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Outside the Band:
Depreciation and Inflation Dynamics in Chile

by Esther Pérez Ruiz

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Abstract

This paper examines inflation dynamics in Chile during the last peso depreciation episode 2013−15. The evidence is for substantial pass-through effects to inflation, given the large and persistent depreciation movement. Widespread indexation practices in non-traded goods markets are found to amplify the inflation response to the depreciation, while the role of wage indexation is less relevant to the inflation dynamics. Overall, inflation would have remained within the central bank's target band absent the peso depreciation. The analysis also shows that tightening monetary policy in response to a depreciation shock can be costly in terms of output: the response of activity to rates is found to be strong, while the transmission from activity to inflation is found to be weak. Simulations under uncertainty about the extent of the pass-through also suggest that monetary policy can play a countercyclical role in the face of depreciation shocks at a moderate inflationary cost, as long as inflation expectations remain anchored.

JEL classification: E31, F3, F41.
Keywords: traded goods inflation, non-traded goods inflation, exchange rate pass-through, indexation, monetary policy, Chile
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"Vergara reconoce que la inflación ha sido más persistente de lo esperado, lo que asoció a una depreciación del peso también más fuerte de lo previsto, que ha tenido efecto en los precios de bienes importados que forman parte de la canasta del IPC, además de la indexación o efectos de segunda vuelta de la inflación."

El Mercurio, Economía y Negocios, March 11, 2016

I. INTRODUCTION[1]

Chile's exposure to external shocks. Chile's small-open, commodity-exporting economy is considerably affected by external shocks. Exports are heavily oriented towards natural resources (copper goods), while a large share of imports are intermediate inputs (fuels, machinery and equipment). The starkly different composition of the production versus demand baskets, alongside a free oriented trade policy and limited public intervention in the economy, implies that shifts in commodity prices feed through the economy fairly quickly, changing inflation dynamics.

Recent inflation developments. As other LATAM countries, Chile has seen a surge in inflation over the last two years. The end of the commodity super-cycle in 2013 and ensuing decline in copper prices have led to a sizable Chilean peso depreciation (almost 50 percent relative to the U.S. dollar and 15 percent in nominal effective terms, cumulatively 2013−15). Headline inflation has exceeded the central bank's target band (2−4 percent) for 23 consecutive months while inflation expectations at 2 years have remained well anchored.

Depreciation pass-through to inflation and second-round effects. Lower copper prices and related peso depreciation constitute an exogenous supply shock for Chile. Two transmission channels to inflation are potentially at play, the depreciation's direct inflationary impact through traded goods (IMF, 2016) as well as second-round effects through non-traded goods and wages. The Chilean economy provides a fertile ground for assessing the impact of second-round effects, given widespread indexation via *unidad de fomento (UF)*[2]. UF (the amount of pesos that preserves the purchasing power of a representative basket of consumer goods) is extensively used as a unit of account in quoting Chilean prices. While expressed in peso terms (as opposed to UFs), wage indexation to the CPI and its transmitter role in the inflationary process also deserves investigation.

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[1] This paper is dedicated to Igor Lebrun. Special thanks to RES's Economic Modeling Unit and Susanna Mursula, who contributed the uncertainty analysis included in Section VI. I am indebted to Ehab Tawfik for excellent research assistance. I am grateful to Stephan Danninger for support and guidance and to Patrick Blagrave, Luis Brandao, Yan Carriere-Swallow, Bertrand Gruss, and Marika Santoro for helpful comments and discussions.

[2] See *Decreto sobre indexación, diario oficial de la república de Chile, January 29, 2010.*

External shocks and relative price adjustment. For external rebalancing purposes, Chile relies on a floating rate regime since 1999. Exchange rate flexibility is desirable in economies frequently exposed to terms of trade shocks, such as Chile (De Gregorio and others, 2005). Exchange rate movements generate relative price adjustments between traded and non-traded goods, leading to resource reallocation and mitigating the impact on output from external real shocks. Specifically, the peso depreciation started in 2013 needs resource reallocation away from non-traded goods and the question arises whether indexation constrains the needed shift.

Purpose. Against this backdrop, this paper explores the implications of the recent peso depreciation for inflation dynamics in Chile. It seeks to understand the following questions. During the floating exchange rate period 1999−2015, has inflation been a stationary process? Has inflation inertia changed since the start of the floating exchange rate regime? During the last deprecation episode 2013−15, what is the role of pass-through effects in driving inflation dynamics? To what extent does indexation amplify the inflation response to the depreciation and slows the adjustment of the economy to the higher traded-goods relative prices?

Methodology. This paper takes an eclectic approach and relies on a suite of techniques. First, we rely on a purely statistical (model-free) approach to establish the degree of inertia embedded in the inflationary process. Second, we use a partial equilibrium framework to characterize inflation in an indexed small open economy and to gauge the relative importance of depreciation pass-through versus second-round effects. Third, we estimate a VAR to analyze the joint time-series behavior of a system of activity, prices, and monetary policy variables in response to a depreciation shock. Fourth, we use a semi-structural general equilibrium model to simulate the response of output and inflation to a depreciation shock under uncertainty about the extent of pass-through, for different assumptions on the conduct of monetary policy and on inflation expectations.

Main results. Despite moderate inflation inertia, we find substantial pass-through effects to inflation, given the large and persistent depreciation episode. Direct depreciation pass-through to traded goods dominates the inflation dynamics, while second-round effects from widespread indexation via UF pricing (or wage indexation) are more limited. Counterfactual analysis finds that inflation would have comfortably remained within the target band absent the peso depreciation. VAR analysis shows that monetary tightening in response to a depreciation shock can be costly in terms of output: the response of activity to rates is found to be strong, while the transmission from activity to inflation is found to be weak. However, a credible monetary authority such as the Central Bank of Chile may need not raise rates to keep inflation on track in the face of a depreciation shock. Indeed, simulations under uncertainty about the extent of the pass-through suggest that, as long as inflation expectations remain anchored, monetary accommodation can cushion the fall in activity at a moderate inflationary cost.

Structure of the paper. The rest of the paper is organized as follows. Section II puts recent inflation developments in historical perspective. Section III uses univariate techniques to analyze inflation inertia during the floating exchange rate period 1999−2015. Section IV estimates a simple model of inflation for Chile's small open economy, whereby depreciation shocks affecting traded goods are transmitted to non-traded goods and wages via indexation. Section V presents VAR evidence for price and wage dynamics in response to an exchange rate shock. Section VI discusses the response of output and inflation to a depreciation shock under uncertainty about the extent of pass-through, for different assumptions on the conduct of monetary policy and on inflation expectations. Section VII concludes.

II. Inflation Developments during the Floating Exchange Rate Period

Adoption of inflation targeting and stabilization. Chile's adoption of an inflation targeting regime in 1990 was instrumental in breaking high inflation expectations, reducing the extent of indexation mechanisms, and lessening the cost of stabilization[3] (Landerretche and others, 2000) (Figure 1). As a result, inflation was brought down monotonically from 30 percent in 1990 to 3 percent in 1999.

Floating exchange rate regime and terms of trade shocks. The credibility of the monetary framework was further strengthened by the adoption of a floating exchange rate regime in 1999 and of a stationary inflation target band (2−4) percent in 2001. Since then, inflation has generally remained within target, exceeding the band on occasion in response to large swings in the terms of trade.

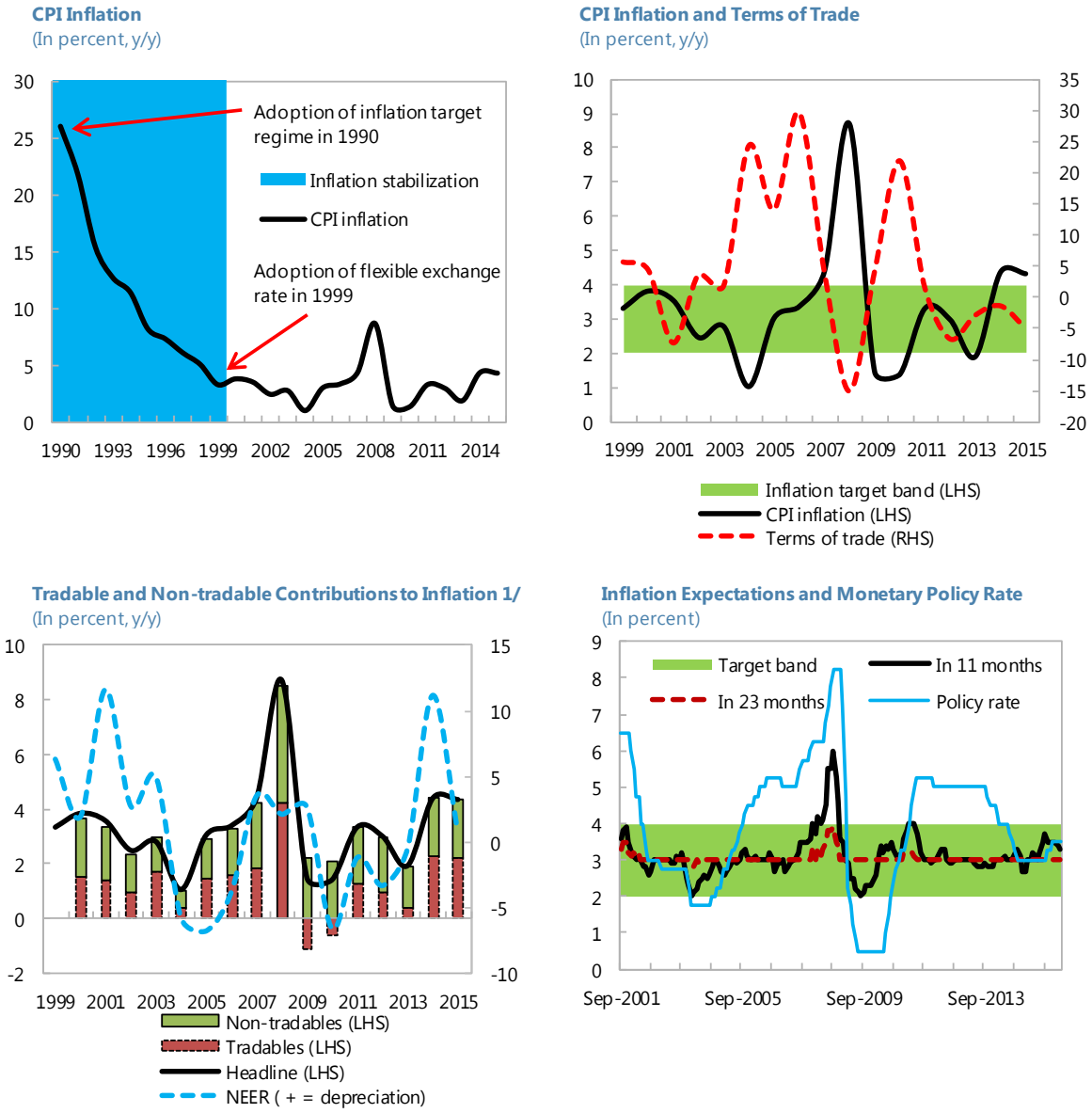
Inflation developments during the last depreciation episode 2013−15. Chile's rise in inflation since the end of the commodity super-cycle has coincided with changes in both the external environment and domestic conditions. The sharp drop in oil prices since 2014Q4 alongside weakening growth have moderated inflation. The depreciation of the Chilean peso and other commodity-exporting EMEs currencies relative to the US dollar (taper tantrum episode, China slowdown) and widespread indexation via UF pricing have generated inflationary pressures. In all, headline inflation in Chile moved out the target band (2−4 percent) in April 2014, peaking at 5.7 percent in October 2014, thereafter declining steadily and crossing the 4 percent upper limit in May 2015. Since then, inflation has proved more volatile and generally remained outside the target range. Meanwhile, expectations at 2 years have remained well anchored.

