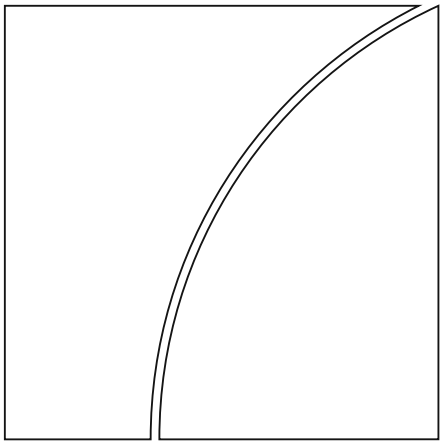

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Interventions and inflation expectations in an inflation targeting economy*

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Abstract

In this paper we explore the role that exchange rate interventions may play in determining inflation expectations in Chile. To that end, we consider a set of nine deciles of inflation expectations coming from the survey of professional forecasters carried out by the Central Bank of Chile. We consider two episodes of preannounced central bank interventions during the sample period 2007–2012. Our results indicate, on the one hand, that the intervention program carried out in 2008 had a significant, but relatively short-lived, impact on the distribution of inflation expectations at long horizons. On the other hand, the intervention carried out in 2011 shows no relevant impact on the distribution of inflation expectations in Chile. A daily analysis using break-even inflation rate as a proxy for inflation expectations is roughly consistent with these results. Our analysis also suggests that the interventions did have an impact on daily exchange rate returns, especially on the day after the announcements of the intervention programs.

JEL codes: E31, E52, E58, F31.

Keywords: Exchange rates, inflation expectations, inflation targeting, interventions.

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1 Introduction

In 1999, Chile announced the adoption of a fully fledged inflation targeting regime. Accordingly, a floating regime for the Chilean peso was also adopted. Nevertheless, the Central Bank of Chile also announced that exchange rate interventions would occur if exceptional circumstances justified them. The natural question to ask is: are exceptional interventions in conflict with an inflation target? Are inflation expectations in danger of becoming unanchored when such interventions occur? In this paper, we address these questions by analyzing whether the amount of interventions Granger-cause some measure of inflation expectations.

We consider two episodes of preannounced central bank interventions during the sample period 2007–2012. Our results using survey-based inflation expectations indicate that the intervention program carried out in 2008 had a significant, but relatively short-lived, impact on the distribution of inflation expectations at long horizons. In sharp contrast, the intervention carried out in 2011 shows no relevant impact on the distribution of inflation expectations in Chile. A daily analysis using break-even inflation rate as a proxy for inflation expectations is roughly consistent with these results. Our analysis also suggests that the interventions did have an impact on daily exchange returns, especially in the following days after the programs were announced.

In the last few decades, an important number of emerging economies have adopted inflation targeting regimes (ITR) for conducting their monetary policy. According to Mishkin (2000), several conditions are required for the adoption of such schemes. In particular, a purely floating exchange rate regime is needed. This is a critical, or at the very least, controversial condition for emerging economies, which have a long tradition of using explicit or implicit exchange rate targets aimed at either achieving low and stable inflation or at improving the competitiveness of their economy. In this regard, in many cases the transition toward a fully fledged inflation targeting regime has been a little impure at times, given that exchange rate interventions have occurred with some frequency.

If we take seriously the well known “impossible trinity”, small open economies implementing a fully fledged inflation targeting regime should refrain from attempts to explicitly intervene in the foreign exchange market.[1] In this context, interventions should in theory be useless and furthermore they have the potential to interfere with the inflation target and to compromise the key role that inflation expectations play in this monetary system.

Beyond any theoretical argument, in practice small open economies implementing inflation targeting regimes do occasionally intervene in the exchange rate market. The effectiveness of these sterilised interventions is the subject of debate and the empirical evidence is mixed: see, for instance, Sarno and Taylor (2001), Kamil (2008), Broto (2013), Adler and Tovar (2011), Dominguez (2006), Fatum and Hutchison (2003) and Contreras, Pistelli and Sáez (2013) for some examples of articles investigating the effectiveness of interventions. Another interesting topic associated with forex interventions is that they may potentially conflict with the conduct of monetary policy. This is important because, irrespective of their effectiveness, interventions could have side effects on other variables of the economy and, as mentioned by Gersl and Holub (2006) and Gnabo, Mello and Moccero (2010), they might run the risk of being perceived as inconsistent with monetary policy.[2] In particular, they could have the collateral effect of an impact on the distribution of inflation

[1] See Obstfeld, Shambaugh and Taylor (2005) and Aizenman (2011) for further insights about the trilemma or imposssible trinity.

[2] See Holub (2004) for a consistency analysis between monetary policy and forex interventions in the Czech Republic.

expectations. This is so mainly for two reasons. 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. Second, if the intervention is perceived as a policy reaction that is in conflict with the inflationary target, then the monetary authority might lose credibility and inflation expectations might become more reluctant to respond to the central bank's actions.[3] It is important to say that, even if interventions are sterilized, these two channels may be present.

The rest of the article is organized as follows. Section 2 presents a short literature review and a description of the Central Bank of Chile's history of interventions. In Section 3 we present our empirical approach and our results. Section 4 concludes.

2 Brief literature review and interventions in Chile

Most of the empirical literature analyzing exchange rate interventions focuses on the impact that these interventions may have on the exchange rate, its volatility or some measures of liquidity (see, for instance, Sarno and Taylor (2001), Tapia and Tokman (2003) and Berganza and Broto (2012)). Irrespective of the effectiveness of the intervention in achieving the preannounced goal, the intervention itself may induce some collateral effects on other variables in the economy. For instance, interventions may affect order flow, risk premiums and expectations. Interestingly, even if the intervention fails to create a desired impact on a given variable, it may generate an undesired side effect on another variable. This is extremely relevant in inflation targeting countries because an exchange rate intervention *"...runs the risk of transforming the exchange rate into a nominal anchor for monetary policy that takes precedence over the inflation target, at least in the eyes of the public"* (Mishkin (2000)). An interesting analysis of interventions in an inflation targeting economy is found in Kamil (2008). He points out that policymakers in many emerging inflation targeting economies are attempting to resist currency appreciation while simultaneously trying to meet their inflation targets. Analyzing the case of Colombia, Kamil (2008) finds that exchange rate interventions were effective during the period 2004–2006, when foreign currency purchases were undertaken during a period of monetary easing. In 2007, however, he found that interventions were ineffective in slowing down the appreciation of the domestic currency, as large-scale interventions became incompatible with meeting the inflation target in an overheating economy. In a related article, Ades et al (2002) focus on the possibility that interventions may be considered excessive by the public. The point here is that, if interventions are not clearly justified, they could threaten the inflation target as people may construct the belief that the implicit target of the central bank is different from the one explicitly announced.

In the particular case of Chile, Ades et al (2002) find that interventions have not been excessive, as they were aimed at preventing deviations of the exchange rate from its long-run equilibrium value, while in other countries, central banks seem to have intervened against any fluctuation of the exchange rate. Following a similar line of thought, we will explore whether the amount of preannounced central bank interventions Granger-cause the distribution of inflation expectations at long horizons and therefore undermine the inflationary target. Before moving to the empirical analysis, in the next subsection we provide a brief description of the exchange rate interventions carried out by the Central Bank of Chile since 2000.

[3] It is important to point out that some intervention programs may be perceived as consistent with the inflationary target, so we should not expect any pervasive consequence for inflation expectations in this case. It is only when market players perceive that an intervention program is in a conflict with the inflationary target that this channel will be present.

2.1 Interventions in Chile

The inflation targeting regime in Chile was adopted in 1990 in a gradual way because, as Schmidt-Hebbel and Werner (2002) point out, the central bank also pursued an exchange rate target between 1984 and 1999, although the inflation target was dominant in Chile's dual nominal anchor system.

In 1999 this scheme was tightened up, when Chile adopted a floating regime for the exchange rate. In this new scenario, the central bank reserved the right to intervene in the foreign exchange market in exceptional circumstances such as excessive depreciations or appreciations of the local currency that could have potentially negative effects for the economy.[4]

Since 2000, the Central Bank of Chile has carried out four intervention programs in the exchange rate market. The first two interventions took place in 2001 and 2002 and shared several common features. First, these two interventions were preannounced by a public press release. Second, they were justified on the grounds of a perceived market overreaction to worsening international conditions. Third, they were implemented in the context of an important depreciation of the domestic currency against the American dollar. Fourth, both interventions were characterized by a mixture of two measures: An increase in the supply of Indexed Bonds in Dollars by an amount that could not exceed US$2,000 million and the announcement that a total amount of US$2,000 million in reserves could potentially be used in direct sales to the market in the upcoming four months. No specific schedule was established for either of these two operations. Interestingly, the actual amount of direct sales of dollars during the 2002 intervention was exactly zero[5].

The interventions of 2008 and 2011 were performed in a very different way. Even though they were also announced in advance, they were justified on the grounds of the benefit that an accumulation of international reserves could bring to the country in the circumstances of international financial turmoil. These two interventions were carried out in a context of an appreciating domestic currency and were implemented via direct purchases of dollars only. In particular, in April 2008, the central bank argued that an increase in the level of international reserves would be useful in order to counter deteriorating international conditions. On that occasion, the exact mechanism adopted was to increase the level of international reserves by the amount of US$8,000 million through daily dollar purchases of US$50 million that would span the period from Monday, April 14 to December 12, 2008. Similarly, in January 2011, the central bank announced another program of accumulation of reserves with the same basic objective of being better prepared to face the event of a significant deterioration in the external environment. The basic plan was to acquire a total of US$12,000 million during the year 2011 by daily dollar purchases of US$50 million from January 5 to December 16 2011. While the last intervention in 2011 was carried out as planned, the intervention in 2008 was abruptly stopped on September 29 2008, when only 71.88% of the preannounced accumulation of reserves was actually acquired.[6] After this announcement, no further purchases of dollars were carried out. The central bank argued that this decision was made in order to mitigate the consequences that the global financial turmoil might have had on the Chilean economy.

