Interventions and Inflation Expectations in an Inflation Targeting Economy

Pablo M. Pincheira

Economic Research Department
Central Bank of Chile

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Motivation

- During 1999 Chile announces the adoption of a full fledge inflation targeting regime
- Accordingly, a floating regime for the Chilean peso was adopted
- Nevertheless, The Central Bank of Chile also announced that interventions could occur if exceptional circumstances justified them
- Are exceptional interventions in conflict with an inflation target?
- Is the anchorage of inflation expectations in danger when interventions occur?
- We take an empirical approach to estimate the impact of interventions on inflation expectations

Outline

- Introduction
- Exchange rate interventions
- Empirical approach
  1. Single equation analysis at a monthly basis
  2. Joint analysis at a monthly basis
  3. Dynamic analysis (VARs) at a monthly basis
  4. Daily analysis
- Conclusions

Introduction
Results

- The intervention Granger-causes several deciles of the distribution of inflation expectations at long horizons
- This causality seems to have a relatively short memory as the distribution of inflation moves back in about 6 months after the intervention shock is realized
- The announcement itself seems to have an impact on break-even inflation rate

Rationale of the Paper

- According to Mishkin (2000), several conditions are required for the adoption of an inflation targeting regime. A purely floating exchange rate regime is one of these conditions

- In practice, small open economies implementing inflation targeting regimes do occasionally intervene the exchange rate market

- Irrespective of how effective interventions may be, they could have the collateral effect of an impact in the distribution of inflation expectations. This is so mainly for two reasons:

    1. First, if as a consequence of an intervention there is a shift in the level of the exchange rate, imported inflation will be affected and inflation expectations should reflect this impact
    2. Second, inflation expectations may be more reluctant to respond to the actions of the monetary authority as it may not be entirely clear whether monetary policy actions are focused on the inflationary target or on any other target related to the exchange rate.

- Even if interventions are sterilized these two channels will be present

Exchange rate interventions
A review

- Literature focus mainly on the impact of interventions in the level or volatility of the exchange rate (Tapia and Tokman, 2003; Berganza and Broto, 2012)
- Collateral effects of interventions may affect order flow, risk premiums, and expectations (Canales et al., 2006)
- In many emerging inflation economies, policymakers are attempting to resist currency appreciation while simultaneously trying to meet their inflation targets (Kamil, 2008)
- In the case of Chile, Ades et al. (2002) find that interventions have not been excessive, as they were aimed to prevent deviations of the exchange rate from its long run equilibrium point

## Exchange rate interventions
The case of Chile

- Inflation targeting was adopted in 1990 in a gradually way as the CBC also pursued an exchange rate target between 1984 and 1999 (Schmidt-Hebbel and Werner, 2002)
- Chile adopts a floating regime for exchange rate in 1999, but the CBC reserves the right to intervene in exceptional circumstances
- Since 2000, the CBC has intervened the exchange market in four occasions: 2001, 2002, 2008, and 2011
- **2001** and **2002**: preannounced, perceived overreaction to the worsening international conditions, depreciation of the domestic currency against US dollar, a mix of two strategies: supply of bonds plus direct sales of dollars
- **2008** and **2011**: preannounced, accumulation of reserves in circumstances of international financial turmoil, appreciation of the domestic currency, only one strategy: direct purchases of dollars

Both the Announcement and the Intervention itself May Impact Other Variables

- Despite of the announcement in 2002, no direct sales of dollars during that intervention period were carried out
- In **2008**, the intervention suddenly stopped in September 29, 2008 when only 70% of the preannounced accumulation of reserves program was actually accumulated
- In **2011**, the plan was succesfully carried out by acquiring a total of US$12,000 million by using the same daily dollar purchases of US$50 million used in the previous intervention (2008).