Monetary policy. Hard-earned credibility during the inflation targeting regime has allowed monetary policy to remain broadly accommodative over the past two years. With inflation below target and a weakening economic outlook, the central bank eased monetary policy in October 2013, cutting the policy rate from 5 to 3 percent by November 2014. The strong monetary accommodation, alongside decisive fiscal impulse, helped stabilize the economy.

[3] Relative to alternative stabilization options, such as an exchange rate targeting regime.

Prospective rates normalization by the Fed and a slight drift in inflation expectations at a one-year horizon led the central bank to tighten monetary policy throughout Q42016, with total hikes of just 50 basis points by January 2015. Since then, monetary policy has been at a standstill amidst continued signs of economic weakness.

Figure 1. Chile: Inflation Dynamics in Historical Perspective



Source: Haver Analytics, Inc., and Staff calculations.

1/ Based on fixed weights of tradable components (56.4%) and non-tradable components (43.6%)

III. MODEL-FREE DIAGNOSIS

Purpose. This section looks into inflation inertia from a model-free perspective. It analyzes the time series properties of monthly inflation during the flexible exchange rate period 1999−2015. It seeks to address the following questions: Has inflation exhibited a unit root in the sample? Has inertia been stable, increased, or decreased over time? We address these questions for headline, traded, and non-traded goods CPI inflation (see Table 1 for a detailed breakdown of inflation into the traded and non-traded goods components).

Table 1. Tradable and Non-tradable Components of CPI Divisions, 2015

CPI Division	CPI Weight	Non-tradable component of division in CPI	Tradable component of division in CPI
	(in percent)		
Food and non-alcoholic beverages	19.06	0.00	19.06
Alcoholic beverages and tobacco	3.31	0.00	3.31
Clothing and footwear	4.48	0.08	4.41
Lodging facilities, water, electricity, gas and other fuels	13.83	8.19	5.63
Furniture, household and household maintenance items	7.02	2.74	4.28
Health-care	6.44	3.91	2.53
Transport	14.47	5.73	8.74
Communications	5.00	4.59	0.41
Recreation and culture	6.76	1.77	5.00
Education	8.09	8.09	0.00
Restaurants and hotels	4.37	4.37	0.00
Miscellaneous goods and services	7.16	4.17	2.99
Total	**100.00**	**43.64**	**56.36**

Source: National Statistics Institute and staff calculations.

Methodology. To test the unit root hypothesis (that is, the effect of a white noise shock eventually dies off if time is long enough) we inspect the variance-ratio test (Cochrane, 1988) and the ADF unit root test. The variance of the *s*-difference of a stationary series grows linearly with *s*, therefore its variance ratio approaches zero.[4] The augmented Dickey-Fuller (ADF) tests whether the AR(1) monthly inflation process contains a unit root. To determine whether inflationary inertia has changed over time, we carry out rolling Quandt-Andrews breakpoint tests.

Moderate inflation inertia. Inflation rates have proved stationary in all three cases and have displayed a limited degree of inertia throughout time (Figure 2, Table 2). The variance ratio decreases and approaches to zero as time goes on for all three CPI indicators considered. The ratio decreases steadily, which is indicative of moderate inflation persistence. By ADF tests,

[4] Specifically, the variance ratio at lag *k* is the ratio between the variance of the *kth* difference to the variance of the first difference. For a random walk, the variance computed at each individual lag interval *k* is equal to unity.

the null of unit root is rejected at 99 percent confidence in all cases. The estimated AR(1) coefficients for traded goods, headline, and non-traded goods CPI inflation over 1999−2015 stood at 0.24, 0.33, and 0.41, respectively. By implication, a one percentage shock hitting prices in *t* dies off after 4, 5, and 6 months, respectively.

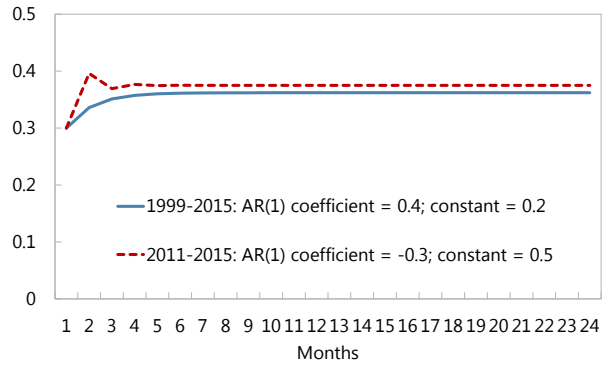
Table 2. Non Stationary and Breakpoint Tests
(monthly data, 1999−2015)

	Variance ratio test					ADF 1/	Quandt-Andrews Breakpoint Test 2/
	k=3	k=6	k=12	k=24	k=36		
CPI	0.45	0.26	0.15	0.09	0.05	-9.92***	3.99***
CPI, traded goods	0.41	0.23	0.14	0.08	0.04	-6.84***	3.26***
CPI, non traded goods	0.57	0.23	0.17	0.10	0.06	-8.99***	9.71

Source: Staff calculations.
1/ *t* statistic for augmented Dickey-Fuller test for the AR coefficient in an OLS regression including intercept. *** means the null of unit root is rejected at the 99 percent level.
2/ Maximum of the individual Chow F statistics on the OLS AR(1) regression including intercept. The breakdpoint is moved sequentially along the sample. *** means the null of no breakpoints cannot be rejected at the 99 percent confidence level. Exp and Ave statistics lead to similar conclusions.

No structural shifts in inflation dynamics. By rolling Quandt-Andrews breakpoint tests, the null of no breakpoints on a regression of monthly inflation on intercept and its own lag[5] cannot be rejected at 99 percent confidence for traded-goods/overall inflation (within the 142 possible dates tested). Non-traded goods CPI nevertheless presents a breakpoint around 2010M03. To gain a better understanding of inflation dynamics by all three indicators we split the sample into three sub-periods, 1999−2004, 2005−10, and 2011−15, meant to capture the copper price norm, super-cycle, and correction periods, respectively (Figure 20. The analysis confirms coefficient instability in non-traded goods inflation during 2011−15. Relative to previous sub-periods, the AR(1) coefficient turns negative[6] and smaller in absolute value, while the intercept more than doubles. In all, the statistical breakpoint suggests a slightly

Inflation Dynamics for Non-traded Goods
(In percent, m/m)



Note: Chart shows the inflation path implied by AR(1) processes estimated for each period under the assumption of 0.3 percent inflation at month 1.

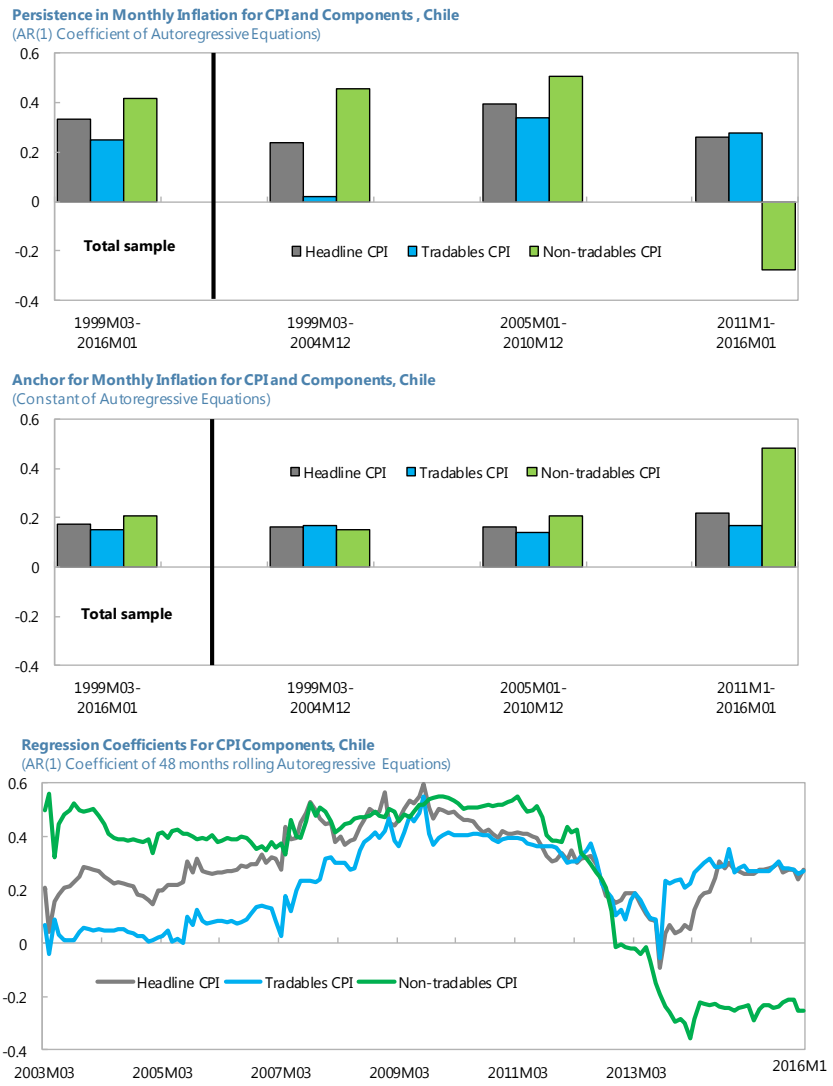
[5] *Joint* test on both the intercept and the AR(1) coefficient of the estimated autoregressive equations.

