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ABSTRACT

The growth rate of “nonprimary gross domestic product (GDP)” (Perú’s urban economy) dropped to 3.6 percent in 2014 and to 2.4 percent in 2015, far below the annual average of 7.3 percent recorded over the previous decade; moreover, an equally low growth rate of 2.8 percent per year is projected in 2016. In the macroeconomic history of Peru, the times of plenty—that is, the more or less prolonged booms—are also times of high prices of the commodities that the country exports; meanwhile, the lean times—that is, the more or less intense recessions in which economic activity slows down—are times of low commodity prices. This article describes the negative external shock undergone by the Peruvian economy and its recessionary and inflationary effects over 2014–15, analyzes the fiscal and monetary policies applied in response to the external shock, and outlines the macroeconomic challenges faced by the new government of Pedro Pablo Kuczynski.

KEYWORDS

External shocks; fiscal policy; monetary policy

JEL CLASSIFICATIONS

E520; E580; E620; F410

In the macroeconomic history of Peru, the times of plenty—that is, the more or less prolonged booms in which economic activity increases, employment rises, and private investment surges—are also times of high prices of the commodities that the country exports (metals, at present); meanwhile, the lean times—that is, the more or less intense recessions in which economic activity slows down and employment and private investment contracts—are times of low commodity prices.

The seven major recessions to have hit Peru since 1950 at a rate of one a decade—except for the 1980s when there were two very deep and long recessions—are all associated with more or less sudden falls in the international prices of export commodities.

In 2014–15, the growth of the Peruvian economy stalled sharply, bringing four years of rapid expansion to a halt. The growth rate of “nonprimary gross domestic product (GDP)” dropped to 3.6 percent in 2014 and to 2.4 percent in 2015,¹ far below the annual average of 7.3 percent recorded over the previous decade (BCRP, 2015); moreover, an equally low growth rate of 2.8 percent per year is projected for the urban economy in 2016 (BCRP, 2016).

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¹Nonprimary GDP accounts for 80 percent of the total and excludes agriculture, fishing, and mining, as well as the processing activities associated with these sectors; the economic activity of urban Peru is measured in this way.

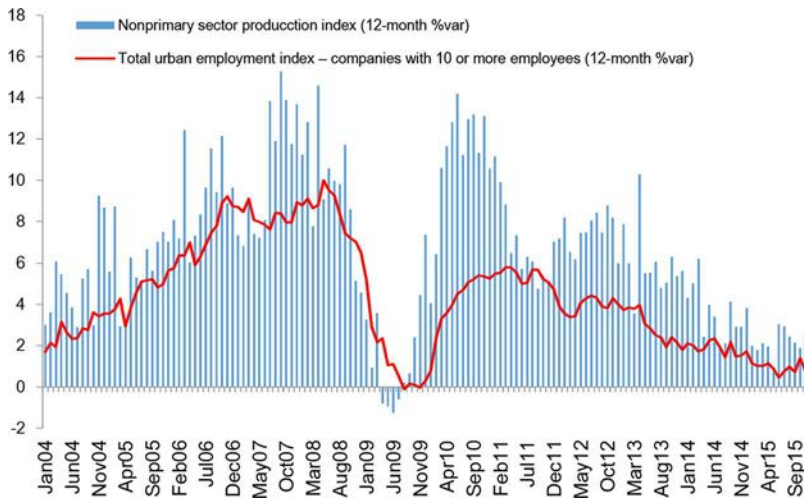


Figure 1. Production and employment in urban Peru. *Source:* Banco Central de Reserva del Perú.

The adverse external shock

The dramatic slowdown in nonprimary GDP growth since 2012 and the significant reduction in the expansion of urban employment among companies with more than ten employees is shown in [Figure 1](#). The urban employment rate fell in fourteen of the thirty biggest cities in the country between November 2013 and the same month in 2014, and again contracted in fifteen of the same cities over the same period between 2014 and 2015; and, in April 2016, the twelve-month growth of this index dropped to zero (BCRP, 2016). The year 2016 will be the third consecutive year of the most recent lean times to face these Peruvian cities, whose combined population is three-quarters of the country's total.²

This cooling in the urban economy has been associated with a marked decline in the value of exports, as shown in [Figure 2](#). Between the third quarters of 2011 and 2015, the value of exports in dollars plummeted by 36 percent (some 11 percent of nominal GDP) due to the export price index dropping by 34 percent between the peak of the past fifteen years (August 2011) and the most recent trough (September 2015). During the recession of 2008–9, this same index fell by 36 percent in less than one year.

The stagnation of the urban economy has also been associated with a decrease in public and private investment. In 2014, fixed private investment fell by 2.1 percent and public investment by 2.0 percent; in 2015, private investment contracted by 4.3 percent and public investment by 7.5 percent;

²Overall GDP grew by 3.3 percent in 2015 and is projected to increase by 4 percent in 2016, according to the *Reporte de Inflación* (BCRP, 2016). These figures reflect the expansion in the mining sector GDP, 15 percent in 2015 and 18 percent in 2016, brought on by the maturation of large-scale investment projects initiated during the period of high metal prices.