Exchange rate and foreign exchange intervention periods

Exchange rate and intervention period
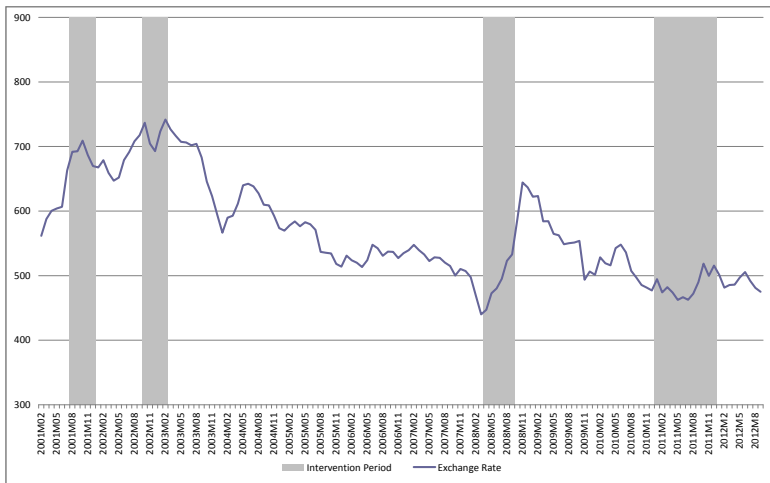
- **1, 2, and 3**: Monthly data, Chilean CPI, amount of purchases, nine deciles of inflation expectations, 1-, 12-, and 24-months ahead, July-2007 to September-2012

- **4**: Daily data, inflation break-even as a proxy of inflation expectations, amount of purchases, announcement day, January, 25th 2005 to February, 2nd 2012

- We also expand the first three exercises by including other controls as the oil price and a food price index

- We also try to identify different responses in the last two intervention periods

Empirical approach
Single equation analysis

We are interested in the following expression:

$$\Delta\left[\pi_{ti}^e(h)\right] = \delta_{it}\Delta\left[\pi_{ti-1}^e(h)\right] + \Delta X_{t-1}^{'}\beta_{ih} + \gamma_{ih}\Delta M_{it-1} + \varepsilon_{ith}$$
$$\Phi_{ih}(B)\varepsilon_{ith} = \Theta_{ih}(B)u_{it}$$

where

$$\pi_{it}^e(h) \quad : \quad \text{Inflation expectations decile } i \in \{1,...,9\} \text{ at time } t$$
$$\text{for horizon } t+h$$
$$M_{t-1} \quad : \quad \text{Interventions in billions of US dollars}$$
$$X_{t-1}^{'} \quad : \quad \text{Covariates}$$
$$\Phi_{ih}(B),\ \Theta_{ih}(B) \quad : \quad \text{Autorregresive and Moving average operator :}$$
$$\Delta \quad : \quad \text{Differencing operator}$$
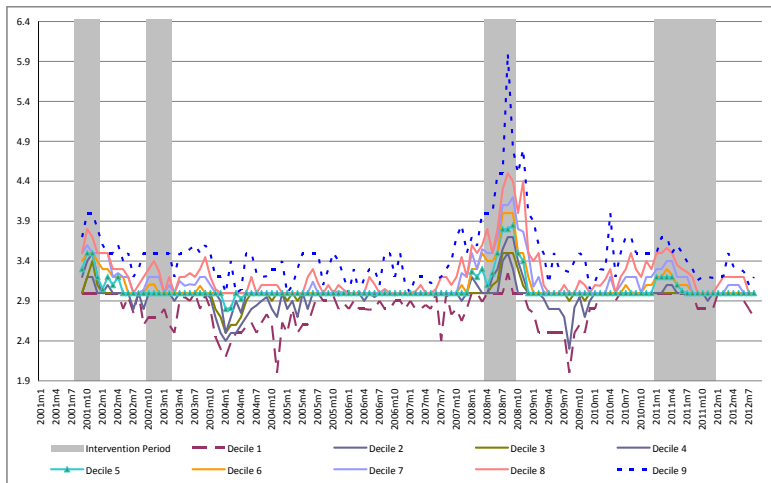$$u_{it} \quad : \quad \text{White noise process with variance } \sigma_i^2$$