[6] The negative AR(1) coefficient delivers a modest overshooting before inflation eventually stabilizes (see text chart).

lower degree of inertia for non-traded goods inflation in the recent past (red line), although the change relative to the longer period does not seem economically meaningful.

Role of shocks to inflation dynamics. In sum, the statistical analysis in this section suggests that inflation appears to follow a similar process since the early 2000s. Absent a structural shift towards higher inertia, a sizable, persistent deviation of inflation from target (as the one seen since 2013) can be rationalized on the basis of a large, persistent peso depreciation. The rest of the paper therefore investigates the role of the 2013−15 peso depreciation in accounting for inflation dynamics over the last two years.

Figure 2. Chile: Inflation Inertia



Source: Staff calculations.
Note: All calculations use monthly data 1999M03−2015M01. All regressions are OLS of monthly inflation on intercept and its own lag.

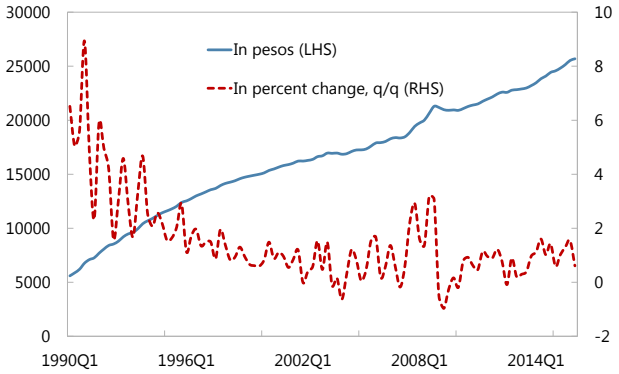
IV. Inflation Dynamics in an Indexed Small Open Economy

Purpose. This section presents a simple model of inflation for an indexed small open economy. The focus is on the relative importance of pass-through versus second-round effects transmitted via indexation. To what extent the inflation response to the depreciation is amplified by indexation?

Theory of indexation. The macroeconomic impact of indexation is subject to considerable debate. From an equity perspective, indexation is perceived as distribution-neutral since it allows the system of relative prices to survive in the face of shocks. From a stabilization perspective, the basic tenet on indexation is that it favors the stabilization of output and facilitates the reduction of inflation in presence of nominal shocks[7], while hindering relative price adjustment and accentuating output volatility in the face of real shocks.

Indexation in Chile. Widespread indexation is a structural feature of the Chilean economy. It is implemented via UF, a currency unit distinct from the peso used for pricing goods and services (Box 1). A broad range of Chilean prices are expressed in UF, including in the non-traded goods market (house rentals, education tuition, health insurance); the financial market (consumer loans, mortgages, fixed-income securities, long-term government securities); and the budget (income tax brackets, public wages, pension payments, and alimony). Private sector wages, consumer good prices, and stock prices are, among others, priced in peso. For wages, evidence nonetheless suggests staggered indexation, with a frequency of adjustment of around nine quarters (Cobb and Opazo, 2008).

Unidad de Fomento, 1990-2016Q1



Source: Central Bank of CHile.

Analytical framework. Following Landerretche and others (2000), we put forward a simple analytical framework to study inflation dynamics in Chile's indexed, small open economy (see Figure 3 for a flow chart). Headline inflation is broken down into traded goods and non-traded goods inflation:

$$\pi_t = \alpha \pi_{Tt} + (1 - \alpha)\pi_{NTt} \qquad (1)$$

[7] An important criticism to this line of argument is that it needs immediate and synchronized indexation. The conclusions are substantially modified in the face of lagged, uncoordinated indexation (see Jadresic, 1998).

where $\pi_t, \pi_{Tt}, \pi_{NTt}$ respectively stand for headline, traded goods, and non-traded goods CPI inflation at month *t*, with α denoting the weight of traded goods in the CPI basket.

Traded goods inflation is driven by a weak version of the purchasing power parity condition, modified to take account of the business cycle:

$$\pi_{Tt} = \gamma_1 neer_t + \gamma_2 \pi f_t + \gamma_3 \left(y_t - y^*\right) \qquad (2)$$

where $neer_t, \pi f_t, \left(y_t - y^*\right)$ respectively denote the rate of nominal effective exchange depreciation, the rate of foreign inflation, and the output gap at month *t*. The inclusion of the output gap term is meant to allow for pro-cyclical pass-through effects, whereby firms compress margins rather than pass on exchange rate changes when the economy cools down (see, e.g., Leiderman and Bar-Or, 1999, Goldfajn and Werlang, 2000).

Non-traded goods inflation reflects the influence of past aggregate inflation owing to indexation practice, nominal wage growth adjusted for non-traded goods labor productivity growth $\left(w_t - \lambda_{Nt}\right)$, and a forward looking inflation expectations term $\left(\pi^e_{t-1,t}\right)$:

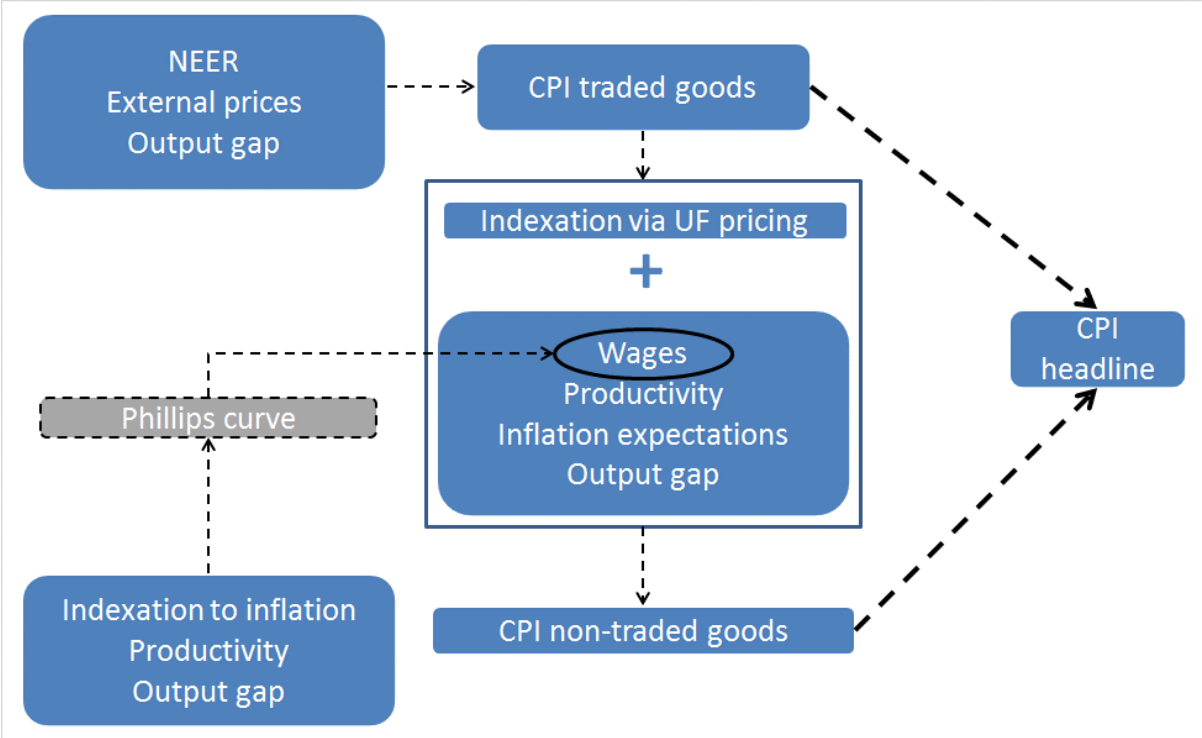
$$\pi_{NTt} = \beta_1 \pi_{t-1} + \beta_2 \left(w_t - \lambda_{NTt}\right) + \beta_3 \pi^e_{t-1,t} \qquad (3)$$

Nominal wage growth is driven by a Phillips curve with three terms, indexation to past and current inflation,[8] growth of aggregate labor productivity λ_t, and the unemployment rate gap $\left(u_t - u^*\right)$:

$$w_t = \sigma_1 \pi_t + \sigma_2 \pi_{t-1} + \sigma_3 \lambda_t + \sigma_4 \left(u_t - u^*\right) \qquad (4)$$

[8] Wage indexation with respect to *current* inflation stabilizes the real wage, preserving full employment (exacerbating employment fluctuations) in the face of nominal (real) shocks (Gray, 1970). However, as pointed by many (see, e.g., Fischer, 1988, Simonsen, 1983, and Jadresic, 1998), wages typically adjust to inflation infrequently and with a lag. In this context, wage indexation defines a nominal (as opposed to real) type of rigidity and needs not stabilize the real wage even in the face of nominal shocks.