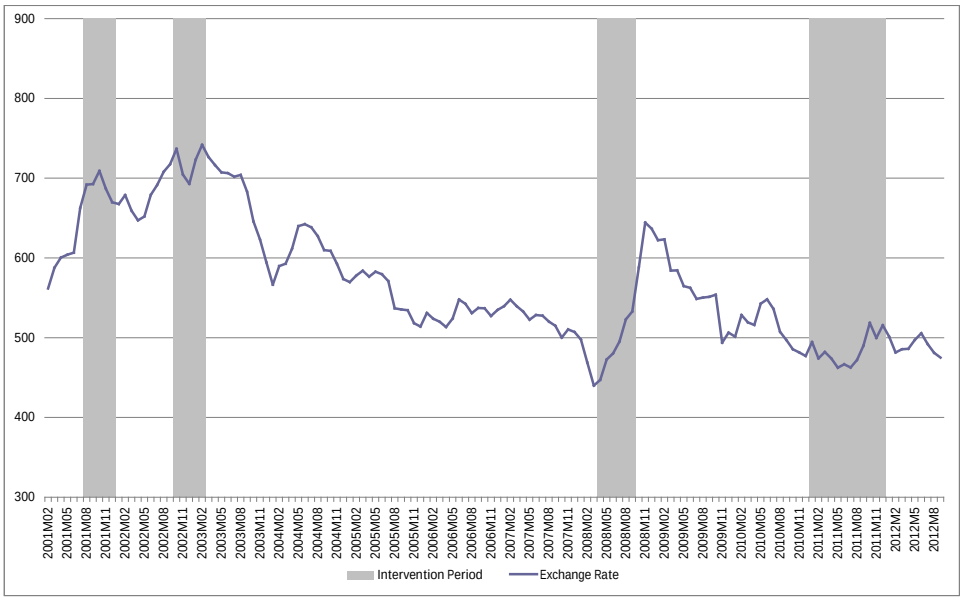
[4] As mentioned by De Gregorio and Tokman (2004), the implementation of the free floating scheme was a reasonable thing to do, because the existence of two nominal anchors, the inflation and exchange rates, eroded the credibility of the inflation targeting regime, and undermined its effectiveness.

[5] This type of unrequited intervention is analyzed in Dominguez and Panthaky (2007).

[6] It is worth noticing that all the four interventions mentioned in this paper were sterilised to avoid undesired inflationary effects.

Figure 1 displays the evolution of the Chilean peso/dollar exchange rate in the last 12 years. Intervention periods are depicted by four shaded bars.

Figure 1: Exchange rate and foreign exchange interventions periods



In the next section, we will show some empirical results aimed at determining a predictive relationship between exchange rate interventions and the distribution of inflation expectations.

3 The empirical approach

We engage in three different exercises to analyze the relationship between exchange rate interventions in Chile and different measures of inflation expectations. The first two exercises make use of monthly data for Chilean CPI, the monthly amount of dollar purchases carried out by the Central Bank of Chile, a set of covariates and nine deciles of inflation expectations at 1, 12 and 24 months ahead. These deciles are obtained from the Survey of Professional Forecasters (SPF) carried out by the Central Bank of Chile on a monthly basis.

The third exercise is carried out using daily data for the break-even inflation rate as a proxy for inflation expectations. This exercise is carried out mainly to analyze the role that the announcements may have in affecting expectations. On a monthly basis, it is hard to detect any impact from the announcements, but we expect better results at a higher frequency.

For the first two exercises, we consider the period from July 2007 to September 2012. For the daily exercise, we consider the period from January 25 2005 to February 2 2012. We explicitly exclude the interventions carried out in 2001 and 2002 because they are very different from the interventions in 2008 and 2011 and also, in the high-frequency analysis, for data availability.

In the next subsections we describe the methodology and results of our exercises.

3.1 Seemingly unrelated approach

We are interested in the following joint system of equations:

$$\Delta[\,\pi^{e}_{it}(h)] = \delta_{ih}[\Delta\pi^{e}_{it-1}(h)] + \Delta X'_{t-1}\beta_{ih} + \gamma_{ih}\Delta M_{t-1} + \emptyset_{ih}(B)\varepsilon_{iht}, \quad i = 1,\ldots,9 \qquad (1)$$

where:

$\pi^{e}_{it}(h)$: Inflation expectation decile $i \in \{1,...,9\}$ at time t for horizon $t+h$

M_{t-1}: Monthly interventions in billions of US dollars

X'_{t-1}: Covariates

$\emptyset_{ih}(B)$: Moving average operator

Δ: Differencing operator

$(\varepsilon_{1ht},\ldots,\varepsilon_{9ht})$: White noise vector process with variance Σ_h

These equations are estimated in differences because the inflation expectation deciles may be extremely persistent. This may pose a problem in a regression with a small number of observations. Figure 2 below shows the median of inflation expectations at 1, 12 and 24 months ahead. This figure shows that inflation expectations at longer horizons are quite persistent. This feature is also shared by other deciles of inflation expectations two years ahead, as shown in Figure 3. Figure 4 shows that when taking first differences, the reduction in the persistence of inflation expectations is important, at least for expectations 1 and 12 months ahead.

It is also worth noticing that the disagreement between the different respondents of the SPF is also important as shown in Figure 5. In this picture we plot the difference between the ninth and first decile of inflation expectations. The gap shown in this picture is, at times, substantial.

We estimate the system of nine equations in (1) using a seemingly unrelated approach. Therefore the possible high correlation between the different expectations deciles is explicitly taken into consideration to get more precise estimates of the parameters.

Given the reduced number of observations in our analysis, we consider a relatively low number of covariates. Basically we select those variables that, in our opinion, are the most relevant to describe the evolution of inflation expectations. We use: Chilean year-on-year CPI inflation, monthly average of the Federal Reserve Funds rate, monthly average of the Dow Jones index, monthly World Bank Commodities Index (WBCI) and the projection of the nominal Chilean exchange rate on the CBOE Volatility Index (VIX) and the WBCI. To construct this last variable we simply estimate the following regression by OLS:

$$\Delta ER_t = c_0 + c_1\Delta(VIX_t) + c_2\Delta(WBCI_t) + u_t$$

and use

$$ERP_t \equiv \hat{c}_0 + \hat{c}_1(VIX_t) + \hat{c}_2(WBCI_t) \qquad (2)$$

as the last covariate in (1).

It is also important to point out that inflation expectations are also expressed in terms of year-on-year variation, so that both inflation expectations and inflation are expressed in the same units.