Intervention periods and inflation expectations
Different horizons
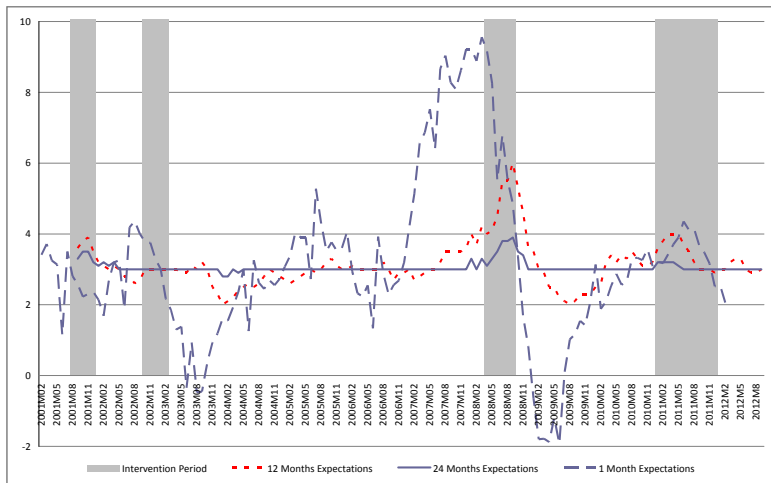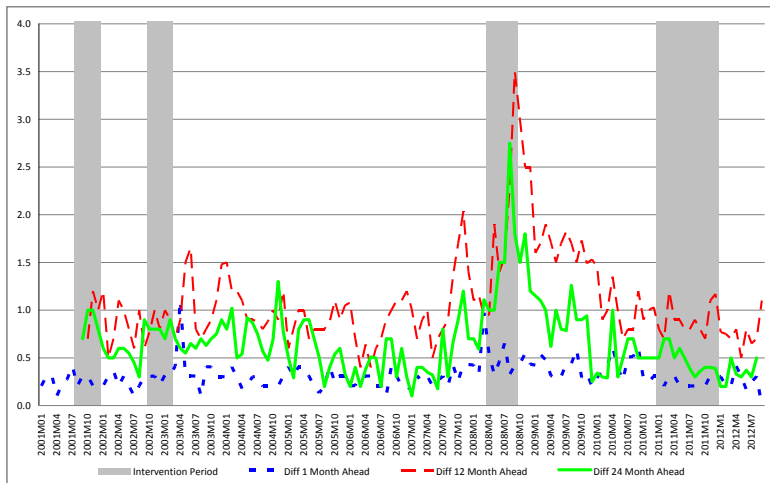
Inflation expectations by decile
2-years ahead

Interventions and differences of inflation expectations
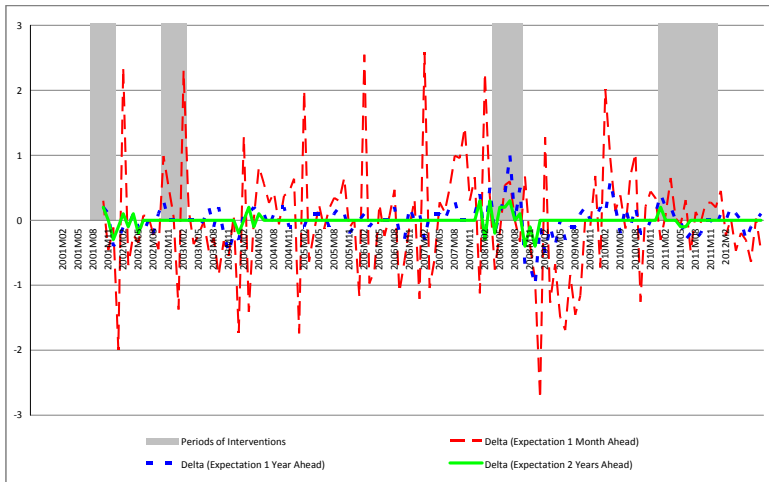
The intervention impact on the distribution of inflation expectations Granger-causality analysis

Dep Variable	Coefficient	Std. Error	t-Statistic	Prob.	R2
Decile 1	0.156	0.177	0.886	**0.379**	0.577
Decile 2	0.106	0.181	0.590	**0.558**	0.567
Decile 3	0.115	0.167	0.687	**0.495**	0.573
Decile 4	0.019	0.178	0.109	**0.914**	0.579
Decile 5	0.080	0.182	0.439	**0.662**	0.580
Decile 6	0.109	0.162	0.674	**0.503**	0.564
Decile 7	0.059	0.215	0.276	**0.784**	0.552
Decile 8	0.036	0.182	0.195	**0.846**	0.565
Decile 9	0.094	0.148	0.636	**0.528**	0.560