Figure 3. Conceptual Framework: Price Formation in Chile's Indexed Small Open Economy



Estimates. Equations (2)−(4) are estimated by OLS for monthly data ranging 2003−15 (Table 3). The estimated coefficients overall have the expected signs and are significant (at 99 percent confidence in most cases). The estimated depreciation pass-through to traded-goods inflation after one month is small (around 5 percent), with further exchange rate lag terms proving non-significant. There is some evidence of inertia embedded in the inflationary process, with indexation explaining over ¼ of the variance for non-traded goods inflation and slightly less than one fifth of the variance for wage inflation. This suggests that indexation practice via UF pricing is more relevant to the inflation dynamics than wage indexation.[9]

Depreciation pass-through to inflation and second-round effects (Figure 2, top and middle charts). By the system (1)−(4), a nominal effective exchange rate depreciation has a direct impact on traded goods inflation and ripples through non-traded goods and wages via indexation, confirming results from the previous literature. The estimated coefficients overall point to a low degree of inertia embedded in the system. By way of illustration, a one percentage depreciation shock dissipates after four months for traded goods and headline CPI (six months for non-traded goods inflation), and barely affects wage inflation.

[9] The de-indexation of wages contributed to the successful implementation of inflation fighting campaigns during the 1990s (Lefort and Schmidt-Hebbel, 2002).

Box 1. Indexation in Chile

Chile's monetary system: two units of account. Money serves as a medium of exchange, store of value, and unit of account. Like other modern currencies, the Chilean peso fulfills all money functions. Unlike other nations, Chile has two units of account. A broad range of Chilean prices is expressed in *Unidad de Fomento (UF).* UF is the amount of pesos necessary to buy a representative basket of consumer goods. Pricing in UFs therefore indicates the seller's will to receive a fixed quantity of CPI basket-equivalents as payment. UF is a purely abstract unit of account, as goods quoted in UFs can only be purchased with pesos.

Origin and rationale. The UF was introduced in 1967 by the Chilean government as an inflation-protection devise (Edmunds and Arroyo, 2012), though it only came into wide use as a unit of account in the 1980s (Levin, 1995). It is calculated and published daily by the Central Bank of Chile. UF is the world's first case of indexation through a money-like unit, as opposed to relying on an indexation formula (Shiller, 2002). Units of account were later adopted in other countries. Analogues include *Unidad de Valor Constante* (Ecuador), *Unidad de Inversión* (Mexico), *Unidad de Poder Adquisitivo Constante* (Colombia), and *Unidad Reajustable* (Uruguay). However, they are not as ingrained in their countries' economies as the UF is in Chile.

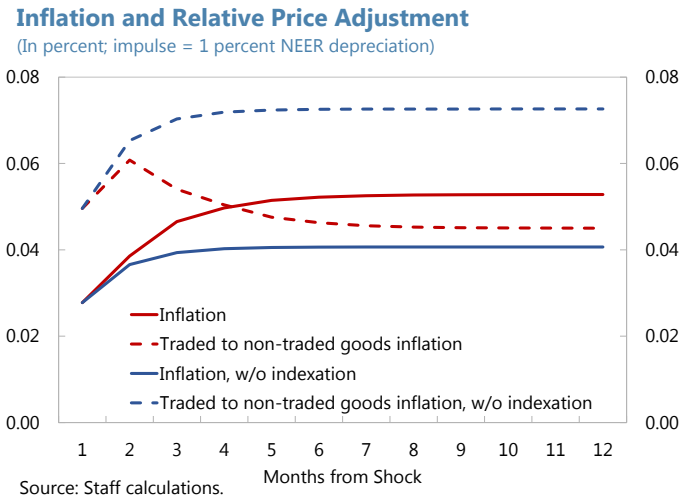
Use of the UF. The UF is widely used for rent payments such as mortgages, car loans, and long-term government securities. All taxes are expressed in UFs. Pension payments, alimony, and child support payments are automatically tied to the UF. Houses and offices for sale are often quoted in UFs. Wages are on the contrary denominated in pesos, still influenced by the UF (the change in the peso value of the UF is taken into account in wage deliberations).

How the system works. By way of illustration, a landlord receiving a monthly rate of 10 UF will get 230,000 pesos for a 23,000 pesos/UF exchange rate. If the central bank eases monetary policy, the peso's purchasing power will fall. If the peso content of the UF rises to, e.g., 25,000 pesos/UF, the monthly rental will now reach 250,000 pesos—while the rent payment is nominally higher, the payment's UF value (or consumer baskets) is constant.

UF pricing versus dollarization. A partially dollarized economy typically uses U.S. dollars to price long-term contracts and the local currency to price current goods and services. Advocates of indexed units of accounts (Shiller, 2002) regard the UF system as superior to dollarization. First, UF indexed payments are constant in terms of purchasing power (insofar as the UF is linked to Chile's CPI), while dollarized payments cannot provide the same protection (international purchasing power does not hold). Second, dollarized economies are vulnerable to balance sheet mismatches in the face of a currency depreciation. Third, indexation via a unit of account is automatic and symmetric, which solves a coordination problem that could otherwise lead to partial indexation, raising distribution concerns. However, one important caveat in adopting an indexed unit of account is that it may contribute to greater inflation inertia—the dimension explored in this paper.

Inflationary pressures from the last depreciation episode 2013−15 (Figure 2, bottom chart). Despite low inertia, the overall inflation response to the depreciation episode that began in 2013 is substantial, given the size and persistence of the shock. During that period, the peso depreciation reached 15 percent in effective terms and displayed and AR(1) coefficient of 0.97. Relative to a counterfactual of no depreciation, these estimates imply additional inflation of 0.6/0.3 percentage points for 2014/15, and 0.1 percentage points for 2016 (assuming that the nominal effective exchange rate remains at its March level through year-end). About 80 percent of the depreciation-induced inflation owes to direct pass through effects, with indexation generating the remaining 20 percent. Consequently, the underlying inflation rate over 2014−15 (the counterfactual, no depreciation inflation rate) would have remained within the central bank's target band.

Indexation and relative prices. In the face of a depreciation shock, indexation mitigates the deterioration in the price of non-traded relative traded goods, and overall slows inflation adjustment towards the new equilibrium (text chart). This is sub-optimal since it reduces the shock absorbing capacity of the exchange rate in response to a real type of shock—flagging world demand for copper goods resulting in lower copper prices. The relative profitability for traded goods is therefore dampened relative to an indexation-free scenario.



Caveats. While the total variance accounted for by the estimates reported in Table 3 is substantial given the monthly frequency of the data, some of the inflationary dynamics remains unexplained. The estimated pass-through/second round effects, and underlying relative price adjustment, should therefore be taken with caution.

Table 3. Estimation Results for Inflation 1/

CPI traded goods inflation			CPI non-traded goods inflation			Nominal wages inflation 2/		
Variable	Coeff.	Prob.	*Variable*	Coeff.	Prob.	*Variable*	Coeff.	Prob.
CPI traded goods (-1)	0.32	0.00	constant	0.16	0.00	constant	0.33	0.00
NEER	0.05	0.00	CPI (-1)	0.36	0.00	CPI non-traded goods	0.08	0.01
Foreign prices	0.10	0.01	CPI (-2)	0.20	0.05	CPI non-traded goods (-1)	0.06	0.04
Oil prices	0.02	0.00	Labor costs non-traded goods (-1)	0.11	0.07	CPI non-traded goods (-2)	0.04	0.10
Oil prices (-1)	0.02	0.00	Labor costs non-traded goods (-2)	0.19	0.00	CPI non-traded goods (-3)	0.08	0.01
Food prices	-0.03	0.04				CPI non-traded goods (-4)	0.04	0.14
Food prices (-1)	0.04	0.01				CPI non-traded goods (-5)	0.06	0.04
Food prices (-2)	-0.03	0.05				Unemployment gap	-0.03	0.04
Output gap	0.09	0.00						
Inflation expectations	0.05	0.00						
Observations	154			154			154	
R-squared	0.50			0.58			0.63	

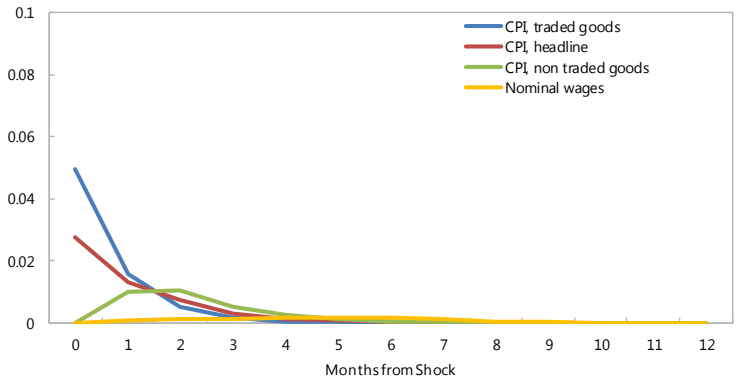
Source: Staff calculations.

1/ All regressions use monthly data 2003−15. All variables are natural log first differences, except the output gap and the unemployment gap, which are percent deviations from HP trend. Output is measured by the GDP proxy IMACEC. Inflation expectations are market expectations at a 2 year horizon (survey on economic expectations by central bank of Chile). All regressions include dummies for outliers (not shown). Outliers are 2008M5 for CPIT, 2009M1/2009M2/2010M8 for CPINT, and 2007M7/2008M1/2013M7/2010M1 for nominal wages.

2/ Sequentially adding lags for non-traded goods inflation marginally reduces the Schwarz criterion (in absolute value) while improving the regression fit.

