price to book ratio
Interest coverage ratio	EBITDA over interest expense	
Uncertainty	Change in Economic Policy Uncertainty by Scott Baker, Nicholas Bloom and Steven J. Davis	

Source: IMF staff estimates.

Higher leverage and policy uncertainty are negatively correlated with investment across most sectors of the economy. Table 3 displays results from models estimated using firms from eight different sectors of the economy. Leverage is statistically significant across most sectors, with health and real estate sectors being the only exceptions. The impact of leverage on investment is particularly large in the energy sector, possibly reflecting the relatively high levels of leverage and falling investment levels at the state-owned energy producer, Petrobras. At the same time, policy uncertainty appears to have significant effects on investment levels in the healthcare, industrials, real estate, and utility sectors, possibly due to a higher aversion to risks associated macroeconomic policy settings among these industries.

Table 2. Brazil: Regression Results, All Sectors

Dependent variable: Investment to capital ratio

Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Leverage, lag	-0.116 ***	-0.120 ***	-0.115 ***	-0.110 ***	-0.139 ***	-0.116 ***	-0.112 ***
	(0.022)	*(0.023)*	*(0.028)*	*(0.021)*	*(0.019)*	*(0.022)*	*(0.021)*
Cash Flow ratio		0.031 ***	0.029 ***	0.022 ***	0.034 **	0.049 ***	0.049 ***
		(0.005)	*(0.005)*	*(0.005)*	*(0.015)*	*(0.015)*	*(0.015)*
Change in debt ratio			0.016 ***	0.011 ***	0.007	0.008	0.008 *
			(0.002)	*(0.003)*	*(0.005)*	*(0.005)*	*(0.005)*
Change in sales ratio				0.010 ***	0.006	0.003	0.003
				(0.003)	*(0.006)*	*(0.007)*	*(0.007)*
Tobin's Q					0.005 ***	0.005 ***	0.004 ***
					(0.002)	*(0.002)*	*(0.002)*
Interest coverage ratio						0.001	0.001
						(0.001)	*(0.001)*
Uncertainty, diff, lag							-0.001 **
							(0.000)
Number of observations	10,763	10,378	10,144	9,805	2,392	2,311	2303
Number of firms	3,286	3,151	3,052	2,930	297	291	291
R^2	0.01	0.03	0.03	0.03	0.04	0.05	0.05

Source: Author's calculations

Note: ***, **, * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Standard errors in parentheses are Driscoll and Kraay (1998) robust to heteroscedasticity, autocorrelation with MA(q), and cross-sectional dependency. The estimation period is 1995–2016. Firm-level fixed effects are included (and time effects for specifications (1)-(6)).

Table 3. Brazil: Regression Results, by Sector

Dependent variable: Investment to capital ratio

Explanatory variables	Consumer Discretionary	Consumer Staples	Energy	Healthcare	Industrials	Real Estate	Telecomm-unication	Utilities
Leverage, lag	-0.142 ***	-0.230 ***	-0.336 ***	0.072	-0.119 ***	-0.062	-0.369 ***	-0.182 ***
	(0.047)	*(0.033)*	*(0.069)*	*(0.120)*	*(0.036)*	*(0.042)*	*(0.135)*	*(0.050)*
Cash Flow ratio	-0.016	0.069 ***	0.094 ***	-0.056	0.029 *	0.039 *	0.099 ***	-0.001
	(0.017)	*(0.020)*	*(0.025)*	*(0.043)*	*(0.018)*	*(0.022)*	*(0.035)*	*(0.010)*
Change in debt ratio	0.002	-0.001	0.044 **	-0.002	0.019 ***	0.001	0.101 ***	-0.003
	(0.004)	*(0.006)*	*(0.022)*	*(0.015)*	*(0.006)*	*(0.005)*	*(0.038)*	*(0.004)*
Change in sales ratio	0.017 ***	0.007 **	-0.019 **	-0.005	0.007 **	0.008	-0.025	0.016 ***
	(0.007)	*(0.003)*	*(0.007)*	*(0.014)*	*(0.007)*	*(0.005)*	*(0.019)*	*(0.003)*
Uncertainty, diff, lag	-0.000	-0.000	-0.000	-0.001 ***	-0.000 ***	-0.001 ***	-0.001	-0.000 ***
	(0.000)	*(0.000)*	*(0.000)*	*(0.008)*	*(0.000)*	*(0.000)*	*(0.001)*	*(0.000)*
Number of observations	1,082	970	282	329	2,160	1,133	137	1215
Number of firms	357	272	80	128	677	422	28	359
R^2	0.05	0.08	0.21	0.06	0.06	0.04	0.29	0.06

Source: Author's calculations

Note: ***, **, * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Standard errors in parentheses are Driscoll and Kraay (1998) robust to heteroscedasticity, autocorrelation with MA(q), and cross-sectional dependency. The estimation period is 1995–2016. Firm-level fixed effects are included.