**The intervention impact on the distribution of inflation
expectations Granger-causality analysis**

Dep Variable	Coefficient	Std. Error	t-Statistic	**Prob.**	R2
Decile 1	0.350	0.166	2.113	**0.039**	0.406
Decile 2	0.338	0.149	2.267	**0.027**	0.270
Decile 3	0.349	0.185	1.884	**0.065**	0.383
Decile 4	0.324	0.174	1.860	**0.068**	0.415
Decile 5	0.416	0.211	1.969	**0.054**	0.434
Decile 6	0.370	0.180	2.050	**0.045**	0.417
Decile 7	0.272	0.156	1.740	**0.087**	0.322
Decile 8	0.380	0.201	1.892	**0.064**	0.351
Decile 9	0.284	0.200	1.421	**0.161**	0.282

The intervention impact on the distribution of inflation expectations Granger-causality analysis

Dep Variable	Coefficient	Std. Error	t-Statistic	**Prob.**	R2
Decile 1	0.016	0.049	0.325	**0.747**	0.496
Decile 2	0.058	0.033	1.770	**0.082**	0.239
Decile 3	0.100	0.061	1.620	**0.111**	0.192
Decile 4	0.082	0.047	1.752	**0.085**	0.534
Decile 5	0.126	0.071	1.775	**0.081**	0.287
Decile 6	0.041	0.027	1.489	**0.142**	0.207
Decile 7	0.129	0.057	2.271	**0.027**	0.246
Decile 8	-0.020	0.090	-0.227	**0.822**	0.273
Decile 9	0.255	0.124	2.067	**0.043**	0.267

Empirical approach
Seemingly unrelated regressions

- So far, we have shown estimates of the equations in isolation
- It is unlikely that shocks affecting different deciles of inflation expectations are uncorrelated
- We move toward the estimation of the following joint system of equations:

$$\Delta\left[\pi_{ti}^e(h)\right] = \delta_{it}\Delta\left[\pi_{ti-1}^e(h)\right] + \Delta X_{t-1}^{'}\beta_{ih} + \gamma_{ih}\Delta M_{it-1} + \Phi_{ih}(B)\varepsilon_{ith}$$

with $i \in \{1, ..., 9\}$ and $(\varepsilon_{1t}, ..., \varepsilon_{9t})$ a vector of white noise processess with variance Σ
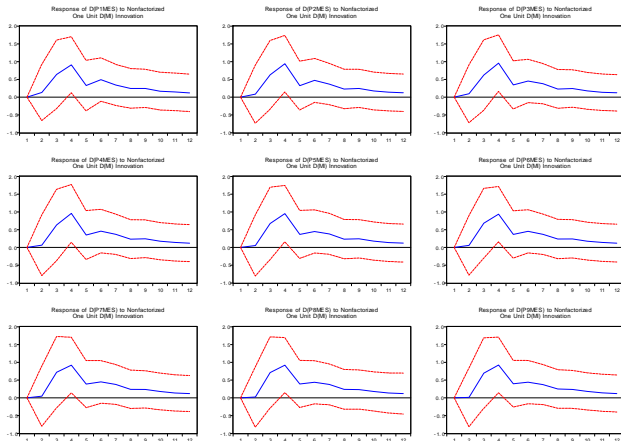
The intervention impact on the distribution of inflation expectations Granger-causality analysis with SUR

Dep Variable	Coefficient	Std. Error	t-Statistic	Prob.	R2
Decile 1	0.085	0.275	0.309	**0.758**	0.468
Decile 2	0.035	0.285	0.124	**0.901**	0.452
Decile 3	0.048	0.289	0.167	**0.868**	0.449
Decile 4	0.023	0.294	0.077	**0.938**	0.445
Decile 5	0.041	0.297	0.138	**0.891**	0.439
Decile 6	0.038	0.296	0.129	**0.897**	0.441
Decile 7	0.044	0.298	0.148	**0.882**	0.429
Decile 8	0.037	0.299	0.125	**0.901**	0.417
Decile 9	0.033	0.296	0.110	**0.913**	0.432