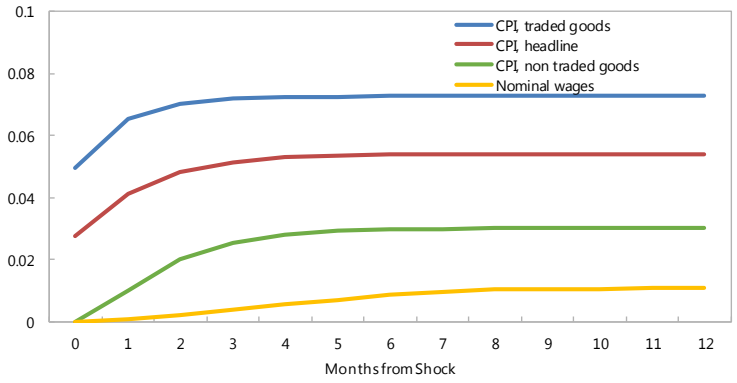
Figure 3. Inflation and the Nominal Effective Exchange Rate

Impulse Response
(In percent; impulse = 1 percent NEER depreciation)



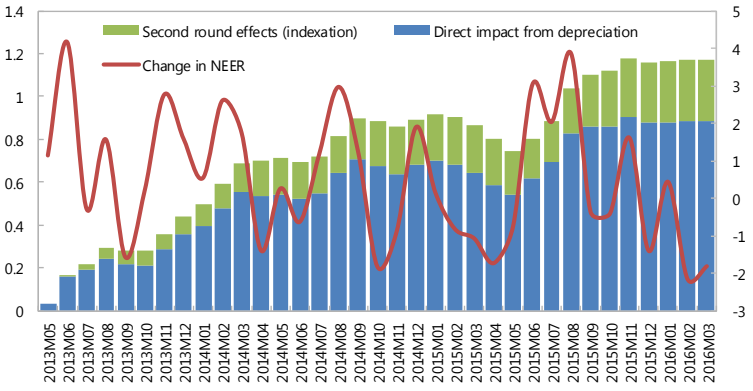
Note: Chart shows CPI and nominal wage inflation response to a 1 percent depreciation in the nominal effective exchange rate.

Accumulated Response
(In percent; impulse = 1 percent NEER depreciation)



Note: Chart shows CPI and nominal wage inflation cumulative response to a 1 percent depreciation in the nominal effective exchange rate.

Inflation and Actual Exchange Rate Movements
(Accumulated response, in percent)



Note: Chart shows accumulated impact on CPI inflation through *t* from exchange rate movements occuring 2013M0 through *t*.

Source: Staff calculations.

V. VAR EVIDENCE

Motivation. Using a VAR approach to examine inflation dynamics, specifically the degree of pass-through from nominal depreciation to domestic inflation, presents several advantages over conventional econometrics (Faruqee, 2006). Theoretically agnostic, a VAR is well suited to capture the complex interaction between the exchange rate, prices, wages, economic activity, and monetary policy. For the purpose of this paper, the approach allows us to investigate pass-through effects to traded and non-traded goods, once feedback effects of all endogenous variables to the (shocked) exchange rate are taken into account.

VAR configuration. Relative to the existing literature for Chile (Table 4), the analysis here presents two novel elements, it distinguishes between traded and non-traded goods inflation and further incorporates wages to the VAR. The analysis is conducted by using a standard VAR model, as in:

$$Y_t = c + \sum_{i=1}^{p} \Phi_i Y_{t-1} + \sum_{i=0}^{p} \Phi_i X_{t-1} + \varepsilon_t \qquad (5)$$

where Y_t, X_t , c, Φ_i , and ε_t respectively denote the vector of endogenous variables, the vector of exogenous variables, the vector of constants, the matrices of autoregressive coefficients, and the vector of white noise processes.

Y_t is a vector of six endogenous variables:

$$Y_t = \{ neer_t, ygap_t, i_t, p_{Tt}, p_{NT}, w_t\} \qquad (6)$$

where $neer_t$, $ygap_t$, i_t, p_{Tt}, p_{NT} , and w_t respectively denote the nominal effective exchange rate, the output gap (HP-filtered industrial production index), the monetary policy rate, traded goods CPI, non-traded goods CPI, and nominal wages. The exchange rate, the two price indicators, and wages are key variables in the analysis; the inclusion of output is intended to capture demand shocks; and the interest rate allows the money market, including the impact of monetary policy, to influence the pass-through relationship. The use of the nominal effective exchange rate, as opposed to the bilateral peso/U.S. dollar rate, is needed to generate pass-through estimates that fully capture price adjustments in Chile's trading partners in response to external shocks, whether common or idiosyncratic.

X_t is a vector of four exogenous variables:

$$X_t = \{oil_t, food_t, p^f_t, i^{US}_t\} \qquad (7)$$

where i^{US}_t, p^f_t, oil_t, and $food_t$ respectively denote the US 3-month Treasury bill, a trade-weighted index of foreign prices, and commodity oil and food prices (all three price indexes

are expressed in US dollars).[10] The VAR uses monthly data 1999−15. With the exception of $ygap_t$ and the domestic and U.S. interest rates), all variables in (6)−(7) are first differences to ensure stationarity, and enter the VAR with two lags.[11]

Identification. Identification of the structural shocks is achieved via a Cholesky recursive scheme, whereby identified shocks contemporaneously affect their corresponding variables and those ordered at a later stage, but have no impact on variables that are ordered before.[12] This implies that the most exogenous (endogenous) variables should be placed first (last) in the VAR. With this in mind, the baseline specification draws on Stulz's (2007) ordering. The exchange rate is placed first given its tight correlation with globally-determined terms of trade[13] (outside Chile's control) and given the lack of intervention in the FX market by the central bank during the inflation targeting regime. The output gap is placed second on the assumption that it is contemporaneously affected by exchange rate shocks while having a simultaneous impact on monetary and price variables. Prices and wages are placed last hence being affected by shocks to all other variables, as in a large body of the pass-through literature.[14] Following the pricing chain, traded-goods inflation precede non-traded goods inflation while wages are placed last. The robustness to alternative VAR identification schemes is examined further below.

$$\text{Baseline Cholesky ordering: } neer_t \rightarrow ygap_t \rightarrow i_t \rightarrow p_{Tt} \rightarrow p_{NT} \rightarrow w_t \qquad (8)$$

Exchange rate pass-through. The exchange rate pass-through is computed as the cumulative impulse response of inflation to a shock in the nominal effective exchange rate over the cumulative impulse response of the nominal effective exchange rate to its own shock. It shows the fraction of the depreciation passing through domestic prices *h* months ahead:

$$ERPT_h = \frac{cumIRF^h_{p,neer}}{cumIRF^h_{neer,neer}} \qquad (9)$$

where $ERPT_h$ is the cumulative response of inflation at *h* due to an exchange rate movement (the fraction of the depreciation that passes through domestic prices *h* periods ahead).

---

[10] Following common practice in the VAR literature for Chile, copper prices are excluded from the analysis. The correlation coefficient with the nominal effective exchange rate is -0.9 during the period inspected, hence copper prices' informational content is captured by the nominal effective exchange rate.

[11] The lag structure of the VAR is determined by means of lag exclusion and lag length criteria.

[12] Cholesky identification scheme attributes all of the effect of any common component to the variable that comes first in the VAR system.

[13] Algabli and others, 2015.

[14] See, for instance, Leigh and Rossi (2002), Hahn (2003), Belaisch (2003), and Faruqee (2006).

Results (Figure 4). How much of the depreciation feeds through to prices and wages? In line with previous findings in the literature (Table 4), the evidence is for a limited pass-through to prices, and even smaller to wages. A small pass-through to consumption prices relative to import prices[15] provides indirect evidence of margins compression along the pricing chain (Banco central de Chile, 2016). The pass-through to overall CPI reaches 0.09 after one year and stabilizes at around 0.11 after two years. The response at a one-year (two-year) horizon for traded goods prices, at 0.11 (0.13), is higher and less persistent than for non-traded goods prices, at 0.07 (0.09). The pass-through to wages is even smaller (0.04 at both one- and two-year horizons), and their response slower than for prices. Despite the limited pass-through, the overall inflation response to the depreciation episode that began in 2013 is substantial, given the size and persistence of the shock. Relative to a stable nominal effective exchange rate counterfactual scenario, these estimates imply 1/0.6 percentage points of additional inflation in 2014/15, and 0.2 percentage points of higher inflation in 2016 (assuming that the nominal effective exchange rate remains unchanged April through December 2016). By implication, the underlying inflation rate over 2014−15 (the counterfactual, no depreciation inflation rate) would have remained within the target band.

Table 4. Exchange Rate Pass-Through to Prices: Evidence for Chile

Reference	Period	Data frequency	Vector of endogenous/ LHS variable	Vector of exogenous/ RHS variables	Pass-through at 1yr/2yrs
VAR Evidence					
Albagli and others (2015)	2000–2014	quarterly	ygap, neer, cpi, i	yf, if, pf, pfood, poil, px	0.19/n.a.
Ca'Zorzi and others (2007)	1980–2003	quarterly	ygap, neer, pm, p, i	poil	0.35/0.35
Justel and Sansone (2015)	1986–2013	monthly	er, ygap, i, p	yf, if, pf, pfood, poil	0.13/0.17
Menkulasi and others (2016)	1999–2015	quarterly	poil, ygapus, ygap, i, neer, p	none	0.05/n.a.
Pérez Ruiz (2016)	1999–2015	monthly	ygap, neer, i, pT, pNT, w	if, pf, pfood, poil	0.09/0.11
Single Equation Approaches					
Bertinatto and Saravia (2015)	2001–2014	monthly	p	ygap, pf, er	0.06/n.a. 1/
IMF (2016)	2000–2015	monthly	p	neer, poil, pfood, pf, ygap	0.06/0.12

Source: Staff.

Note: the table reports the accumulated CPI price response to a 1 percent (nominal effective) exchange rate shock. er, neer, ygap, i, p, pT, pNT, pm, yf, if, pf, px, poil, pfood, ygapus respectively denote the peso to dollar exchange rate, nominal effective exchange rate, domestic output gap, domestic short term interest rate, CPI, traded-goods CPI, non-traded goods CPI, import prices, foreign activity, 1/ At six months.