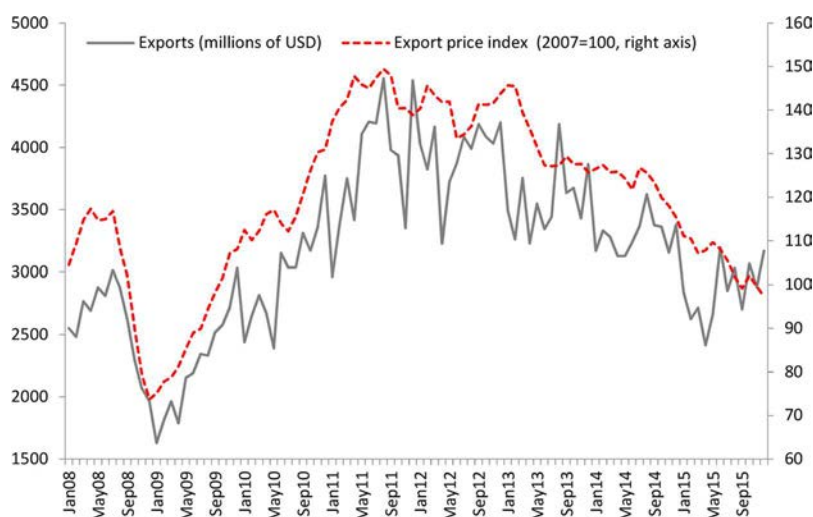


Figure 2. Peru: Export value and export price index. *Source:* Banco Central de Reserva del Perú.

and for 2016, zero growth in private investment and a 33 percent drop in mining investment is projected (BCRP, 2016).

The main cause of the downturn in the urban economy is the international metal price slump. When mineral prices fall, the exploration and construction of new mines decreases, as does private investment throughout the economy. This can be appreciated in Figure 3.

Global investment by the ten biggest mining companies on the planet, several of which operate in Peru, has contracted alongside the collapse in global mineral prices (International Monetary Fund; IMF, 2015, ch. 1).

Thus, there was a decrease in the private spending that propels the construction industry and others connected to it, whose importance to the urban economy is considerable. The construction of new mines (or public infrastructure), has a high multiplier effect on the Peruvian economy and the capacity to drive other sectors.³ In contrast, an increase in mining production has a very small multiplier effect.

Any collapse in metal prices will be accompanied by a drop in government current revenues. The Ministry of the Economy cuts public investment, which is the budgetary adjustment variable, so that the fiscal deficit does not exceed the target set by law. As with a balanced budgetary policy, this fiscal deficit target requires that nonfinancial expenditure—or a portion thereof, such as public investment in Peru—varies in the same direction and magnitude as current revenues. This fiscal rule promotes procyclical public investment, which increases at a boom time and decreases during a recession, thereby

³A sufficiently broad expansion in nontraditional exports and tourism, accompanied by import substitution, can also serve to boost the rest of the economy.

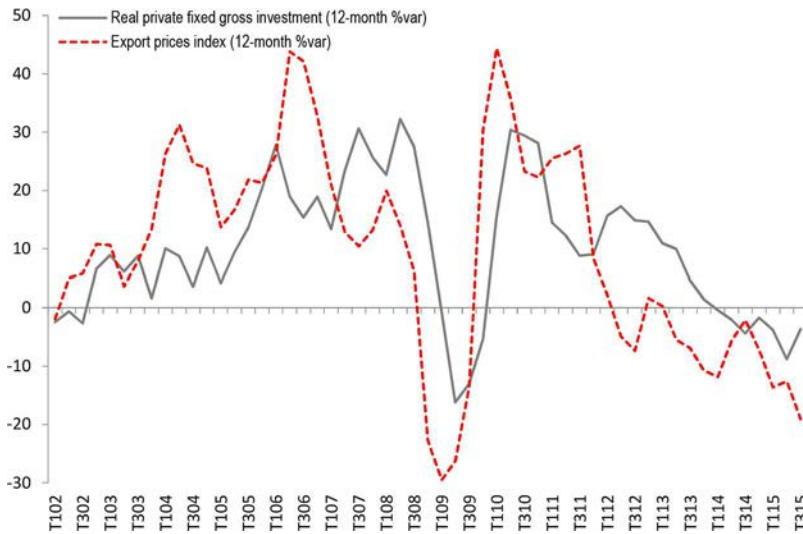


Figure 3. Peru: Total private investment and export prices. *Source:* Banco Central de Reserva del Perú.

exacerbating both the times of plenty and the lean times, arising from fluctuations in commodity prices.

The other external shock behind this slowdown in the urban economy is a credit crunch in foreign currency. The last two recessions in the Peruvian economy have coincided with a slump in international mineral prices, and with a sudden fall in credit in dollars provided by the local banking system to businesses and individuals, which is what happens when local banks lose access to their external sources of funds.

This credit crunch, usually triggered by external factors such as contagions, financial crises, or U.S. monetary policy adjustments, also pushes down private spending and engenders a strong recessionary impulse. In late 2015, the banking system's foreign-currency lending to the private sector accounted for 13 percent of GDP,⁴ while local-currency lending represented 22 percent of GDP. As shown in Figure 4, three major episodes of foreign-currency credit crunch in the Peruvian economy have been recorded over the past two decades; the first two are associated with the past two recessions (1998–2000 and 2008–9), and the third—linked to U.S. monetary-policy adjustment—started at the beginning of 2013.

Inflation and exchange rate

These external adverse shocks not only reduce aggregate demand and generate a strong recessionary impulse; they also deteriorate the balance of payment

⁴This figure does not include the external debt in foreign currency of large local nonfinancial companies, which stood at almost 15 percent of GDP at the end of 2015.