The intervention impact on the distribution of inflation expectations Granger-causality analysis with SUR

Dep Variable	Coefficient	Std. Error	t-Statistic	Prob.	R2
Decile 1	0.355	0.135	2.633	**0.009**	0.188
Decile 2	0.408	0.133	3.060	**0.002**	0.168
Decile 3	0.384	0.117	3.294	**0.001**	0.174
Decile 4	0.392	0.110	3.577	**0.000**	0.279
Decile 5	0.462	0.111	4.165	**0.000**	0.302
Decile 6	0.423	0.107	3.968	**0.000**	0.302
Decile 7	0.428	0.140	3.053	**0.002**	0.178
Decile 8	0.457	0.161	2.837	**0.005**	0.258
Decile 9	0.469	0.181	2.595	**0.010**	0.267

The intervention impact on the distribution of inflation expectations Granger-causality analysis with SUR

Dep Variable	Coefficient	Std. Error	t-Statistic	**Prob.**	R2
Decile 1	-0.005	0.084	-0.057	**0.954**	0.290
Decile 2	0.077	0.074	1.042	**0.298**	0.012
Decile 3	0.101	0.030	3.371	**0.001**	0.179
Decile 4	0.120	0.037	3.213	**0.001**	0.263
Decile 5	0.114	0.040	2.836	**0.005**	0.343
Decile 6	0.047	0.057	0.833	**0.405**	0.171
Decile 7	0.061	0.059	1.030	**0.304**	0.338
Decile 8	-0.087	0.088	-0.980	**0.328**	0.283
Decile 9	0.037	0.140	0.267	**0.790**	0.275

Granger-causality analysis with VAR in differences
$\{\Delta\pi_t, \Delta M_{t-1}, \Delta\pi_{ti}^e(h)\}$, expectations 1-month ahead
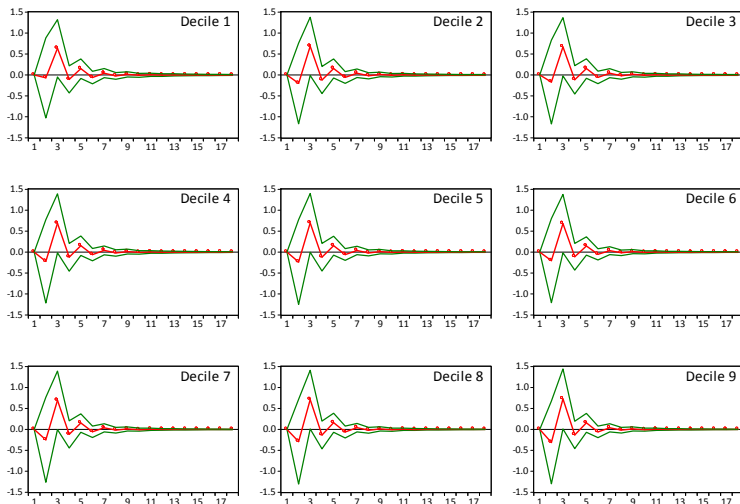
Dynamic analysis
The intervention impact on the distribution of inflation expectations