Robustness to alternative Cholesky orderings (Figure 5). The VAR (5)–(7) is estimated for alternative identification schemes used in the literature. These include: alternative 1 $neer_t$ →

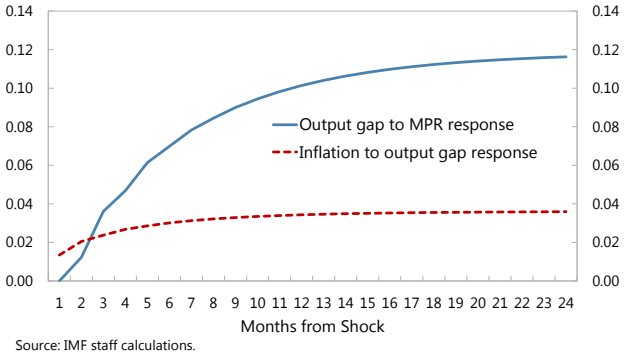
[15] In line with the international literature on the pass-through to import prices (Gopinath, 2015), recent evidence based on customs data for Chile finds that over 90 percent of the total value of imports is invoiced in U.S. dollars, hence the high pass-through to customs prices (De la Huerta and others, 2016). Over the medium term, the pass-through dynamics depends on the nature of the peso depreciation (global versus idiosyncratic), since only 20 percent of imports come from the U.S. In a purely peso depreciation scenario, the pass-through is expected to be more persistent, as trade partners have little incentives to change their prices (in dollars) for the Chilean market. In a dollar appreciation scenario, the immediate pass-through via invoicing effects should gradually reversed as depreciating partners adjust their dollar prices downwards to restore competiveness.

$ygap_t \rightarrow p_{Tt} \rightarrow p_{NT} \rightarrow w_t \rightarrow i_t$, the main motivation is which is to reflect the impact of all other shocks over monetary policy rates; alternative 2 $ygap_t \rightarrow neer_t \rightarrow p_{Tt} \rightarrow p_{NT} \rightarrow w_t \rightarrow i_t$ (McCarthy, 1999, Ca'Zorzi and others, 2007), whereby the output gap is taken as the most exogenous variable; and alternative 3 $ygap_t \rightarrow i_t \rightarrow neer_t \rightarrow p_{Tt} \rightarrow p_{NT} \rightarrow w_t$ (Ito and Sato, 2008, Albagli and others, 2015), which instead of regarding the exchange rate as an exogenous variable postulates a contemporaneous impact on the exchange rate from demand shocks and the conduct of monetary policy. The sensitivity analysis broadly confirms the baseline results.

Monetary transmission. In thinking about the role of monetary policy in the face of a depreciation shock, it is helpful to review monetary transmission to the Chilean economy. The VAR analysis in this section points to a relatively strong response of activity to policy rates, while the transmission from activity to inflation is found to be weaker (the latter being about three times as weak as the former at a two-year horizon). This confirms previous findings on price formation for Chile, overall suggesting a limited informational content of the Phillips curve (García and Restrepo, 2001, Pincheira and Rubio, 2015). By implication, the output costs of raising rates to control inflation in response to a depreciation shock are potentially high. However, as we show in the next section, a credible monetary authority such as the Central Bank of Chile may need not raise rates to keep inflation on track following the depreciation the currency, insofar as inflation expectations remain anchored.

Monetary Policy, Activity, and Inflation

(Impulse response functions, in percent)



Source: IMF staff calculations.

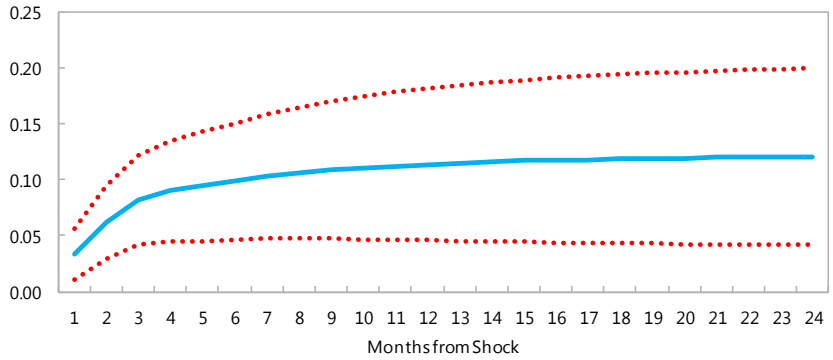
Note: Chart shows the accumulated response of the output gap (inflation) to a MPR (an output gap) shock normalized by the corresponding response of the MPR (output gap) to its own shock.

Figure 4. Exchange Rate Pass Through to Inflation

(Baseline VAR; coefficient ± two standard error bands)

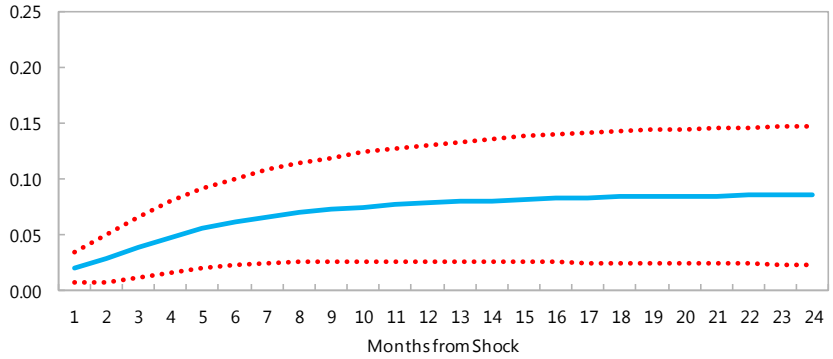
Traded-Goods CPI

(Impulse response functions, in percent)



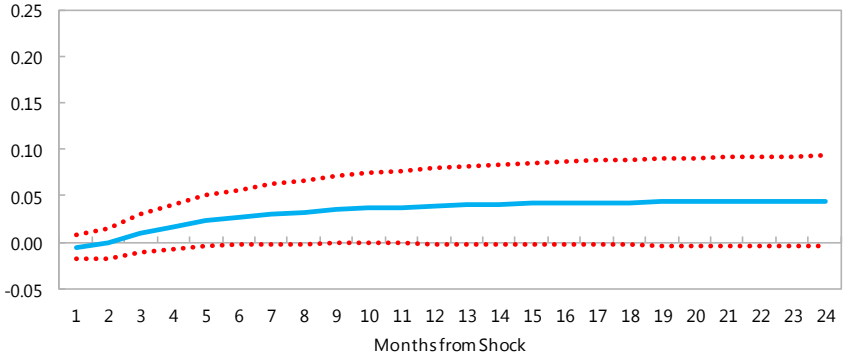
Non-traded Goods CPI

(Impulse response functions, in percent)



Nominal Wages

(Impulse response functions, in percent)

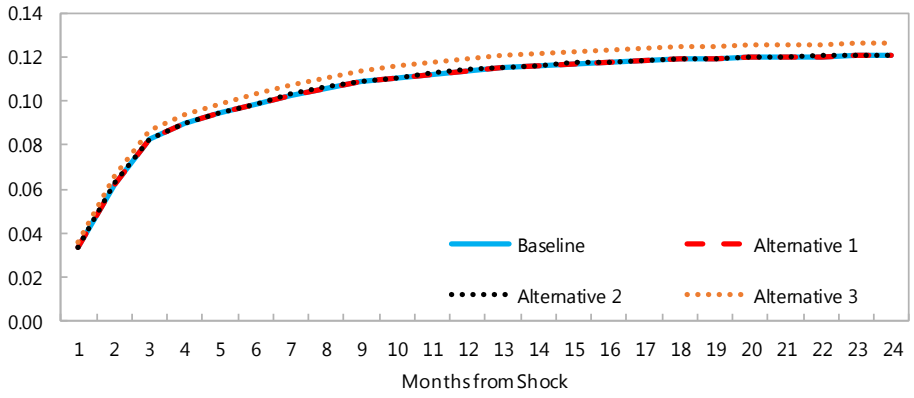


Source: Staff calculations.

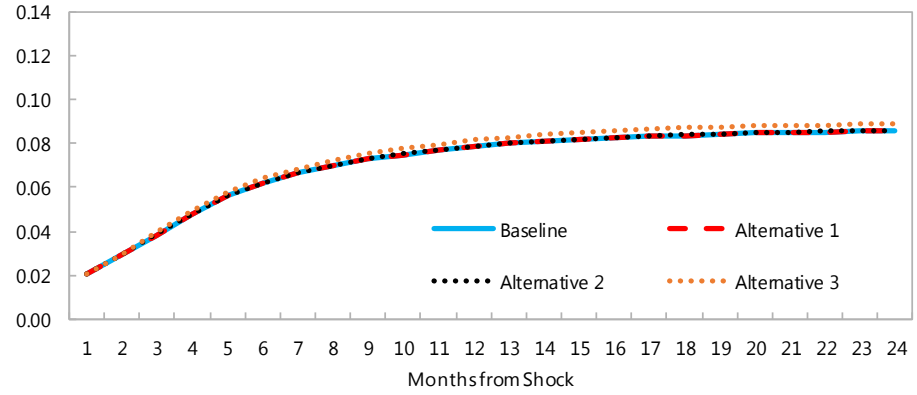
Note: Charts show accumulated response of prices and nominal wages to a NEER shock (normalized by the corresponding response of the NEER to its own shock) for baseline Cholesky ordering $neer_t \rightarrow ygap_t \rightarrow i_t \rightarrow p_{Tt} \rightarrow p_{NT} \rightarrow w_t$

Figure 5. Sensitivity to Cholesky Ordering

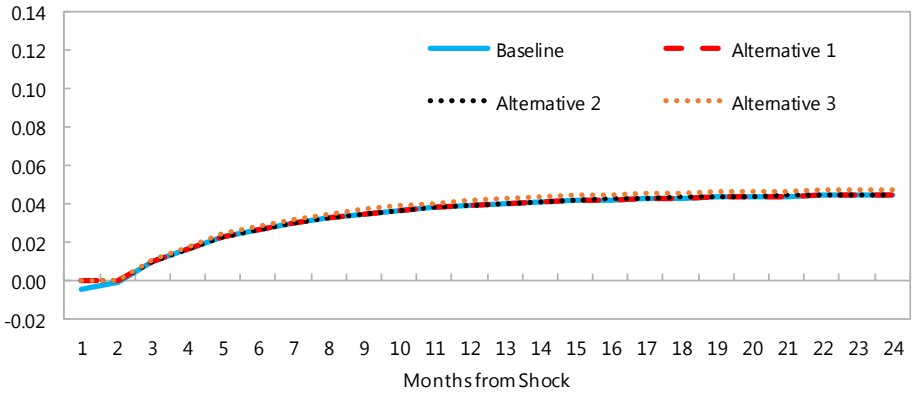
Sensitivity to Cholesky Ordering, Traded goods CPI
(Impulse response functions, in percent)



Sensitivity to Cholesky Ordering, Non Traded Goods CPI
(Impulse response functions, in percent)



Sensitivity to Cholesky Ordering, Nominal Wages
(Impulse response functions, in percent)



Source: Staff calculations.
Note: The charts show robustness to alternative Cholesky orderings. Cholesky ordering is $neer_t \rightarrow ygap_t \rightarrow p_{Tt} \rightarrow p_{NT} \rightarrow w_t \rightarrow i_t$ for alternative 1; $ygap_t \rightarrow neer_t \rightarrow p_{Tt} \rightarrow p_{NT} \rightarrow w_t \rightarrow i_t$ for alternative 2; and $ygap_t \rightarrow i_t \rightarrow neer_t \rightarrow p_{Tt} \rightarrow p_{NT} \rightarrow w_t$ for alternative 3.