IV. Summary and Conclusion

There are several factors that have contributed to the decline in investment since 2014. Rising costs, falling profitability—and expected profitability—and higher levels of corporate leverage appear to have played a role in the decline in investment over the course of the recession. The empirical evidence in this chapter also suggests that a rise in policy uncertainty has played a significant role in the decline.

Some factors point to stronger investment in the short term. The empirical results suggest that stabilization of regulated-price inflation, the terms of trade, and real interest rates should improve both investment growth and growth expectations. The large and necessary increases in fuel and electricity tariffs in 2015 and are not expected to be repeated going forward, the central bank has begun an easing cycle that is expected to continue over the remainder of 2017, and Brazil's terms of trade have improved markedly since the beginning of 2016. These are positive signs.

However, headwinds remain. While stabilization of some of the factors weighing on investment should provide some support investment in the short term, the prospect of a return to past levels of strong investment growth crucially depends on an alleviation of other sources of weakness, most notably high levels of corporate leverage and policy uncertainty and low medium-term growth expectations. While corporate leverage appears to have stabilized recently, it remains high from both a historical perspective and relative to other countries in the region. The analysis also suggests that if medium-term growth expectations remain subdued, the recovery in investment may be incomplete. Likewise, implementation challenges related the governments reform agenda—most notably related to pension reform—and the prospect of rising levels of government debt over the next several years could lead to persistently high policy uncertainty that might weigh on investment decisions for some time.

APPENDIX I. DATA, RESULTS, AND ROBUSTNESS

A. Economic Policy Uncertainty

The Economic Policy Uncertainty (EPU) Index for Brazil is computed in the same manner as the newspaper-based EPU Index for the United States, following the methods in "Measuring Economic Policy Uncertainty" by Baker, Bloom and Davis (policyuncertainty.com).

- The index is derived from the text archives of the newspaper Folha de São Paulo from 1991 onwards. The raw data for the index is the number articles containing relevant terms. Specifically, the number of articles containing the terms "incerto" or "incerteza", "econômico" or "economia", and one or more of the following policy-relevant terms: regulação, déficit, orçamento, imposto, banco central, alvorada, planalto, congresso, senado, câmara dos deputados, legislação, lei, tarifa.

- To obtain the EPU rate, the raw EPU counts are scaled by the number of all articles in the same newspaper and month. The resulting series is multiplicatively rescaled to a mean of 100 from January 1991 to December 2011.

B. Estimating Medium-Term Growth Expectations

The Brazilian central bank has a very comprehensive consensus expectations survey. On a weekly basis, forecasters submit their expectation for end-of-year Real GDP growth for the current year, as well as for the 4 years ahead. The Central Bank then reports averages, medians, and other properties of the sample in their website.

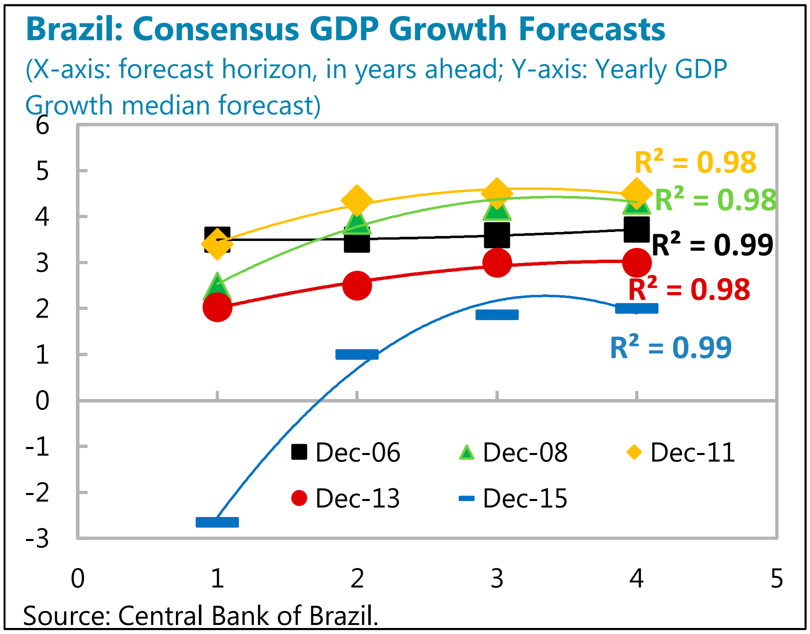
While there is no constant forecast horizon, forecasts usually behave in a predictable fashion (see Figure below). The surveyors ask analysts for end-of-year forecasts, which means that, for any given year, the forecast horizon shortens as time passes. However, since the underlying models expect the economy to return to potential GDP growth over the long run, there is a strong relationship between expected growth and forecast horizons.