Granger-causality analysis with VAR in differences
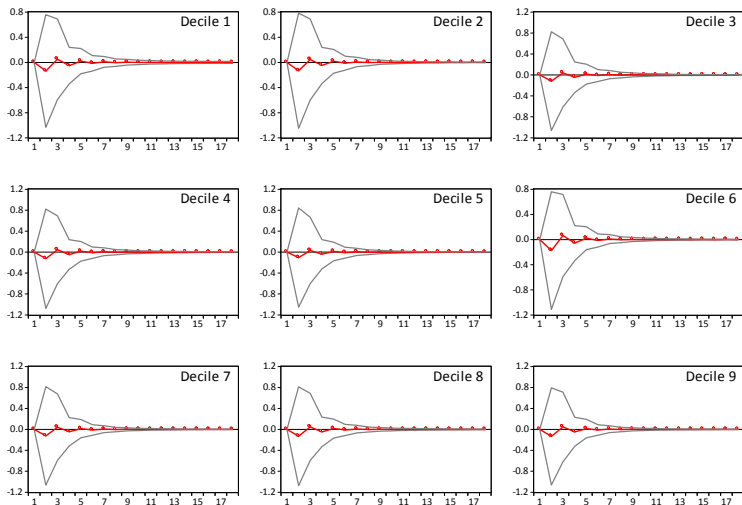$\{\Delta\pi_t, \Delta M_{t-1}, \Delta\pi_{ti}^e(h)\}$, expectations 1-year ahead
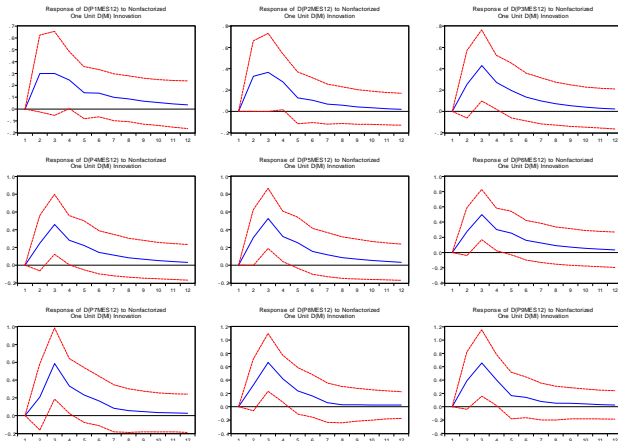
Dynamic analysis
The intervention impact on the distribution of inflation expectations

Granger-causality analysis with VAR in differences
$\{\Delta\pi_t, \Delta M_{t-1}, \Delta\pi_{ti}^e(h)\}$, expectations 2-years ahead

Response to Foreign Exchange Market Intervention Shock of 2008

Response to Foreign Exchange Market Intervention Shock of 2011

Response to Foreign Exchange Market Intervention Shock of 2008

Response to Foreign Exchange Market Intervention Shock of 2011

Response to Foreign Exchange Market Intervention Shock of 2008

Response to Foreign Exchange Market Intervention Shock of 2011

Daily analysis –Estimates results

	(1)	(2)	(3)	(4)	(5)
Y_{t-1}	0.703**	0.701**	0.703**	0.701**	0.703**
	[16.885]	[16.769]	[16.866]	[16.754]	[16.866]
Y_{t-2}	0.245**	0.241**	0.245**	0.241**	0.245**
	[5.920]	[5.858]	[5.912]	[5.854]	[5.912]
Interv. Amount$_{t-1}$	0.078	0.076	0.080	0.078	
	[1.659]	[1.623]	[1.710]	[1.676]	
Dummy Interv.$_{t-1}$					0.040
					[1.710]
Announcement$_{t-1}$			0.411**	0.396**	0.411**
			[22.326]	[14.927]	[22.326]
Inflation$_{t-1}$		0.004		0.004	
		[0.734]		[0.734]	
R^2	0.883	0.883	0.883	0.883	0.883

var. dep.: inflation break-down 1:1, constant included, $n=1,000$, [t-Stat], **: $p<1\%$

Conclusions

- Exchange rate interventions are controversial:
    1. Huge amount of resources involved
    2. Is not entirely clear if they meet the various targets they are designed for
    3. Empirical evidence provide mixed results
    4. **Inflation targeters**: effect on the distribution of inflation expectations may be relevant

Conclusions
The case of Chile

- The intervention Granger-causes several deciles of the distribution of inflation expectations at long horizons

- This causality seems to have a relatively short memory as the distribution of inflation moves back in about 6 months after the intervention shock

- These results seem to show that the collateral damage of the exchange rate interventions over the distribution of inflation expectations is neither large nor long-lived

- Nevertheless, this collateral damage is larger in the 2008 intervention, period in which the accumulation of reserves could have been interpreted as a policy action in conflict with the inflation target

Interventions and Inflation Expectations in an Inflation Targeting Economy

Dynamic analysis
The intervention impact on the distribution of inflation expectations

Granger Causality Analysis with VAR in levels
$\{\pi_t, M_{t-1}, \pi_{ti}^e(h)\}$, expectations 1-month ahead