VI. THE CONDUCT OF MONETARY POLICY UNDER UNCERTAINTY

Purpose. Adding to the previous exchange rate pass- through literature for Chile, the empirical findings in this paper provide some indication what considerations the conduct of monetary policy needs to take into account in the face of a depreciation shock. However, despite every effort to produce reliable pass-through estimates, there will always be uncertainty about the relationship between external shocks and domestic inflation. Given that uncertainty inevitably remains a fact of life for policy makers, a natural endeavor is to explore the cost of potential policy mistakes in the face of uncertainty following a terms of trade shock.[16]

Simulated scenarios. To illustrate the implications of possible misperceptions by the central bank on pass-through effects, we use two different versions of the Phillips curve within the WHDMOD model (Andrle and others, 2015). In the first scenario (model 1), import prices do not feed into core inflation. In the second scenario (model 2), import prices do feed into core inflation. The model is then used to illustrate the implications of the central bank making two possible "policy errors":

- "First policy error". The central bank does the inflation forecast and sets the policy rate according to model 2 (import prices feeding into core inflation), when in fact the true model is 1 (import prices do not feed into core inflation). The central bank makes this mistake for two years, then realizes (as inflation surprises on the downside) that the true model is 1. From year 3 on, the central bank uses model 1 to generate inflation forecasts and set its policy rate.

- "Second policy error". The central bank does the inflation forecast and sets its policy rate according to model 1 (import prices do not feed into core inflation), when in fact the true model is 2 (import prices do feed into core inflation). The central bank makes this mistake for two years, then realizes (as inflation surprises on the upside) that the true model is 2. From year 3 on, the central bank uses model 2 to generate inflation forecasts and set its policy rate.

Modeling devise. The scenarios are generated using WHDMOD, which includes Chile. WHDMOD is one of modules of the Flexible System of Global Models (FSGM) recently developed by the IMF. It has 19 countries (among which Chile) and 6 regions encompassing the global economy[17]. As other FSGM modules, WHDMOD is an annual,

[16] For Brazil, Perrelli and Roache (2014) assess the implications for monetary policy of incorrectly estimating the natural rate and the output gap.

[17] Countries include Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Mexico, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, Canada, China, Japan, and the U.S. Regions include other Central America, Euro Area, other Latin America, other Advanced Economies, Oil Exporters, and Rest of the World.

semi-structural general equilibrium model. Real GDP in the model is determined by the sum of its demand components in the short run, and the level of potential output in the long run. Some key elements, like private consumption and investment, have micro-foundations, while others, such as trade, labor supply, and inflation having reduced-form representations. The reduced-form components of the model (which have been designed carefully using IMF's GIMF and GEM models as consistency checks) allow for country-specific dynamic adjustment properties.

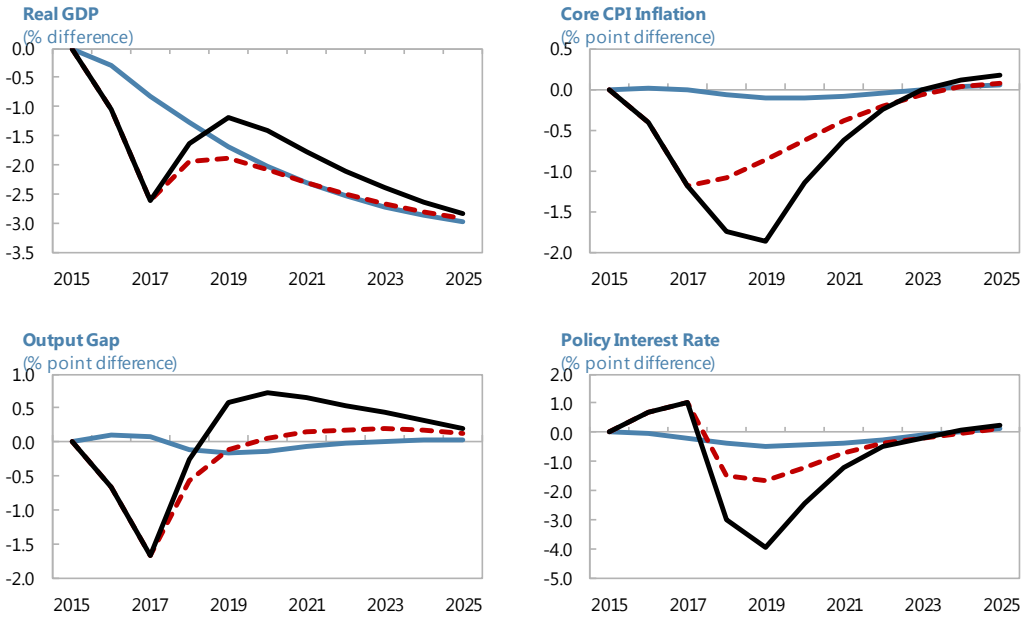
Terms of trade shock. WHDMOD is shocked with a persistent decline in copper prices (down by 10 and 20 percent relative to baseline in the first and second year, respectively). The shock deteriorates Chile's terms of trade and leads to a depreciation in the currency and an increase in import prices.

Outcomes under no uncertainty scenario. What are the possible outcomes when the central bank knows the true structure of the economy (Figure 6, blue line)? Under model 1 (import prices do not feed into core inflation), only headline inflation rises. Core inflation, and hence the policy rate, remain unchanged. GDP falls because of the decline in potential output brought about by the negative terms of trade shock, but the output gap remains essentially closed at every horizon. Potential output also declines under model 2 (import prices feed into core inflation), and, in addition, monetary policy tightens (to re-anchor core inflation following the rise in import prices), which generates a negative output gap.

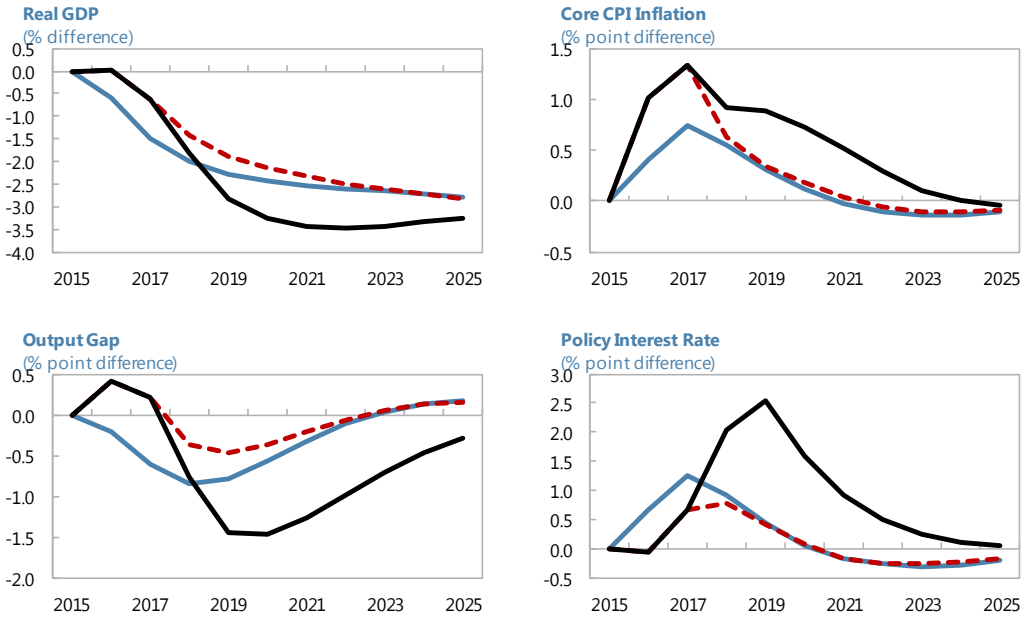
Outcomes under uncertainty scenarios with anchored expectations. What are the possible outcomes when the central bank has misperceptions on the true structure of the economy yet inflation expectations remain anchored (Figure 6, red dashed line)? Under the "first policy error", the central bank tightens policy in the first year. Although inflation surprises on the downside in the second year, the additional decline in copper prices and ensuing depreciation leads to further tightening. In the third year, inflation comes in much lower than projected, the central bank realizes the true model is 1 and eases policy sharply. Under the "second policy error", the central bank leaves the policy rate unchanged in year one. In year two, inflation surprises on the upside and another decline in copper prices occurs. The central bank tightens policy mildly, just in response to the higher-than-forecast inflation outcome. In the third year, the upside surprise in inflation is substantial, the central bank realizes the true model is 2 and interest rates are tightened more in the third year such that a negative output gap opens up and helps re-anchor core inflation to the target.

Figure 6. Monetary Policy under Uncertainty in the Face of a Terms of Trade Shock

Policy Error 1: Import prices do not feed into core inflation; central bank assumes they do



Policy Error 2: Import prices do feed into core inflation; central bank assumes they don't



Source: Staff calculations.