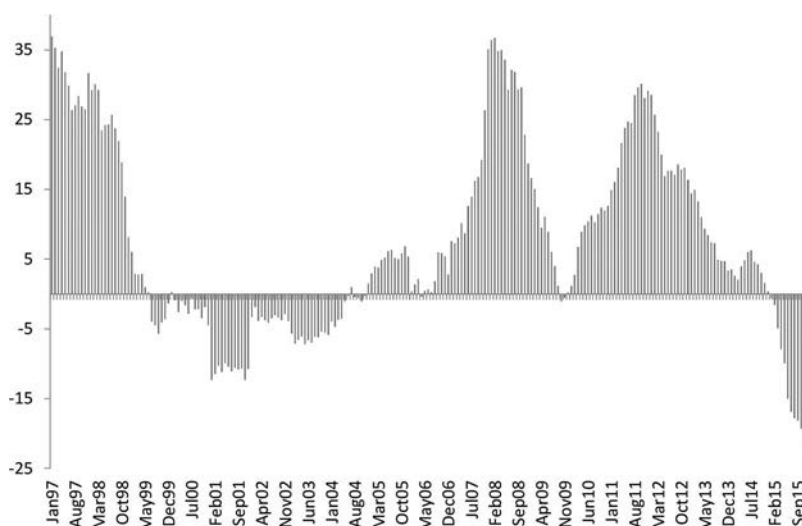


Figure 4. Foreign-currency banking system lending to the private sector (annual growth rates).
Source: Banco Central de Reserva del Perú.

and push up the exchange rate. As shown in [Figure 5](#), the price of the dollar in terms of the sol, or the exchange rate, goes up during lean times (2008–9, 2013–15) and goes down during times of plenty (2003–12).

A long-lasting rise in the exchange rate temporarily pushes up inflation; activates the balance sheet effect (debtors in dollars who earn in soles reduce their spending when the price of the dollar goes up, and the default rate of this debt typically increases); and, finally, stimulates the production of Peruvian goods and services that compete with foreign production on internal or

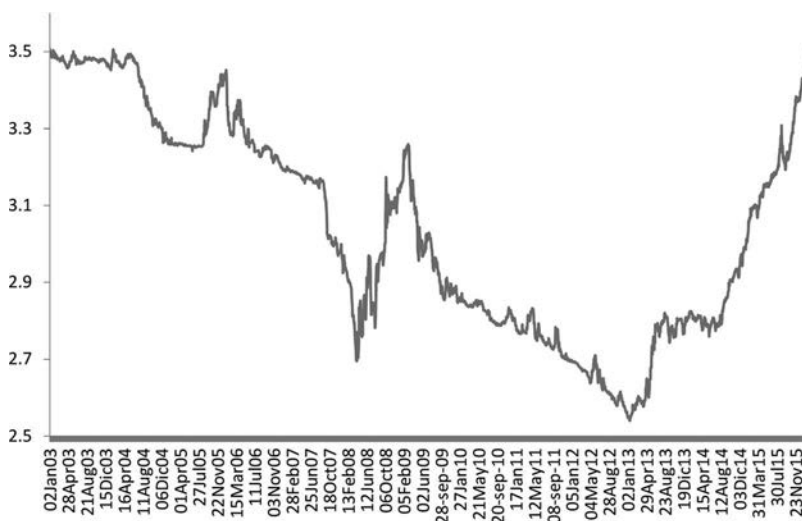


Figure 5. Exchange rate (PEN to USD). *Source:* Banco Central de Reserva del Perú.

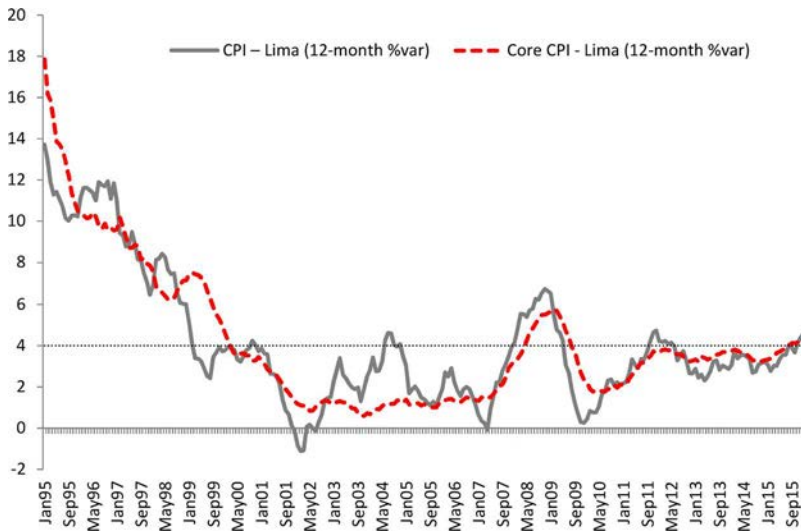


Figure 6. Inflation. *Source:* Banco Central de Reserva del Perú.

external markets.⁵ In the short term, the balance-sheet effect prevails in the Peruvian economy over the competitiveness effect, such that an increase in the real exchange rate tends to be recessionary and inflationary and, at the same time, improves the balance of payments.

A negative external shock tends to prompt an increase in the real exchange rate to some degree. If inflation is a weighted average of the percentage increase in salaries and the nominal exchange rate, if the salary readjustment period is constant, and if salary indexing to past inflation is incomplete, then inflation can increase temporarily in tandem with the rise in the real exchange rate, and decrease when the real exchange rate reaches its new level and stays there (see Appendix 1).

From the beginning of the inflation targeting regime in 2002 to date, inflation has mostly remained within a corridor of between 0 percent and 4 percent per annum, as shown in Figure 6—whether one observes total inflation, measured by the Metropolitan Lima consumer price index (CPI), or core inflation, excluding the volatile prices of fresh foods and fuel, thus allowing the inflation trend to be discerned.

In 2002, the Peruvian central bank (Banco Central de Reserva del Perú; BCRP) established a lower inflation target range (1.5 percent–3.5 percent per annum) than its counterparts in Chile, Colombia, and Mexico (2–4 percent per annum). At the start of the second government of Alan García—who bore the blame for the hyperinflation of the late 1980s—the BCRP under new management made the decision to reduce the inflation target to 2 percent per annum, with a target range between 1 percent and 3 percent per annum.