Figure 2: Intervention periods and inflation expectations, different horizons

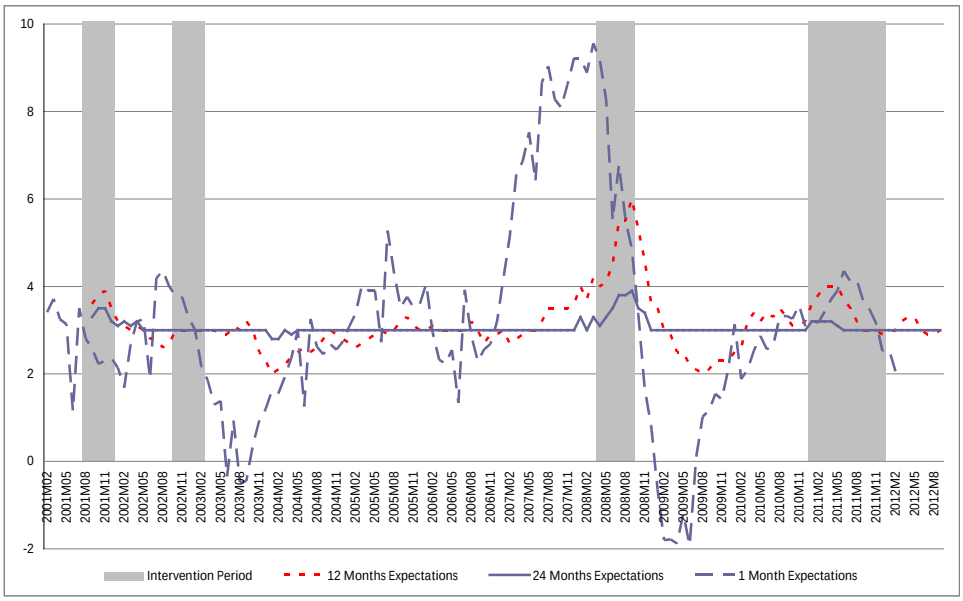


Figure 3: Inflation expectations by decile, two years ahead

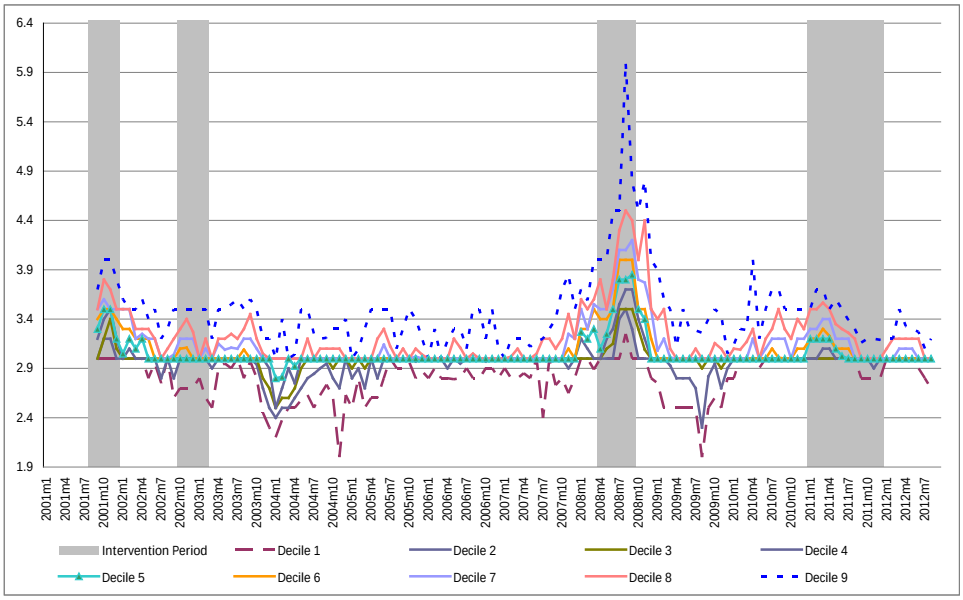


Figure 4: Intervention periods and differences of inflation expectations

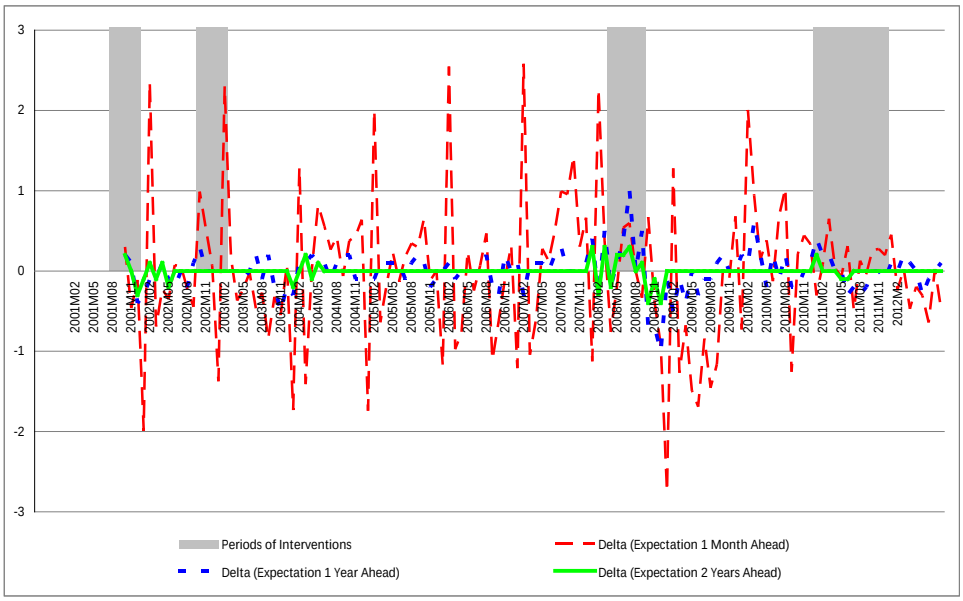
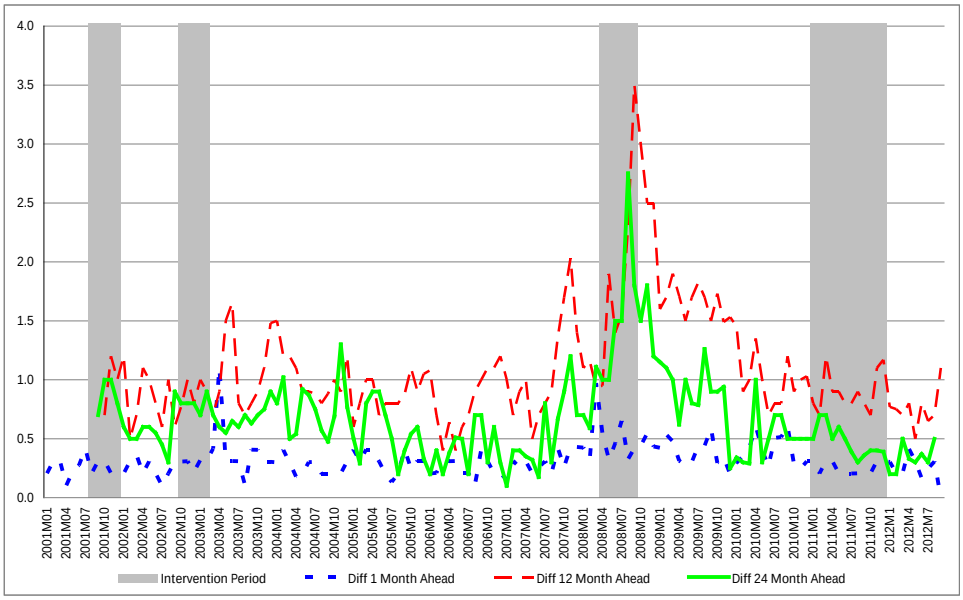


Figure 5: Spread in inflation expectations: Decile 1–Decile 9



Tables 1–3 below show the results of the estimation of (1). In these tables we report the γ coefficient associated to the intervention variable. We also report its *t*-statistic, its *p*-value (called "Prob" in the tables) and the R^2 of the corresponding equation. Table 1 shows that the amount of interventions do not Granger-cause inflation expectations one month ahead. In fact, not a single decile seems to be determined by the amount of the intervention.

Table 1: The intervention impact on the distribution of inflation expectations (γ_{i1})

Granger causality analysis with SUR, expectations one month ahead

Dep Variable	Coefficient	Std. Error	t-Statistic	**Prob.**	R2
Decile 1	0.072	0.290	0.250	**0.804**	0.501
Decile 2	0.032	0.298	0.109	**0.914**	0.490
Decile 3	0.055	0.304	0.181	**0.857**	0.480
Decile 4	0.002	0.307	0.006	**0.995**	0.480
Decile 5	0.021	0.310	0.067	**0.947**	0.477
Decile 6	0.014	0.310	0.046	**0.964**	0.471
Decile 7	0.023	0.313	0.073	**0.942**	0.460
Decile 8	0.022	0.312	0.070	**0.944**	0.452
Decile 9	0.015	0.310	0.047	**0.963**	0.470

Table 2 below shows a quite different view for inflation expectations 12 months ahead as eight out of the nine deciles are statistically not indifferent to the amount of interventions at the 10% level. In terms of the economic interpretation, we see coefficients that are far from negligible. For instance, for the median of inflation expectations one year ahead, we obtain a coefficient of 0.313, indicating that an increment of $1 billion in purchases predicts a rise of 31.3 basis points in inflation expectations one year ahead. It is interesting to remark that the impact is the highest in the case to the ninth decile. In this case an increment of $1 billion in purchases predicts a rise of 39.4 basis points in inflation expectations one year ahead.

Table 2: The intervention impact on the distribution of inflation expectations (γ_{i12})

Granger causality analysis with SUR, expectations one year ahead

Dep Variable	Coefficient	Std. Error	t-Statistic	**Prob.**	R2
Decile 1	0.220	0.139	1.582	**0.119**	0.230
Decile 2	0.269	0.138	1.947	**0.056**	0.215
Decile 3	0.246	0.122	2.024	**0.047**	0.199
Decile 4	0.254	0.109	2.326	**0.023**	0.331
Decile 5	0.313	0.108	2.895	**0.005**	0.368
Decile 6	0.262	0.102	2.573	**0.013**	0.378
Decile 7	0.274	0.140	1.951	**0.056**	0.260
Decile 8	0.295	0.154	1.914	**0.060**	0.337
Decile 9	0.394	0.187	2.106	**0.039**	0.270

Table 3 below indicates that the amount of the interventions seems to have an impact on only two or three deciles of the distribution of inflation expectations two years ahead. In particular, the impact on the median of the distribution is statistically significant with an 89% confidence level. The economic impact is much lower than in Table 2. For instance, for the median of inflation expectations we obtain a coefficient of 0.082, indicating that an increment of $1 billion in purchases predicts a rise of 8.2 basis points in inflation expectations two years ahead. It is interesting to remark that this impact is the highest in the case of the fourth decile. In this case, an increment of $1 billion in purchases predicts a rise of 9.5 basis points in inflation expectations two years ahead.

Table 3: The intervention impact on the distribution of inflation expectations (γ_{i24})

Granger causality analysis with SUR, expectations two years ahead

Dep Variable	Coefficient	Std. Error	t-Statistic	**Prob.**	R2
Decile 1	-0.053	0.068	-0.775	**0.442**	0.184
Decile 2	0.015	0.075	0.204	**0.839**	0.045
Decile 3	0.056	0.031	1.798	**0.077**	0.310
Decile 4	0.095	0.038	2.478	**0.016**	0.303
Decile 5	0.082	0.050	1.648	**0.105**	0.257
Decile 6	-0.004	0.059	-0.074	**0.942**	0.232
Decile 7	0.041	0.070	0.587	**0.560**	0.278
Decile 8	-0.118	0.105	-1.118	**0.268**	0.247
Decile 9	0.076	0.153	0.499	**0.619**	0.258

In Table 4 below, we summarize the results shown in Tables 1–3 but now considering joint tests rather than single tests for each expectation decile. In the first two columns, we show results when we test the null hypothesis that all nine γ_{ih} coefficientes are zero. In the last two columns, we focus on a null hypothesis in which only the five central parameters are jointly equal to zero. These are the parameters associated with the third, fourth, fifth, sixth and seventh deciles. It is interesting to note that: the joint tests cannot reject the null when considering expectations one month and one year ahead; and the null is strongly rejected, however, when considering the distribution of inflation expectations two years ahead.[7]

Table 4: Testing the joint hypothesis of no intervention impact on the distribution of inflation expectations

	F-Statistic	P-Value	F-Statistic	P-Value
1 Month	6.98	0.63	4.05	0.54
12 Months	10.47	0.31	8.92	0.11
24 Months	23.9	0.00	14.9	0.01

Notes: In the first two columns we test the null hypothesis that all nine γ_{ih} coefficients are zero.