This exercise builds on this relationship. The starting point to estimate a continuous time-series for mid-term growth expectations, then, regresses forecasts on a polynomial of the forecast horizon:

$$E_t\left[\Delta g_{t+s}^{yoy}\right] = c_t + \gamma_t (s-t)_{t,s} + \phi_t (s-t)_{t,s}^2 + e_t \quad (1)$$

where $E_t\left[\Delta g_{t+s}^{yoy}\right]$ is end-of-year growth forecast for date s at time t; $(s-t)_{t,s}$ denotes the forecast horizon in days, c_t, γ_t and ϕ_t are time varying parameters estimated for each period t. Those parameters yield a continuous time series for growth expectations for any horizon h ahead:

$$\hat{E}_t[\Delta g_{t+s}^{yoy}] = \hat{c}_t + \hat{\gamma}_t(h) \quad + \hat{\phi}_t(h)^2 \tag{2}$$



C. Estimation Results: Aggregate Model

Table 1. Brazil: Results—Aggregate Model

	Model (1)	(2)	(3)
Growth Expectations			
$\Delta^4 y_t$	0.069**	0.093***	0.093***
	(0.026)	(0.027)	(0.027)
$\Delta^4 p_t$	-0.022	-0.031	
	(0.019)	(0.020)	
$\Delta^4 t_t$	0.030**	0.028*	0.029**
	(0.014)	(0.014)	(0.014)
$\Delta^4 r_t$	-0.094***	-0.105***	-0.106***
	(0.035)	(0.033)	(0.032)
$\Delta^4 s_t$	-0.006	-0.009**	-0.010***
	(0.004)	(0.004)	(0.004)
$\Delta^4 l_t$	0.013	0.011	
	(0.015)	(0.015)	
R-Squared	0.507	0.499	0.496
Adjusted R-Squared	0.458	0.439	0.467
Investment Growth			
Δp_{t-1}	-0.793***	-0.512***	-0.542***
	(0.187)	(0.167)	(0.165)
Δt_t	0.411***	0.448***	0.476***
	(0.108)	(0.100)	(0.092)
Δr_{t-1}	-0.009***	-0.009***	-0.009***
	(0.003)	(0.002)	(0.002)
Δs_{t-1}	0.096***	0.041	
	(0.029)	(0.028)	
Δl_{t-1}	-0.104	-0.167**	-0.173***
	(0.068)	(0.064)	(0.059)
ϵ^Z_{t-1}	1.360**	1.110**	1.179**
	(0.536)	(0.479)	(0.483)
L_{t-1}		0.520***	0.529***
		(0.136)	(0.130)
L_{t-2}		-0.381*	-0.581***
		(0.206)	(0.131)
L_{t-3}		-0.282	
		(0.212)	
L_{t-4}		0.080	
		(0.143)	
U_{t-1}		0.143	
		(0.986)	
U_{t-2}		0.201	
		(1.047)	
U_{t-3}		-1.976*	-1.370*
		(1.039)	(0.821)
U_{t-4}		-2.067**	-2.181**
		(0.951)	(0.877)
R-Squared	0.696	0.790	0.770
Adjusted R-Squared	0.635	0.698	0.704

Jointly estimated standard errors in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01

D. Robustness Checks: Firm-Level Model

Table 2. Brazil: Results—Firm-Level Model, Robustness Checks

Dependent variable: Investment to capital ratio

Explanatory variables	(4) with leverage (net debt/equity)	(4) with leverage (net debt/EBITDA)	(4) with cash ratio	(5) with Tobin Q	(7) estimated using GMM
Leverage, lag	-0.003 ***	-0.001 **	-0.110 ***	-0.292 ***	-0.172 ***
	(0.001)	*(0.000)*	*(0.021)*	*(0.046)*	*(0.068)*
Cash Flow ratio	0.028 ***	0.034 ***	0.021 **	0.025	0.049 ***
	(0.007)	*(0.005)*	*(0.005)*	*(0.016)*	*(0.014)*
Change in debt ratio	0.014 ***	0.015 ***	0.009 ***	0.009 **	0.008
	(0.003)	*(0.002)*	*(0.002)*	*(0.005)*	*(0.007)*
Change in sales ratio	0.008 ***	0.011 ***	0.009 ***	0.006	0.005
	(0.003)	*(0.003)*	*(0.002)*	*(0.006)*	*(0.008)*
Tobin's Q				0.004 ***	0.005 ***
				(0.001)	*(0.004)*
Interest coverage ratio					0.001
					(0.001)
Uncertainty, diff, lag					0.000 **
					(0.000)
Number of observations	9,144	11,391	9,779	2,632	2,190
Number of firms	2,833	3,357	2,925	382	290
R^2	0.03	0.04	0.03	0.06	-

Source: Author's calculations

Note: ***, **, * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Standard errors in parentheses are Driscoll and Kraay (1998) robust to heteroscedasticity, autocorrelation with MA(q), and cross-sectional dependency. The estimation period is 1995–2016. Firm-level fixed effects are included.

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