⁵This is the case of apparel exporters, local producers who compete with imported garments largely from China, the tourism industry, agroindustrial exports, and so on.

The basic purpose of the inflation targeting system is to influence public expectations of inflation so that the pricing decisions of companies, or wage negotiations between companies and unions, take into consideration that future inflation is normally within a target range established by the BCRP. This can only be achieved if the BCRP meets the inflation target over a sustained period.⁶ If, on the other hand, the inflation target is exceeded too frequently, inflation expectations will tend to be situated outside the target range.

Between January 2002 and December 2006, the twelve-month inflation rate was outside the target range for 43 percent of the period. Between January 2007 and December 2015, inflation was outside the target range 69 percent of the time. If the inflation target had not been reduced, inflation would have been outside the target range for only 50 percent of the 2007–15 period.

During the two-year period 2014–15, characterized by strong inflationary pressures caused by the rise in the exchange rate, inflation lay outside the target range 87 percent of the time; something similar occurred during the crisis of 2008–9. Thus, the inflation expectations of nonfinancial companies for 2016 are situated above 3 percent per annum. If the target inflation range had been similar to that of Chile, Colombia, or Mexico (2–4 percent per annum), inflation would have been outside the target range for just 12 percent of the period 2014–15.⁷

The core inflation peaks over the past two decades have been linked to sudden spikes in the real bilateral exchange rate,⁸ as can be seen in [Figure 7](#). It is worth noting that these core inflation peaks may also be associated with the increase in the international oil price.⁹

The behavior of the exchange rate is a basic determinant of inflation in the Peruvian economy. In the consumer price index there are many goods and services whose prices are directly dependent on the exchange rate because they are imported, contain imported inputs, or are indexed to the exchange rate (such as housing rental or the electricity price set by a state entity). History shows that the price of the dollar falls during times of plenty—when export commodity prices increase and/or capital flows in—and rises during lean times—when commodity prices plummet and/or capital flows out.

⁶In the words of Janet Yellen (2015), “My interpretation of the historical evidence is that long-run inflation expectations become anchored at a particular level only after a central bank succeeds in keeping actual inflation near some target level for many years.”

⁷A higher inflation target directly increases inflation. But if monetary policy credibility also increases, thereby restricting the inflationary impact of real exchange-rate shocks, inflation may be reduced indirectly. Appendix 1 gives an example of how this indirect effect predominates in the transition from one equilibrium to another. Albagli et al. (2015) show empirically, using a panel of countries that includes Peru, that this credibility effect—measured by past level of attainment of the inflation target—reduces the inflationary impact of the exchange rate. A similar result is obtained in IMF (2016a), using the dispersion of one-year inflation expectations as an indicator of credibility.

⁸Since the start of the 2000s, bilateral real exchange-rate fluctuations have been closely connected to bilateral nominal exchange-rate fluctuations.

⁹In this analysis, we have not taken into account the role of two supply shocks with opposite signs: the collapse in the oil price and the El Niño phenomenon.

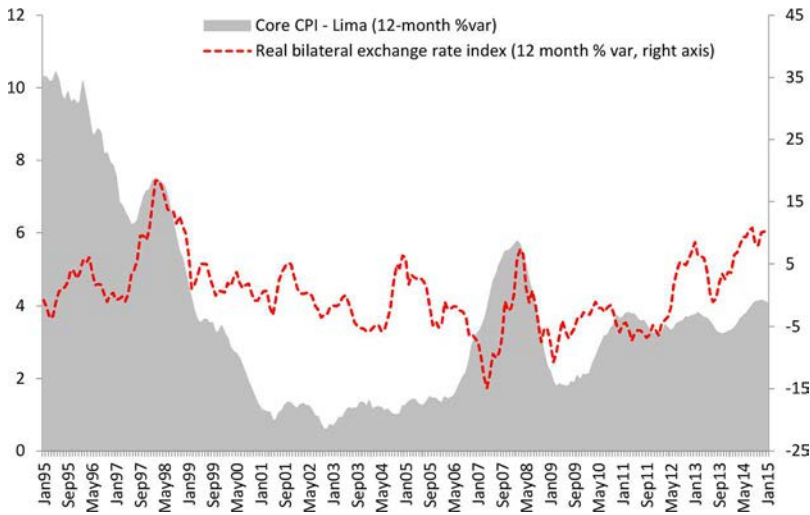


Figure 7. Inflation and real exchange rate (var% 12 months). *Source:* Banco Central de Reserva del Perú.

Moreover, the evidence shows that the impact of the exchange rate on inflation is greater when the dollar goes up;¹⁰ if the pass-through effect is 0.2, a local currency depreciation of 30 percent per annum will add six extra percentage points over one or two half years.

The inflation target in the Peruvian economy should be higher if it is to be met most of the time—not just during times of plenty with an exchange rate on a downward trend, but also in lean times with an exchange rate on an upward trend.¹¹

Monetary and fiscal policy in 2013–2015

A drop in the price of metals or capital flight constitute a negative demand shock, as well as a negative supply shock via the exchange-rate increase. Economic activity declines and inflation can go up.

The monetary and fiscal authorities should reduce the local interest rate and increase public spending to counteract the negative demand shock. Moreover, they should sell dollars to counteract the negative supply shock. It is assumed that price stability and full employment are the objectives of the monetary and fiscal authorities. The BCRP loses foreign currency reserves during the time in which the external shock is not reversed or the real exchange rate fails to rise. If the external shock is persistent, the real exchange rate has to rise.

The BCRP must sell dollars to curb the rising exchange rate. However, in six of the seven major recessions of the past sixty years, the BCRP's foreign

¹⁰On the emerging economies, see Caselli and Roitman (2016); on Peru, see Pérez Forero and Vega (2015).