In the last two columns we test the null hypothesis that only the central coefficients γ_{ih} are zero. In other words: H_0: $\gamma_{3h} = \gamma_{4h} = \gamma_{5h} = \gamma_{6h} = \gamma_{7h} = 0$.

Tables 1–4 display the results when estimating (1) without making a distinction between the two intervention programs carried out in our sample period. Consequently, results in Tables 1–4 may be considered as the average impact of the two intervention programs. We may as well try to explore the impact of each of the programs. To that end, we decompose the intervention variable in two components, the first and second intervention, so we now consider the following model

$$\Delta[\pi_{it}^{e}(h)] = \delta_{ih}[\Delta\pi_{it-1}^{e}(h)] + \Delta X'_{t-1}\beta_{ih} + \gamma_{ih}^{(1)}\Delta M_{t-1}^{(1)} + \gamma_{ih}^{(2)}\Delta M_{t-1}^{(2)} + \emptyset_{ih}(B)\varepsilon_{iht}, i = 1,\dots,9 \qquad (3)$$

which is exactly the same as (1) with the only difference that now we have two intervention variables:

[7] Differences between single and joint tests are typically due to the correlation structure of the t-statistics. When testing a set of single hypothesis using t-statistics, their correlation structure is overlooked creating some discrepancies with a joint test that takes into account this correlation structure.

$M_t^{(1)}$: Monthly interventions during 2008 in billions of US dollars (4)

$M_t^{(2)}$: Monthly interventions during 2011 in billions of US dollars (5)

The two corresponding parameters

$$\gamma_{ih}^{(1)} \ \& \ \gamma_{ih}^{(2)}$$

will help us decompose the impact of each intervention on the distribution of inflation expectations. Tables 5–7 next show the results of $\gamma_{ih}^{(1)}$ in the estimation of the system in (3).

Table 5: The 2008 intervention impact on the distribution of inflation expectations
Granger causality analysis with SUR, expectations one month ahead, ($\gamma_{i1}^{(1)}$)

Dep Variable	Coefficient	Std. Error	t-Statistic	**Prob.**	R2
Decile 1	0.373	0.449	0.830	**0.410**	0.505
Decile 2	0.301	0.462	0.651	**0.517**	0.492
Decile 3	0.305	0.471	0.647	**0.520**	0.483
Decile 4	0.178	0.477	0.372	**0.711**	0.481
Decile 5	0.205	0.481	0.426	**0.672**	0.479
Decile 6	0.254	0.482	0.528	**0.599**	0.474
Decile 7	0.220	0.486	0.454	**0.652**	0.461
Decile 8	0.194	0.484	0.401	**0.690**	0.453
Decile 9	0.189	0.482	0.392	**0.697**	0.471

Table 6: The 2008 intervention impact on the distribution of inflation expectations
Granger causality analysis with SUR, expectations 12 months ahead, ($\gamma_{i12}^{(1)}$)

Dep Variable	Coefficient	Std. Error	t-Statistic	**Prob.**	R2
Decile 1	0.295	0.220	1.343	**0.184**	0.241
Decile 2	0.253	0.222	1.138	**0.260**	0.204
Decile 3	0.384	0.189	2.035	**0.046**	0.223
Decile 4	0.380	0.170	2.243	**0.029**	0.353
Decile 5	0.486	0.165	2.955	**0.004**	0.407
Decile 6	0.442	0.155	2.845	**0.006**	0.418
Decile 7	0.333	0.221	1.505	**0.137**	0.249
Decile 8	0.364	0.243	1.498	**0.139**	0.324
Decile 9	0.219	0.311	0.704	**0.484**	0.276

Table 7: The 2008 intervention impact on the distribution of inflation expectations

Granger causality analysis with SUR, expectations 24 months ahead, ($\gamma_{i24}^{(1)}$)

Dep Variable	Coefficient	Std. Error	t-Statistic	**Prob.**	R2
Decile 1	-0.037	0.110	-0.334	**0.739**	0.220
Decile 2	0.119	0.125	0.950	**0.346**	-0.064
Decile 3	0.232	0.044	5.319	**0.000**	0.462
Decile 4	0.350	0.056	6.195	**0.000**	0.400
Decile 5	0.321	0.064	5.027	**0.000**	0.404
Decile 6	0.153	0.088	1.731	**0.089**	0.245
Decile 7	0.185	0.109	1.700	**0.094**	0.269
Decile 8	-0.215	0.167	-1.289	**0.202**	0.292
Decile 9	0.130	0.263	0.493	**0.624**	0.275

In Table 8 we summarize the results shown in Tables 5–7 but now considering joint tests rather than single tests for each expectation decile.

Table 8: Testing the joint hypothesis of no intervention impact on the distribution of inflation expectations During the 2008 intervention program

	F-Statistic	P-Value	F-Statistic	P-Value
1 Month	17.47	0.04	10.42	0.06
12 Months	12.56	0.18	12.18	0.03
24 Months	130.04	0.00	91.66	0.00

Notes: In the first two columns we test the null hypothesis that all nine $\gamma_{ih}^{(1)}$ coefficients are zero.

In the last two columns we test the null hypothesis that only the central coefficients $\gamma_{ih}^{(1)}$ are zero. In other words: H_0: $\gamma_{3h}^{(1)} = \gamma_{4h}^{(1)} = \gamma_{5h}^{(1)} = \gamma_{6h}^{(1)} = \gamma_{7h}^{(1)} = 0$.

Tables 5–8 provide much stronger results that those shown in Tables 1–4. In particular, Table 8 shows that the 2008 intervention had a significant impact on the center of the distribution of inflation expectations at every single horizon under consideration. The economic significance is also stronger when analyzing the 2008 intervention only. For instance, an increment of $1 billion in purchases predicts a raise of 48.6 basis points in inflation expectations one year ahead, which is much higher than the 31.3 basis points shown for the same decile in Table 2. Similarly, the maximum impact reported in Table 3 is less than 10 basis points whereas the maximum impact reported in Table 7 is 35 basis points for expectations 2 years ahead.

In sharp contrast with the remarkable results reported in Tables 5–8, Tables 9–12 show figures indicating that the intervention carried out in 2011 had little effect on the distribution of inflation expectations. In fact, the only statistically significant figure reported in these tables corresponds to the impact of the interventions on the ninth decile of the distribution of inflation expectations one year ahead. For the rest of the deciles and expectations horizons, no statistically significant impact is detected whatsoever. The joint tests reported in Table 12 corroborate these findings.

Table 9: The 2011 intervention impact on the distribution of inflation expectations
Granger causality analysis with SUR, expectations one month ahead, ($\gamma_{i1}^{(2)}$)

Dep Variable	Coefficient	Std. Error	t-Statistic	**Prob.**	R2
Decile 1	-0.114	0.360	-0.316	**0.753**	0.505
Decile 2	-0.135	0.371	-0.365	**0.716**	0.492
Decile 3	-0.102	0.378	-0.268	**0.789**	0.483
Decile 4	-0.112	0.383	-0.292	**0.772**	0.481
Decile 5	-0.098	0.386	-0.253	**0.801**	0.479
Decile 6	-0.138	0.386	-0.357	**0.723**	0.474
Decile 7	-0.105	0.389	-0.269	**0.789**	0.461
Decile 8	-0.090	0.388	-0.231	**0.818**	0.453
Decile 9	-0.098	0.386	-0.254	**0.801**	0.471

Table 10: The 2011 intervention impact on the distribution of inflation expectations
Granger causality analysis with SUR, expectations 12 months ahead, ($\gamma_{i12}^{(2)}$)

Dep Variable	Coefficient	Std. Error	t-Statistic	**Prob.**	R2
Decile 1	0.161	0.176	0.917	**0.363**	0.241
Decile 2	0.261	0.178	1.462	**0.149**	0.204
Decile 3	0.145	0.150	0.966	**0.338**	0.223
Decile 4	0.163	0.135	1.200	**0.235**	0.353
Decile 5	0.185	0.132	1.404	**0.165**	0.407
Decile 6	0.139	0.124	1.121	**0.267**	0.418
Decile 7	0.216	0.174	1.246	**0.217**	0.249
Decile 8	0.220	0.191	1.155	**0.252**	0.324
Decile 9	0.417	0.248	1.682	**0.098**	0.276

Table 11: The 2011 intervention impact on the distribution of inflation expectations
Granger causality analysis with SUR, expectations 24 months ahead, ($\gamma_{i24}^{(2)}$)

Dep Variable	Coefficient	Std. Error	t-Statistic	**Prob.**	R2
Decile 1	-0.086	0.088	-0.981	**0.331**	0.220
Decile 2	-0.009	0.097	-0.090	**0.929**	-0.064
Decile 3	-0.017	0.031	-0.535	**0.595**	0.462
Decile 4	0.009	0.041	0.224	**0.823**	0.400
Decile 5	-0.006	0.049	-0.127	**0.899**	0.404
Decile 6	-0.031	0.068	-0.456	**0.650**	0.245
Decile 7	0.007	0.085	0.077	**0.939**	0.269
Decile 8	-0.079	0.130	-0.603	**0.549**	0.292
Decile 9	-0.009	0.200	-0.044	**0.965**	0.275

Table 12: Testing the joint hypothesis of no intervention impact on the distribution of inflation expectations During the 2011 intervention program

	F-Statistic	Probability	F-Statistic	Probability
1 Month	3.56	0.93	2.52	0.77
12 Months	4.63	0.86	2.25	0.81
24 Months	3.39	0.94	1.15	0.94

Notes: In the first two columns we test the null hypothesis that all nine $\gamma_{ih}^{(2)}$ coefficients are zero.
In the last two columns we test the null hypothesis that only the central coefficients $\gamma_{ih}^{(2)}$ are zero. In other words: H_0: $\gamma_{3h}^{(2)} = \gamma_{4h}^{(2)} = \gamma_{5h}^{(2)} = \gamma_{6h}^{(2)} = \gamma_{7h}^{(2)} = 0$.