Note: Blue line = no uncertainty scenario; red line = policy error scenario; black line = policy error and dislodged inflation expectations scenario.

Outcomes under uncertainty with dislodged expectations. What are the possible outcomes when the central bank has misperceptions on the true structure of the economy and inflation expectations become dislodged because of previous policy mistakes (Figure 6, black line)? The simulations assume that expectations become dislodged in the third year, changing in both the third and fourth years by about 1 percentage point.[18] Under the "first policy error", the central bank must cut the policy rate sharply and generate a positive output gap that lasts for several years to re-anchor inflation expectations. Under the "second policy error", the central bank must raise the policy rate sharply and generate a long- lived negative output gap to re-anchor inflation expectations.

Preferred course of action under uncertainty. To discuss the role of monetary policy in a context of uncertainty we inspect both output and inflation outcomes under alternative assumptions on inflation expectations and on the two alternative models describing the economy.

- With anchored inflation expectations, inflation dynamics are governed by movements in the terms of trade and the output gap. In this context, the best outcomes seem to be achieved when the policy rate is kept constant, irrespective of what the true model describing the economy is (Figure 7, top charts). When import prices do not feed into core inflation and the central bank mistakenly hikes rates, a negative output gap opens relative to the certainty scenario, exacerbating the contraction in output (top left chart, red dashed line) and dragging the economy into deflation. None of them is optimal, since in such circumstances, inflation undershoots the target and monetary policy becomes pro-cyclical. When import prices do feed into core inflation and the central bank mistakenly keeps the policy rate unchanged, a positive output gap opens relative to the certainty scenario. This dampens the fall in output (top right chart, red dashed line) at the cost of higher inflation. However, as long as inflation expectations remain anchored, inflationary pressures will remain moderate, and so will be the output loss needed to bring inflation back to target over the medium term, once the error has been recognized. In sum, with monetary policy credibility, there is room for the central bank to take a wait-and-see approach and not initially respond to the negative terms of trade shock.

- With dislodged inflation expectations, inflation dynamics are driven by shifts in inflation expectations due to past policy mistakes on top of movements in the terms of trade and the output gap (Figure 7, bottom charts). In this context, the simulations

[18] Under policy mistakes, the deviation in inflation from the no uncertainty scenario amounts to about ± 1 percent after two years.

imply asymmetric costs from policy errors. When import prices do feed into core inflation and the central bank mistakenly does not tighten, monetary tightening after year 3 needs to correct inflationary pressures coming from the depreciation shock, higher domestic demand, and the upward shift in inflation expectations. The cost of stabilizing inflation in terms of foregone output over the medium term is therefore large (bottom right chart, black dotted line). When import prices do not feed into core inflation and the central bank initially hikes rates, monetary easing after year 3 just needs to correct deflationary pressures coming from flagging activity and the dislodged inflation expectations (core inflation is unaffected by terms of trade shocks in this scenario). By implication, when monetary policy is wrongly set too loosely, the output loss required to bring inflation back to target over the medium term outweighs the output gains from the initial delay in the policy response. When import prices do not feed into core inflation, the output gains from bringing inflation back to target roughly offset the initial losses from setting policy too tightly.

While these results may be sensitive to assumptions on the size of the pass through, the extent of inflation de-anchoring, and the rate used to discount future output flows, it would seem preferable to assume no feed through of import prices to core inflation if there is no risk of dislodging inflation expectations (no crossing of the relevant curves). On the contrary, with dislodged inflation expectations (a curve crossing occurs), there is ambiguity on the preferred course of action. Briefly put, central bank's credibility provides monetary policy with room of maneuver to accommodate a negative terms of trade shock.

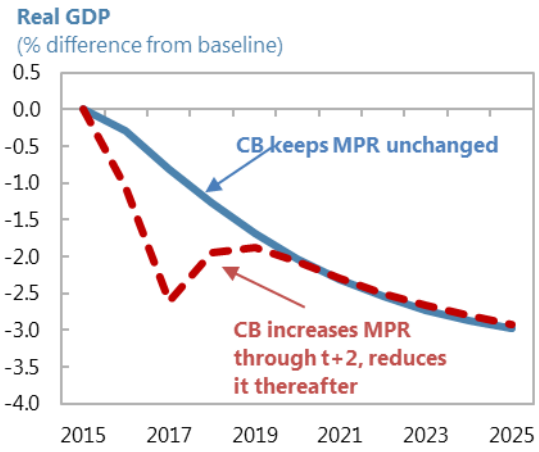
Role of communication in keeping inflation expectations anchored. The analysis in Sections IV and V of this paper finds that inflation can remain above target for a long period in the face of a large and persistent depreciation shock, further amplified by indexation practice. Phillips curve effects seem to be of second-order importance in inflation developments. This section shows that, as long as inflation expectations remain anchored, monetary policy can take a wait-and-see approach in the face of a depreciation shock at a moderate inflationary cost. The challenge is therefore for monetary policy to keep inflation expectations anchored for a long period despite inflation being outside the band on forces largely exogenous to the central bank. This puts a premium on communication.[19] To live up to the challenge, it is essential that the central bank's reading of inflation (relative roles of the exchange rate, second-round effects, and the Phillips curve) be well understood by markets and that the monetary authority decisively reacts to any signs of large inflation forecasts errors or de-anchoring of inflation expectations.

[19] Communication is crucial to a successful inflation targeting strategy, in particular for emerging markets (Mishkin and Savastano, 2002).

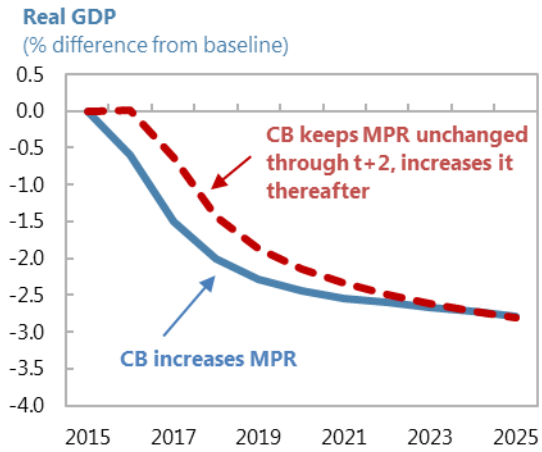
Figure 7. Inflation Expectations and Monetary Policy

Anchored inflation expectations

Import prices do not feed into core inflation

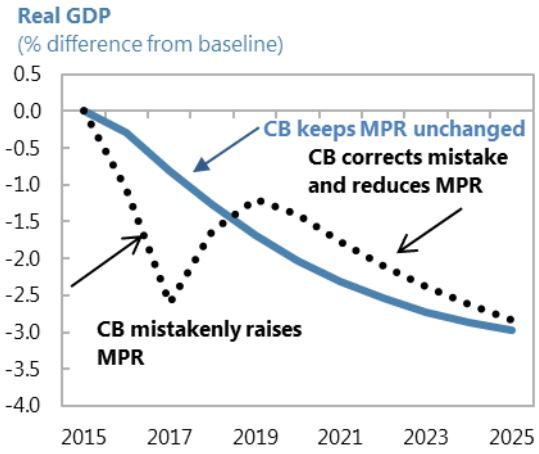


Import prices feed into core inflation

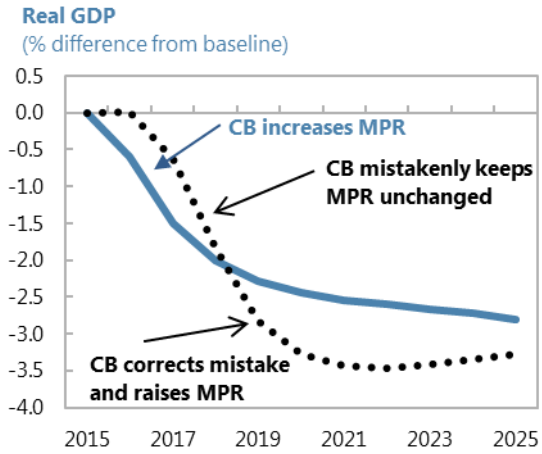


Dislodged inflation expectations

Import prices do not feed into core inflation



Import prices feed into core inflation



Source: Staff calculations.

Note: Blue line = no uncertainty scenario; red line = policy error scenario; black line = policy error and dislodged inflation expectations scenario.

VII. CONCLUSION

Above-target inflation during the last depreciation cycle. The end of the commodity super-cycle and ensuing deterioration in the terms of trade since 2013 has led to a sizable peso depreciation. Inflation has remained above target over the last two years despite a slowdown in activity, reflecting substantial pass-through to traded goods inflation from a large and persistent depreciation as well as amplification effects from widespread indexation practices in non-traded goods. Counterfactual analysis finds that inflation would have comfortably remained within the target band absent the peso depreciation.

Monetary policy considerations in the face of a depreciation shock. VAR analysis shows that monetary tightening in response to a depreciation shock can be costly in terms of output: the response of activity to rates is found to be strong, while the transmission from activity to inflation is found to be weak. However, a credible monetary authority such as the Central Bank of Chile may need not raise rates to keep inflation on track in the face of a depreciation shock. Indeed, simulations under uncertainty about the extent of the pass-through suggest that, as long as inflation expectations remain anchored, monetary accommodation can cushion the fall in activity at a moderate inflationary cost.

Monetary policy communication strategy. Communication has gradually evolved from primarily Phillips-curve-based to a strategy that emphasizes exchange rate shocks and second-round effects as key inflation drivers. This has set the right market expectations on the time needed for inflation to converge to target in the face of a large and persistent shock, while preserving the central bank's credibility and accountability.

Indexation bears watching. While indexation was a rational response to high inflation in the past and arguably contributed to the development of Chile's financial markets, the empirical literature on indexation overall suggests that the benefits of indexation are diluted and its costs rise when a formerly high-inflation country achieves moderate-to-low inflation rates. By increasing inertia and dampening relative price adjustment, indexation slows inflation adjustment to the new equilibrium and makes it more costly in terms of output.

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