¹¹Misgivings regarding the desirability of such a low target inflation rate are ongoing; see IMF (2016c).

exchange reserves were left depleted. The only exception to this was the crisis of 2008–9 during García’s second term in office. The BCRP had accumulated dollars during the times of plenty, and the lean times were short-lived. Thus, the BCRP was able to put the brakes on the rising exchange and inflation rates and the balance sheet effect.

The BCRP ought to reduce the interest rate and the Ministry of the Economy should increase public investment to cushion the recessionary impact of the negative external shock. This is the basic lesson of Keynesian economics. However, in six of the past seven recessions, Peru has increased the interest rate (tightening monetary policy instead of loosening it) and cut public spending, thus intensifying the external recessionary impulse. Again, the sole exception was 2008–9 when the BCRP lowered the interest rate and the Ministry of the Economy increased public spending. Of the past four recessions, for which quarterly GDP data are available, this was the least prolonged and the least deep, despite the considerable severity of the negative external shock.

The application of these Keynesian policies requires extensive foreign-currency reserves in the BCRP.

Finally, a dollarized banking system such as Peru’s can become dangerously unstable if the central bank does not have dollars, and a negative external shock occurs. The banking crisis and the recession of 1998–2000, late in the Fujimori dictatorship, demonstrated as much. Defaults increased rapidly with the rise in the exchange rate,¹² triggering runs by external creditors and depositors on local commercial banks. A number of banks either went bust or were bailed out by the Treasury, including the second- and third-largest in the country by total deposits.

What was done with the monetary policy in 2013–15? The first point regarding the monetary policy is that, by the end of 2015, half of the BCRP’s foreign-currency reserves—measured by the net international position at its historical peak, which reached 25 percent of GDP—had been sold.¹³ During the crisis of 2008–9, the BCRP only sold a quarter of its foreign-exchange position, measured in the same way. At this rate of dollar sales, the foreign-exchange reserves would be exhausted in two or three years. Because it is unlikely that this negative external shock could be reverted in that time, it is clear that the BCRP overdid it considerably in its sale of dollars, thereby jeopardizing future monetary policy.

The BCRP has been leaning against the wind in the foreign-exchange market. As shown in [Figure 8](#), when the exchange rate goes up, the BCRP sells dollars and the foreign-exchange reserves decrease; and vice versa, when the exchange rate goes down, the BCRP buys dollars and the foreign-exchange

¹²See BCRP (2016) for an analysis of the impact that the current increase in the exchange rate has had on dollar loan defaults.

¹³The BCRP’s net international position discounts foreign currency belonging to the public sector and the commercial banks from net international reserves.

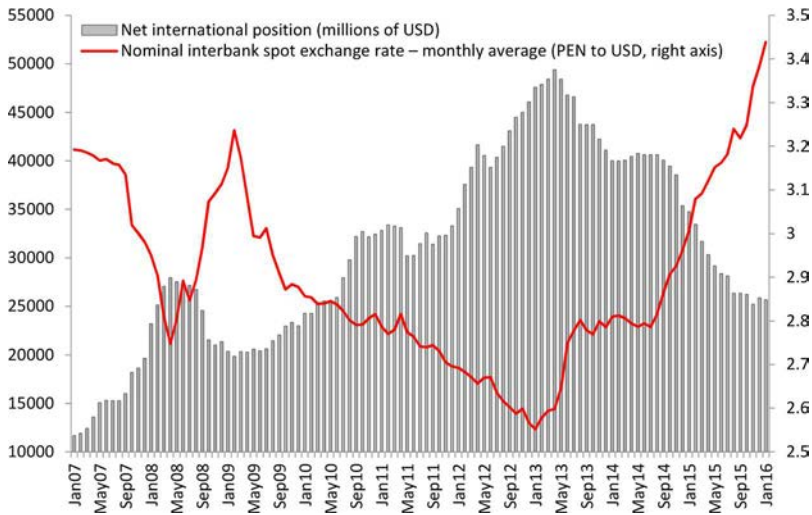


Figure 8. BCRP net international position and nominal exchange rate. *Source:* Banco Central de Reserva del Perú.

reserves increase. From April 2013 until the start of 2016, the exchange rate rose by 36 percent while the BCRP sold half of its foreign-exchange position.¹⁴ By the end of the first half of 2016, the BCRP resumed its dollar purchases after the exchange rate reversed its upward trend, both in Peru and in other Latin American countries.

The second point regarding the monetary policy is that the central bank did not respond to this drastic slowdown in the urban economy with an aggressive cycle of reductions in the reference interest rate, as it did during the crisis of 2008–9. The BCRP decided to use this instrument chiefly to temper the rise in the exchange rate and not to counteract the recessionary impulse generated by the negative external shock and the cutbacks in public investment.¹⁵ Thus, in the first stage, it dropped its reference rate from 4.25 percent per annum in late 2013 to 3.25 percent per annum at the start of 2015. In the second stage, between late 2015 and early 2016, the BCRP reversed its position with a fourfold increase in the reference interest rate to 4.25 percent per annum—the same as had been in place at the start of 2013.

The reduction in the reference rate during the first stage had two characteristics that served to diminish its positive impact. First, the BCRP warned in November 2013 that this reduction did not mark the beginning of a cycle of

¹⁴The private pension funds (Administradoras de Fondo de Pensiones, AFPs) increased the proportion of their total portfolio invested abroad from 30 percent to 40 percent over the period 2013–15 with the authorization of the BCRP; at the start of 2013, the total AFP portfolio accounted for 80 percent of the BCRP's exchange-rate position.