Results in Tables 1–12 suggest that the interventions in 2008 and in 2011 had different implications over the distribution of inflation expectations. Results reported in Tables 1-4 are probably significant mainly as a consequence of the intervention carried out in 2008. This distinction is important as the macroeconomic conditions surrounding both interventions were very different. It is possible that the high levels of inflation preceding the 2008 intervention may have created an inappropriate environment for an intervention to take place without collateral effects. This is just a hypothesis. The precise reasons behind the different results associated to the two similar intervention programs are ultimately unknown, and are left as a subject for further research.[8]

Thus far we have investigated whether the interventions carried out in 2008 and 2011 in Chile had an impact on the distribution of inflation expectations or not. In the next section, we further explore the nature on these impacts. In particular we place our attention on the duration of the impact via an impulse-response analysis.

3.2 Impulse-response analysis

Our previous analysis offers an answer to the question about the predictive power of the interventions on the distribution of inflation expectations. With Tables 1–12, we have shown that interventions did have the ability to predict some changes in the distribution of inflation expectations in 2008. We now focus on the dynamic response of the distribution of inflation expectations to an intervention shock. In particular we would like to know something about the persistence of this response. To that end, we estimate a reduced VAR using several endogenous and exogenous variables. Table 13 shows the variables that we use in our VAR specification:

[8] Gnabo, Mello and Moccero (2010) study the interdependencies between monetary policy and forex interventions in inflation targeting economies. This type of linkage might help to explain the heterogeneous results shown in this paper for the two intervention programs under consideration.

Table 13
Variables included in the VAR analysis

Endogenous variables	Exogenous variables
$\pi_{it}^{e}(h)$	$Food_t$
M_t	Fed_t
π_t	ERP_t
	Oil_t

where:

$\pi_{it}^{e}(h)$: Inflation expectations decile $i \in \{1,...,9\}$ at time *t* for horizon *t+h*

M_t: Monthly interventions in billions of US dollars

π_t: Year-on-year CPI inflation rate

$Food_t$: Year-on-year food price index inflation rate

Fed_t: Monthly average of the Federal Reserve Funds Rate

ERP_t: Projection of the nominal Chilean exchange rate according to (2)

Oil_t: Year-on-year oil price inflation rate.

We estimate a VAR(1) with the variables in first differences just as we did with the previous exercise (SUR). We consider only a first-order VAR due to our small sample size. First we run a total of 27 VARs, one for each inflation expectation decile and horizon. Then we split the intervention variable M_t into its two components $M_t^{(1)}$ and $M_t^{(2)}$ defined in (4) and (5). Then we estimate again a total of 27 VARs, one for each inflation expectation decile and horizon but replacing the intervention variable M_t by its two components $M_t^{(1)}$ and $M_t^{(2)}$

Figures 6-8 show non-orthogonalized impulse response functions and their respective 90% confidence bands for every single inflation expectation decile when we run the VAR(1) with the intervention variable M_t. The shock is $1 billion in dollar purchases. These figures indicate that the impact on inflation expectations is relatively short-lived, as after a few months the response is not statistically significant at the 10% significance level.

Figure 6: The Intervention impact on the distribution of inflation expectations
Expectations one month ahead. Both intervention programs included

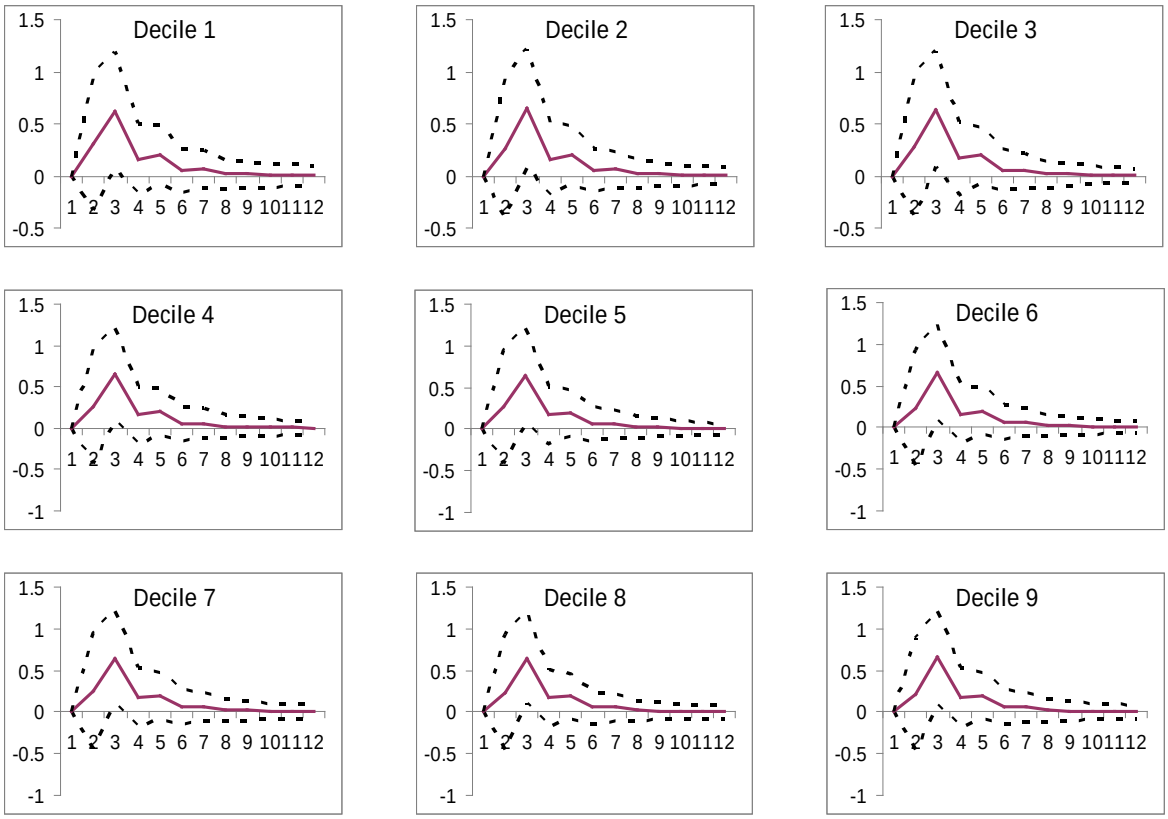


Figure 7: The intervention impact on the distribution of inflation expectations
Expectations 12 months ahead. Both intervention programs included