¹⁵The effect of the interest rate on the exchange rate should operate via the channel of capital flows. However, neither gross inflows nor gross outflows of capital respond significantly to the local-external interest rate differential on a panel of twenty-two emerging economies, according to the IMF (2016, ch. 2). Conversely, there is in fact evidence of the impact of the BCRP's exchange-rate intervention on the price of the dollar; see Adler et al. (2015) and Tashu (2015). In the Peru of today, external factors would seem to be the driving force behind the evolution of the exchange rate, counteracted by the BCRP's sterilized exchange-rate intervention.

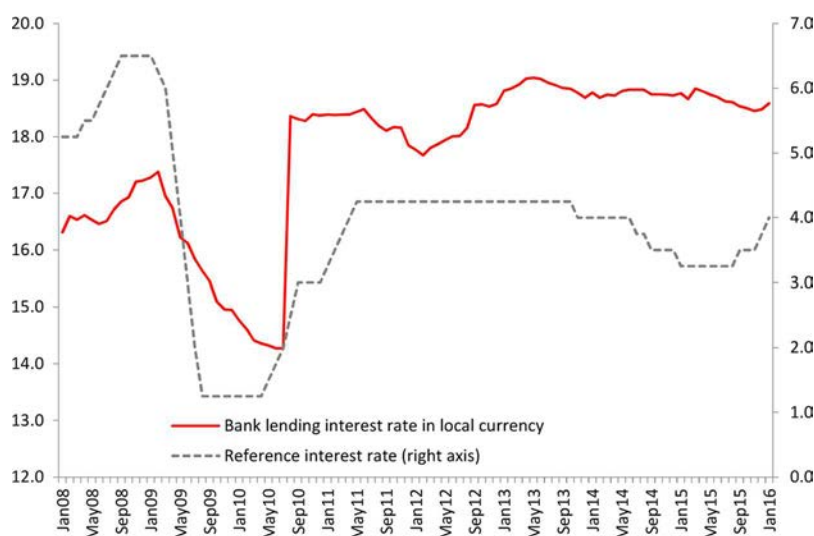


Figure 9. Reference interest rate and bank lending interest rate in local currency. *Source:* Banco Central de Reserva del Perú.

decreases.¹⁶ Second, the BCRP allowed the interbank market interest rate to stray increasingly from the reference rate, which took the commercial banks by surprise.¹⁷ International experience shows that both of these characteristics push down the reference interest rate pass-through on long-term bank lending rates, which are those that influence private consumption and investment spending. As shown in Figure 9, between the third quarter of 2013 and the second quarter of 2015, the reference interest rate fell by 100 basis points while a representative bank lending interest rate decreased by just 20 basis points; this was completely different from what happened during the crisis of 2008–9.

In summary, the BCRP stopped selling half of its foreign-currency reserves to halt the rise in the exchange rate without pushing down the reference rate. Under this monetary policy, the interests of large foreign-currency debtors,¹⁸ as well as their creditors, prevailed over the interests of the national economy, and the BCRP embarked on a policy course that will prove unsustainable if the negative external shock persists.

According to the BCRP, the instrument used to combat the stagnation of the urban economy was the progressive lowering of the reserve requirement ratio on deposits in local currency (LC) from 24 percent at the start of 2013 to 7 percent at the end of 2015, which serves to cheapen LC bank credit and make it more abundant.

¹⁶Since 2008, the U.S. and European central banks have done the opposite: they have announced that their reference interest rates, close to zero, will remain there for an extended period in order to lower the longer-term interest rates.

¹⁷See BCRP (2015), which contains a daily graph, for one year, of the gap between the interbank interest rate and the reference rate.

¹⁸According to Kliatskova and Mikkelsen (2015), the exchange-rate intervention (sale of dollars) and the increase in the reference exchange rate are stronger in the case of local currency depreciation, in those emerging countries with greater foreign-currency debt in the nonfinancial private sector.

However, there is not much evidence as to the potential effectiveness of this instrument in the current monetary regime, where the BCRP regulates the interbank interest rate.¹⁹ Moreover, it is debatable whether the expansion of LC banking system credit to the private sector—which increased by ten GDP points in 2011–15—can be attributed to this decrease in the reserve ratio rather than the fixing of the interbank interest rate per se, combined with the need on the part of big nonfinancial companies to substitute debt in dollars with debt in local currency in the context of exchange-rate rises.

In the case of fiscal policy, the first thing to be pointed out is that the Ministry of the Economy and Finance (MEF) gave priority to “structural reform” over macroeconomic stabilization—that is, to lowering working standards (fortunately, without success) and environmental protection standards (unfortunately, with success),²⁰ on the pretext that costs associated with labor and environmental standards had to be curbed in order to increase private investment and stimulate the economy.

The second point regarding fiscal policy is that the MEF reduced public investment in 2014 and 2015—especially that implemented by local and regional governments—while the economy cooled off,²¹ as can be seen in [Figure 10](#). Studies show that the public investment multiplier is greater than that corresponding to current expenditure or tax reductions (see BCRP, 2016; IMF, 2016b; and MEF 2015). This occurred even though greater public investment and a larger fiscal deficit could easily have been financed: the Fiscal Stabilization Fund and other dollar deposits of the Peruvian government included in the BCRP’s foreign-currency reserves are equivalent to 7 percent of GDP; the Peruvian government has seamless access to credit on the internal and external bond markets; and finally, the Peruvian public debt is small and does not exceed 25 percent of GDP.

The third point regarding the fiscal policy is that in late 2014 the MEF launched a package of tax reductions aimed primarily at companies; this precipitated a decline in tax income from 22.2 percent of GDP in 2014 to 20.0 percent of GDP in 2015,²² adding to the effects of the slowdown in economic activity and the decrease in commodity prices. The fiscal deficit reached 2 percent of GDP in 2015 after an all but balanced budget was achieved in 2014, while a fiscal deficit of 3 percent of GDP is projected for 2016 (BCRP, 2016b).