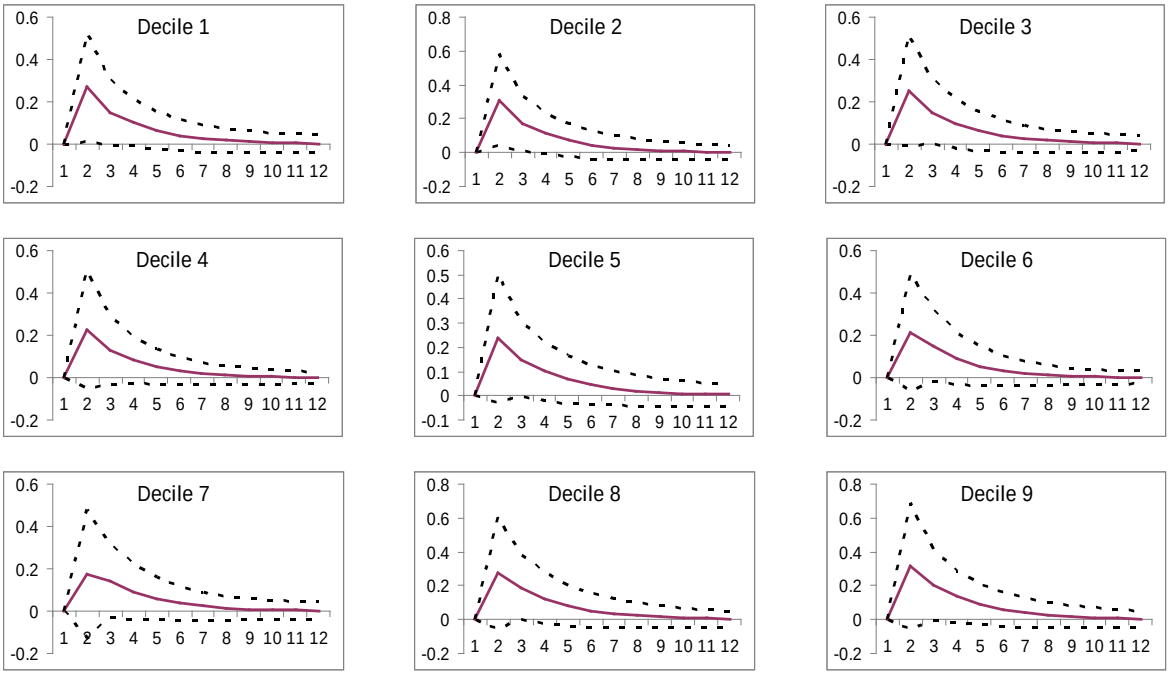
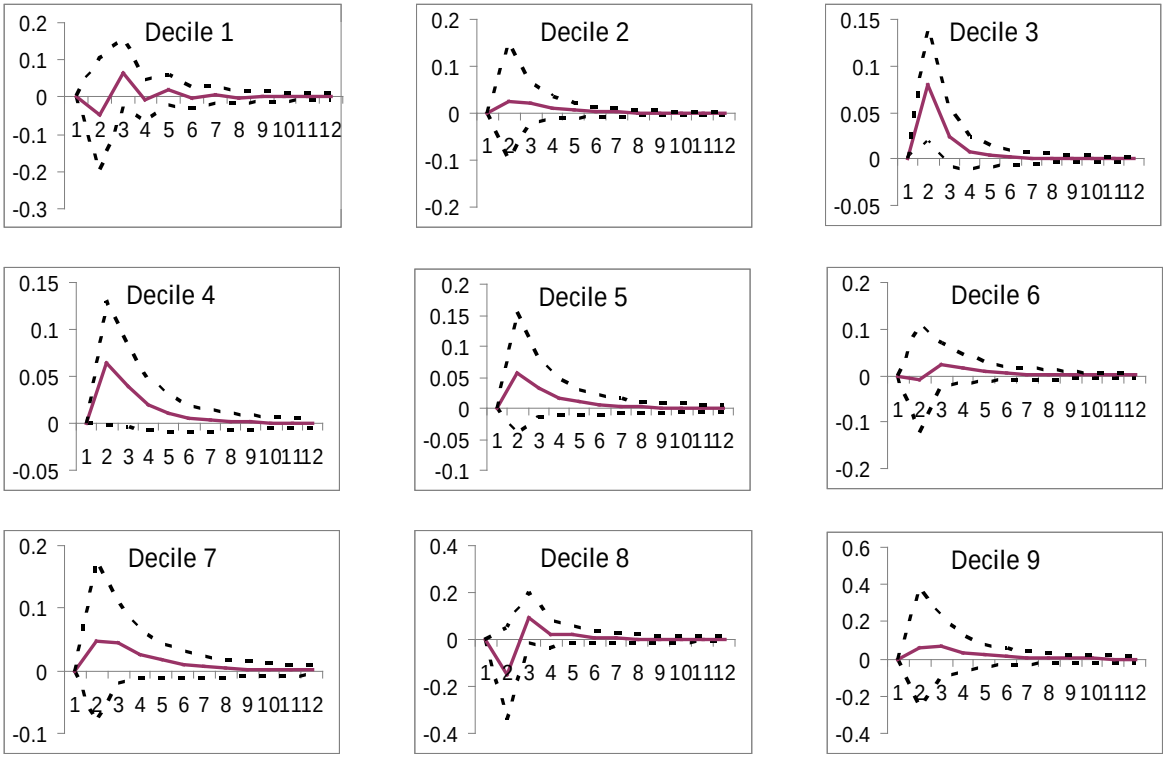


Figure 8: The intervention impact on the distribution of inflation expectations
Expectations 24 months ahead. Both intervention programs included



Figures 9-14 show non-orthogonalized impulse response functions and their respective 90% confidence bands for every single inflation expectation decile when we split the intervention variable M_t into its two components $M_t^{(1)}$ and $M_t^{(2)}$. This allows us to analyze the impact of the two intervention periods separately. Figures 9-11 show impulse-response functions after a $1 billion intervention shock in 2008. Figures 12–14 show impulse-response functions after a $1 billion intervention shock in 2011. While the impact of the intervention in 2008 is still reported as much higher than that of the intervention in 2011, Figures 9–11 corroborate the findings reported in Figures 6–8 as the impact on inflation expectations is relatively short-lived. Actually, after six months the response is not statistically significant at the 10% significance level.

Figure 9: The 2008 intervention impact on the distribution of inflation expectations
Expectations one month ahead

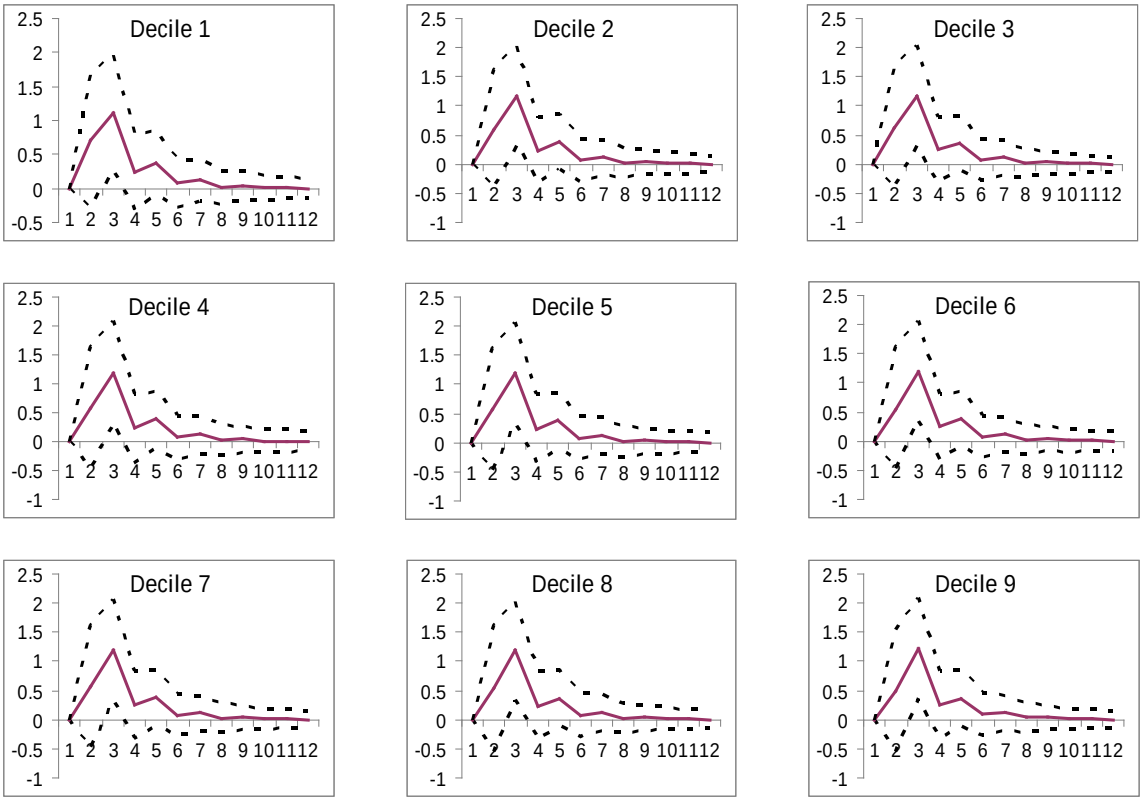


Figure 10: The 2008 intervention impact on the distribution of inflation expectations
Expectations 12 months ahead

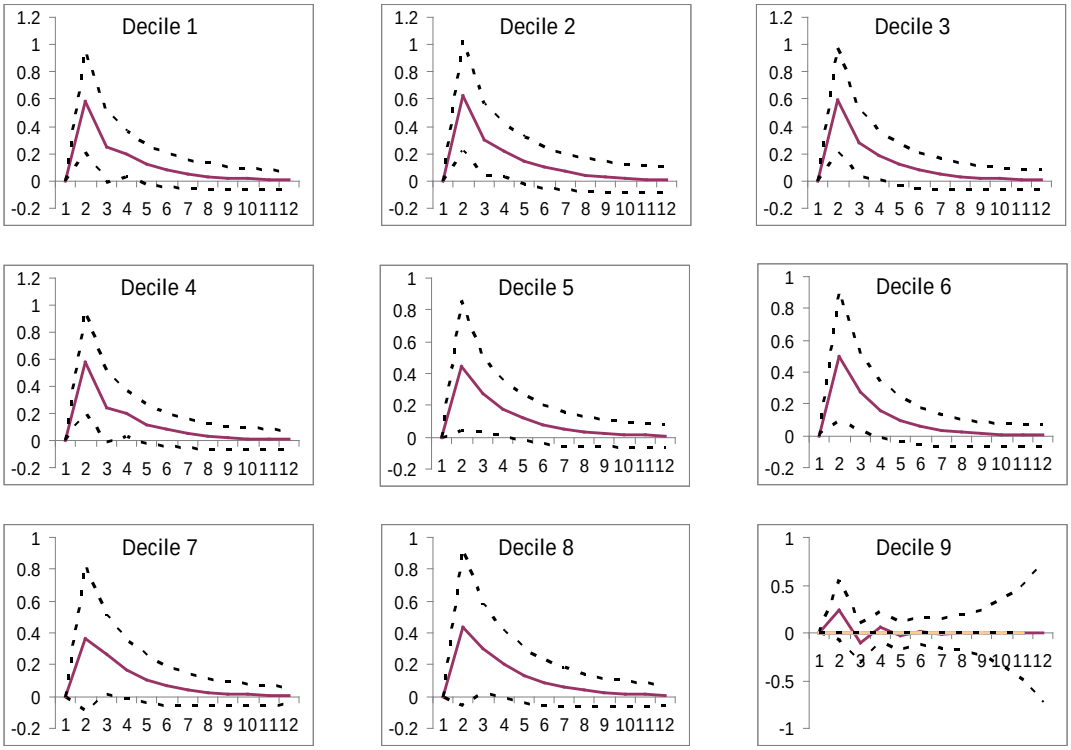


Figure 11: The 2008 intervention impact on the distribution of inflation expectations
Expectations 24 months ahead