The net effect of the tax cut and the public investment cutbacks on economic activity was recessionary in 2015. “When the fiscal impulse is

¹⁹According to Cermeño et al. (2015), the reserve ratio—in contrast to the reference interest rate—does not influence the bank lending interest rates in LC fixed by the six biggest banks in Peru. According to Dancourt (2012), the reserve ratio—in contrast to the reference rate—only influences the LC bank credit of small financial institutions.

²⁰For a detailed analysis of this policy process, see Durand (2016).

²¹The gross fixed capital formation of the local and regional governments fell from 3.9 percent of GDP in 2013 to 2.7 percent of GDP in 2015; see BCRP (2016a, p. 83).

²²A third of this decrease in tax revenue is attributed to tax cuts; see BCRP (2016). Of particular note is the cut in income tax payable by companies, scheduled over several years, and the modifications to the general sales tax payment system.

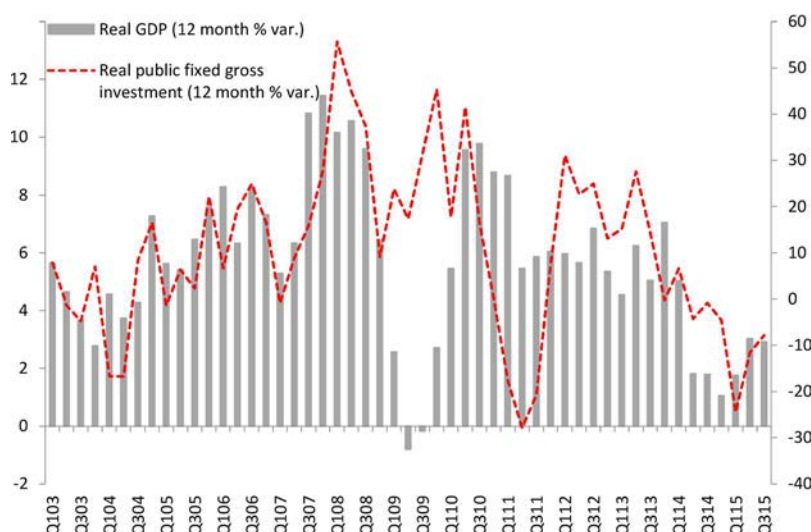


Figure 10. Gross domestic product (GDP) and public investment (annual growth rates). *Source:* Banco Central de Reserva del Perú.

broken down by income and expenses and each of these factors is weighted by its multiplier effect on economic activity, [it turns out that] the fiscal policy had a contractionary impact of 0.5 percent of GDP” (BCRP, 2016a).²³

Conclusion: The challenges facing the new government

The outlook is not promising. The new government of Pablo Kuczynski has inherited a stagnant urban economy,²⁴ low inflation that has nonetheless been above the monetary authority’s target range for a prolonged period, and a fiscal deficit of 3 percent of GDP—a fifteen-year high. The external forces—high commodity prices and capital inflows—that have driven economic growth during the recent times of plenty will be out of bounds for the foreseeable future.

The first task of the new government will be to stimulate Peru’s urban economy and create jobs during these lean times, which may persist throughout the entire term. This would require positive monetary and fiscal impulses to propel the urban economy. However, Pedro Pablo Kuczynski has confirmed that the current president of the BCRP will remain in his post; this appears to suggest that the reference interest rate will not be lowered while inflation is above the target or while there are upward pressures acting on the exchange rate.

As to fiscal impulse, Kuczynski’s government has promised to lower taxes again to stimulate private spending, apparently without reversing the income tax reduction initiated by the Humala administration. These tax cuts, accompanied by a fiscal deficit equal to 3 percent of GDP, would generate a negative fiscal impulse, as in 2015. A fall in tax revenues would demand

²³Translated by the author.

²⁴For an optimistic view of this inheritance, see IMF (2016c).

an equivalent reduction in public investment to guarantee that this target fiscal deficit is met. And as the balanced budget multiplier establishes, this fiscal policy has a recessionary effect if the private sector does not spend all the money saved from the tax cut.

The stagnation of Peru's urban economy will continue if the new government persists with the combination of monetary and fiscal policies applied in 2014–15.

The second task of the new government will be to diversify the Peruvian economy. Industries other than mining, and spending components other than investment in the extractive sectors will have to spearhead economic growth. A plan is required, underpinned by public investment, to develop new non-traditional exports—tourism included—and substitute imports. A higher exchange rate, prompted by a long-lasting negative external context, will favor this process of diversifying the economy.

A third task of the new government will be to mitigate the incipient conflict between a high real exchange rate and low inflation, which could intensify. Directly tackling excessive local medication, fuel, and electricity prices by way of regulation, for instance, could aid in this task.

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Appendix

Core inflation in the current period (p) is given by:

$$p = (1 - a)w + aE, \quad (1)$$

where w , E represent the percentage variation in the nominal wage and exchange rate during the current period, where $0 < a < 1$.

The current wage increase, which results from negotiations between entrepreneurs and employees, is given by:

$$w = bp(-1) + (1 - b)pm + cY, \quad (2)$$

where $p(-1)$ is the inflation from the previous period, pm is the central bank’s inflation target, in which $0 < b < 1$, and Y is the output gap or difference between effective and potential output.

From (1) and (2), the following is obtained:

$$p = bp(-1) + (1 - b)pm + [a/(1 - a)]e + cY, \quad (AS)$$

where $e = E - p$ is the percentage variation of the real exchange rate by period. Current inflation, according to the aggregate supply (AS) equation, depends on past inflation, the central bank’s inflation target, real exchange rate shocks—considered an exogenous variable—and the output gap (Y). In an inflationary equilibrium, inflation is equal to the target ($p = pm$) if the real exchange rate does not vary ($e = 0$), and the output gap is null ($Y = 0$).