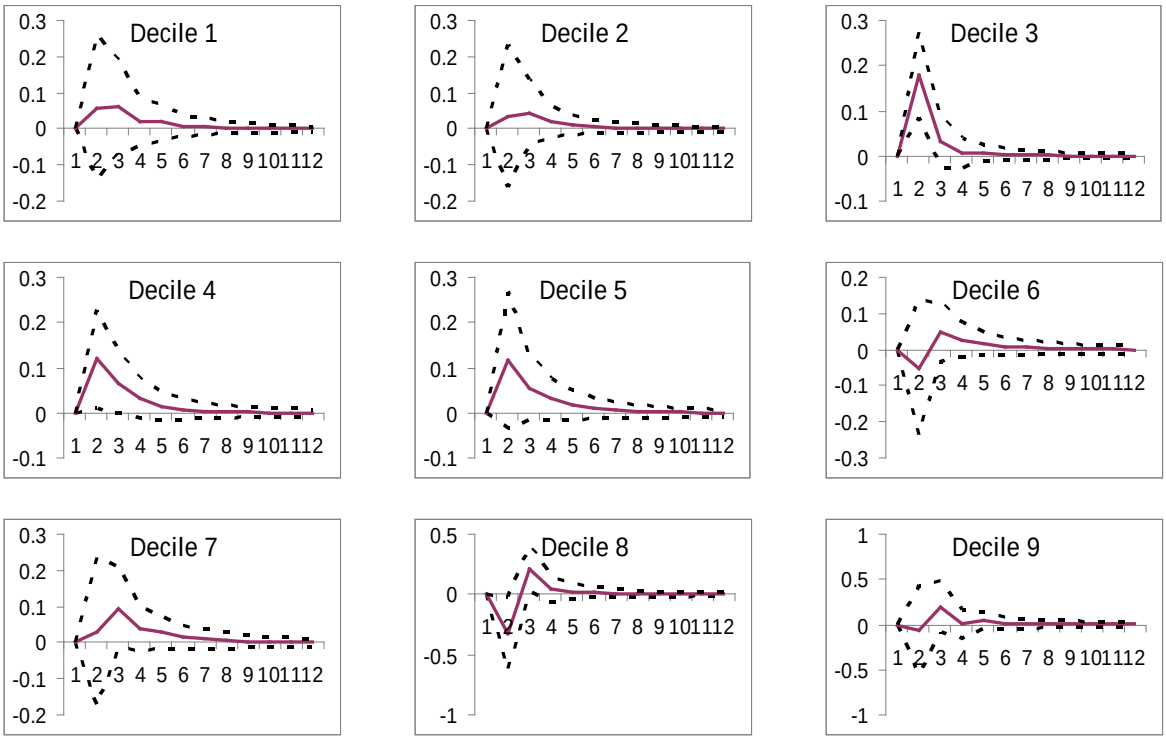


Figure 12: The 2011 intervention impact on the distribution of inflation expectations
Expectations one month ahead

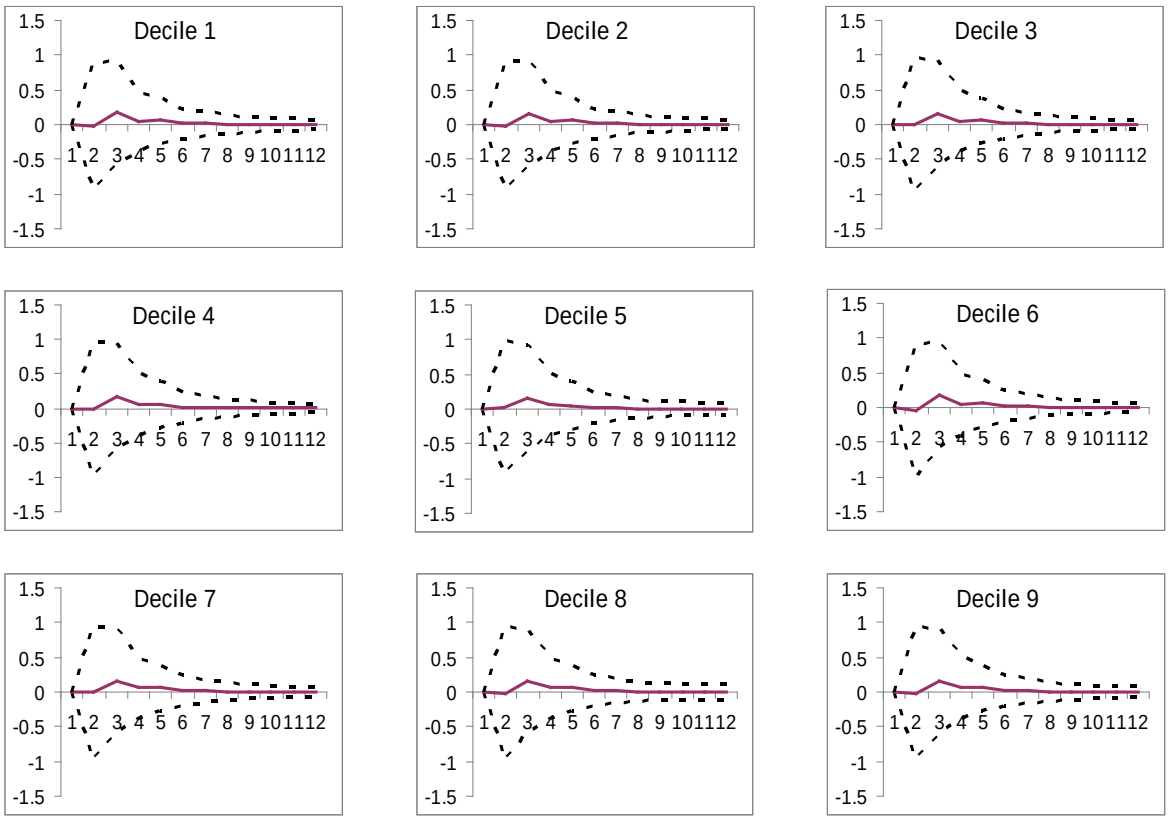


Figure 13: The 2011 intervention impact on the distribution of inflation expectations
Expectations 12 months ahead

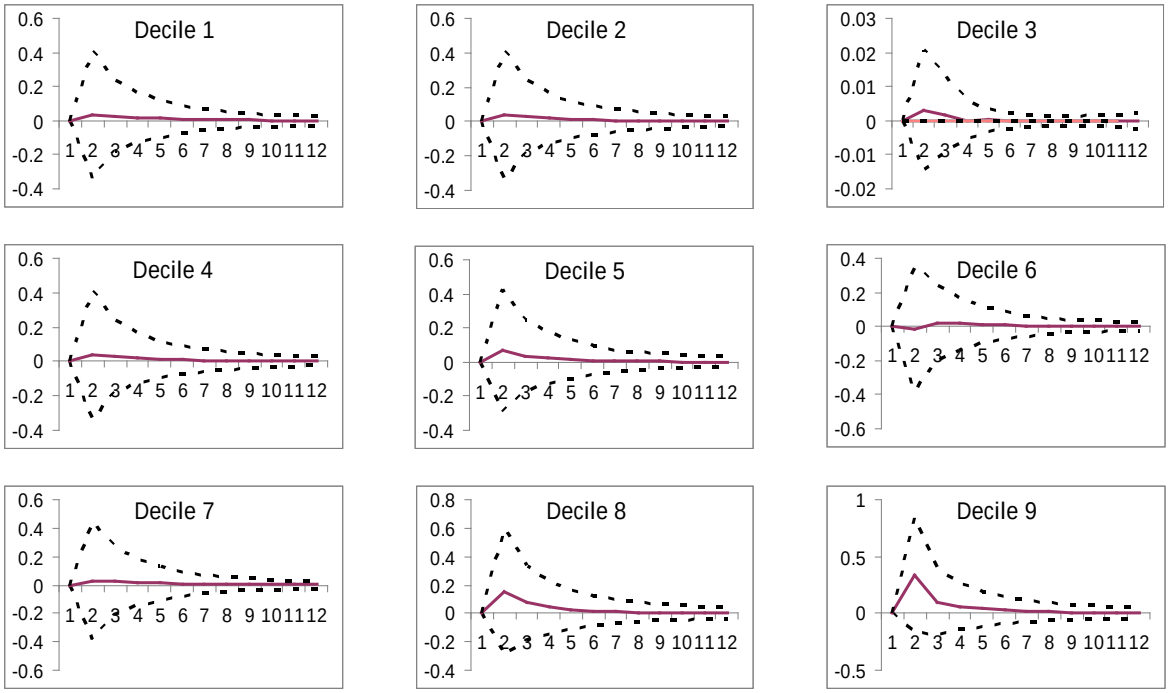
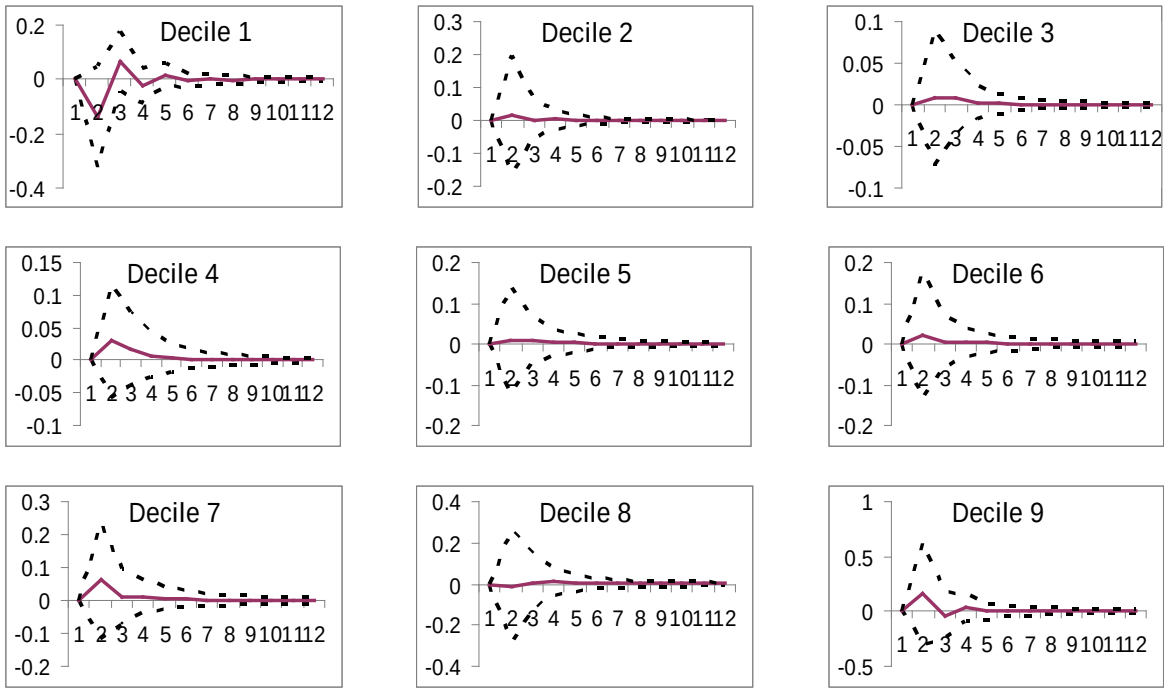