The output gap is inversely dependent, with a lag, on the real interest rate, which is defined as the nominal interest rate less the core inflation, as in Rudebusch and Svensson (1999); and also depends on a shock (G) on aggregate demand. It is assumed that the competitiveness effect and the balance sheet effect of the real exchange rate cancel each other out. That is,

$$Y = -d[i(-1) - p(-1)] + G. \quad (4)$$

Finally, we have a central bank that applies an incomplete Taylor rule. The central bank is only concerned about the inflation gap, the deviation of inflation relative to the inflation target, and does not try to stabilize the output gap. That is,

$$i = pm + h[p - pm], \quad (5)$$

where the nominal interest rate (i) is directly dependent on the inflation gap ($p - pm$); let us assume that $h > 1$ so that the real interest rate ($i - p$) is positive (negative) when inflation is higher (lower) than the target. The intercept of (5) is explained by the assumption that the real interest rate is zero at stationary equilibrium—that is, the nominal interest rate is the same as the inflation target.

From (4) and (5), the following is obtained:

$$Y = -d(h - 1)[p(-1) - pm] + G. \quad (AD)$$

The aggregate demand equation (AD) implies that the output gap of today is negative (there is idle productive capacity) if the inflation of yesterday was above target, because the real interest rate was positive given no demand shock ($G = 0$). Equation (AS), the aggregate supply curve, and Equation (AD), the aggregate demand curve, where the Taylor rule has already been inserted, summarize the model.

From (AS) and (AD), assuming no demand shocks ($G = 0$), the following is obtained:

$$p = [B]p(-1) + [1 - B]pm + [a/(1 - a)]e. \quad (6)$$

That is, current inflation is a weighted average of past inflation and the central bank's inflation target, plus the real exchange rate shocks. In Equation (6), $B = b + cd(h - 1)$.

If x is the deviation of inflation from the target attained in the past,

$$x = \{[p(-1) + p(-2)] / 2pm\}, \quad (7)$$

it can be established that the coefficient (a) depends directly on x ; for example, that

$$a = x/x + 1. \quad (8)$$

The idea is that the system of wages and prices fluctuates between two alternative anchors: the exchange rate and the central bank's inflation target. Thus, the weight of a real exchange-rate shock in Equation (6), given by $a / (1 - a)$, will increase the lower the attainment with the inflation target in the past is. If target attainment in the past has been perfect [$p(-2) = p(-1) = pm$], this means that $x = 1$, that $a = 0.5$, and that the coefficient of a real exchange rate shock in Equation (6) is equal to 1, then the credibility effect is at its maximum. If average past inflation has been 3 percent per period and the target is 2 percent per

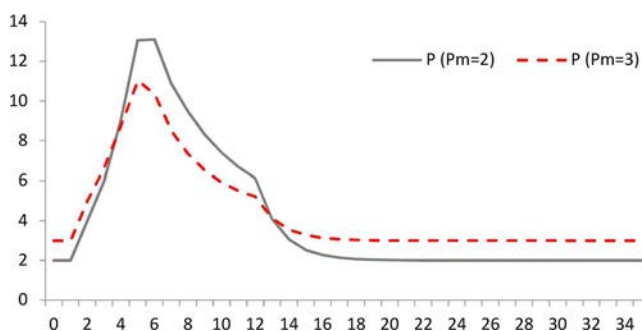


Figure A1. Inflation trajectories.

period, then $x = 1.5$, $a = 0.6$, the credibility effect is reduced, and the coefficient of the variation in the real exchange rate in Equation (6) increases to 1.5; a similar idea in reference to coefficient (b) of Equation (2) is proposed in Argov et al. (2007).

According to (6), a higher target (pm) pushes up inflation, given past inflation and the real exchange rate shock. According to (7) and (8), there is an opposite credibility effect because a higher inflation target enables a greater degree of attainment with the target and, as such, a lower real exchange rate shock coefficient. In this way, it could be that the same temporary real exchange rate shock elevates inflation with a higher target to a lesser extent than that with a lower target, in the transition from one equilibrium to another.

Using (6), (7), and (8), if $b = 0.5$, $c = 0.2$, $d = 1$, $h = 1.2$, which implies that $B = 0.5$, and if the two alternative inflation targets are 2 percent and 3 percent per period, the inflation trajectories in both economies with the same real exchange rate shock are shown in Figure A1. The persistent exogenous real exchange rate shock is 2 percent per period for four consecutive periods starting from period 2; 1 percent in the following period; 0.5 percent in the following six periods; and 0 in the remaining periods. Inflation with a higher

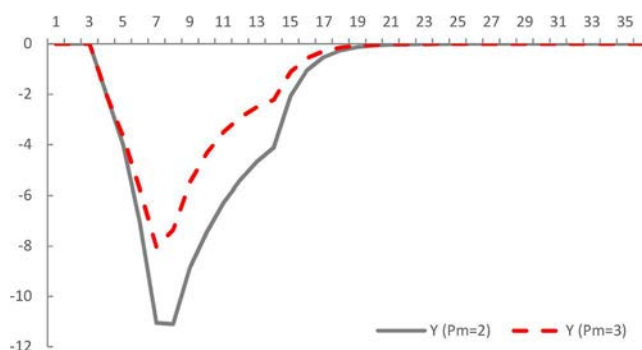


Figure A2. Output gap trajectories.

target is less than that with a lower target in the transition from one stationary equilibrium to another, because the credibility effect dominates. The trajectories of both output gaps are shown in [Figure A2](#). Recession is also less with a higher inflation target in the transition from one stationary equilibrium to another. The stationary equilibrium, with no supply shocks ($e = 0$) or demand shocks ($G = 0$), implies a constant inflation equal to the target and an output gap equal to zero.