Figure 14: The 2011 intervention impact on the distribution of inflation expectations
Expectations 24 months ahead



3.3 Daily analysis

So far we have worked with monthly data and we have characterized the intervention programs in Chile with the monthly amount of dollar purchases. This is a reasonable approach to follow but it has some shortcomings. One of them is that it is difficult to break down the impact of the intervention impact into its announcement component and the impact of the subsequent direct dollar purchases. This is so because the three announcements released during our sample period occurred during months in which purchases were also carried out. For a proper identification of the announcement and direct purchases effect, we think it is much better to work with daily data which will allow us to capture the timing of the interventions programs more adequately.

In the case of the last two intervention programs in Chile, we are able to identify three relevant announcements:

Announcement 1: On April 10, 2008, the Central Bank of Chile published a press release between 7:15 PM and 7:45 PM indicating that an intervention program would start on April 14, 2008. A total of US$,8000 million would be purchased at a rate of US$50 million every day.[9]

Announcement 2: On September 29, 2008, the Central Bank of Chile published a press release between 5:40 PM and 5:48 PM indicating that the intervention program announced on April 10, 2008 would be discontinued immediately after the press release. After this announcement, no further dollar purchases were carried out. The central bank argued that this decision was made in order to mitigate the consequences that the global financial turmoil might have on the Chilean economy[10].

Announcement 3: On January 3, 2011, the Central Bank of Chile published a press release at 6 PM indicating that an intervention program would start on January 5, 2011. A total of US$12,000 million would be purchased at a rate of US$50 million every day.

Figures 15–17 show the level of intraday spot exchange rate around the intervention announcement. They suggest that the announcement itself caused an important shift in the level of the exchange rate.[11] In these figures, we use different colours to identify three different periods: previous to the announcement (blue), after the announcement but previous to the beginning of the forex operations (red) and the period of market operations (green).

[9] The exact time of the announcement is unknown.

[10] The exact time of this announcement is also unknown.

[11] These short-term prices are calculated according to the representative price of the currency following the methodology in Dominguez (1999). Most of the short-term prices correspond to five-minute prices. This means that they are representative prices of the transactions that occurred in a five minute window. Nevertheless, we also consider in our analysis longer period windows when no transactions are recorded during a five-minute window. We also include in our data the open and close price. In summary, our data are heterogenous, but they share the common feature of being either five-minute prices or the representative exchange rate during the shortest available window when no transactions are recorded during a five-minute window.

Figure 15: The 2008 intervention announcement impact on the level of the Chilean peso–US dollar parity

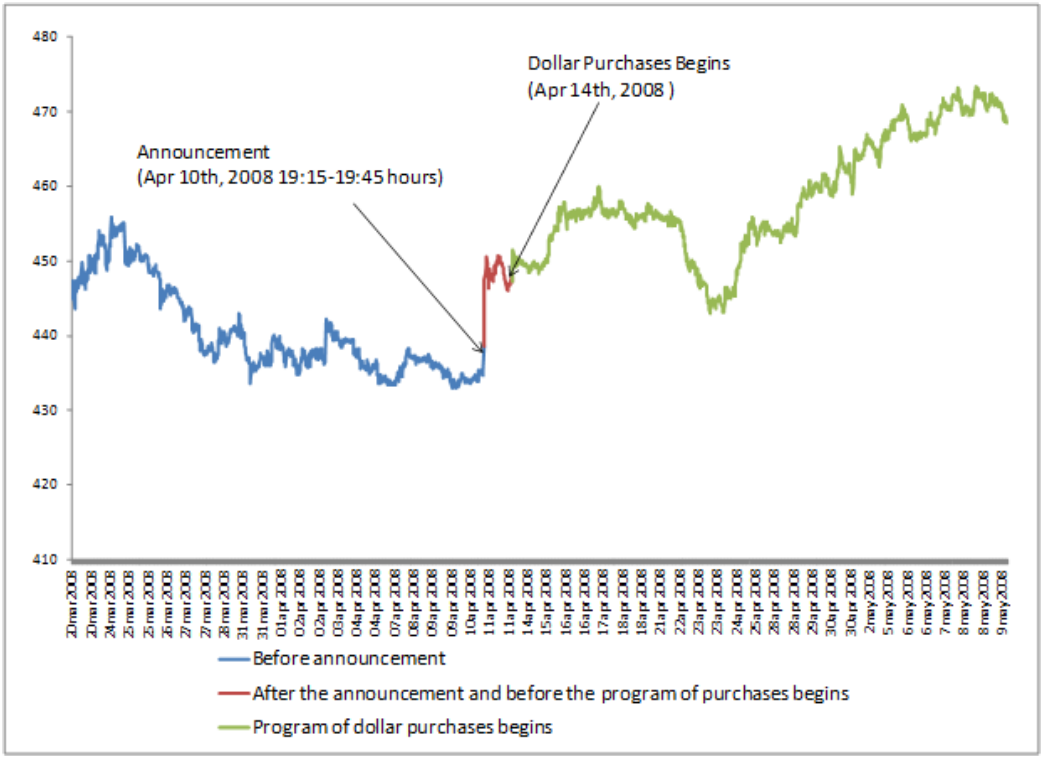


Figure 16: The 2008 termination announcement impact on the level of the Chilean peso–US dollar parity

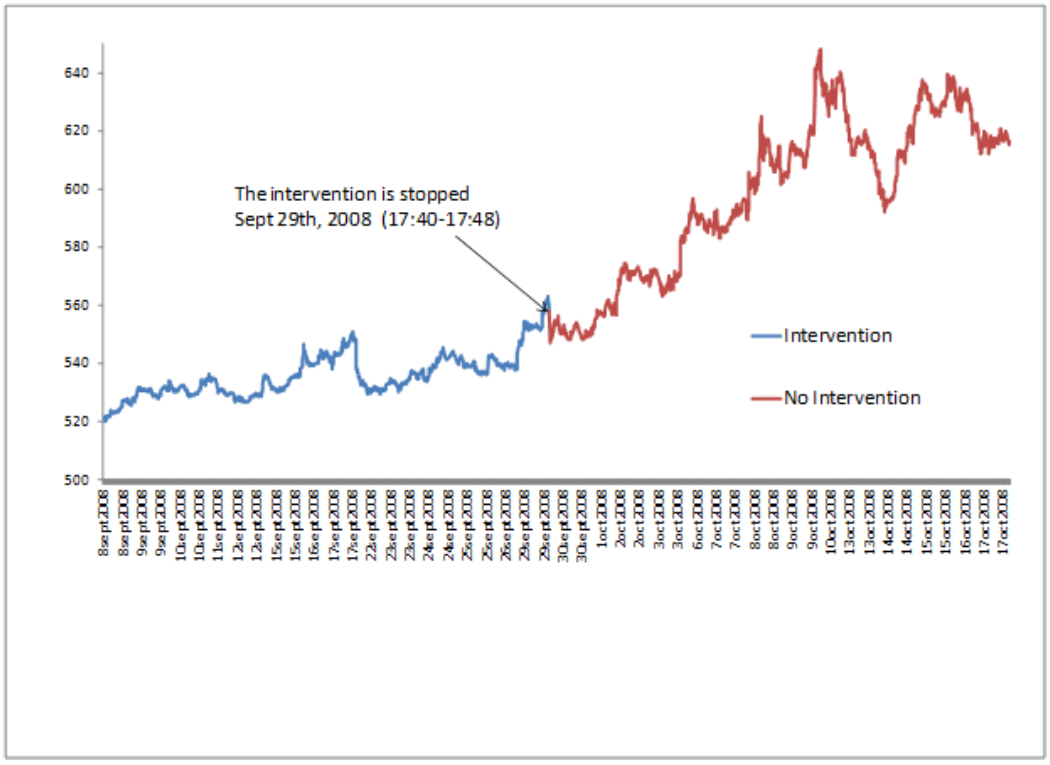
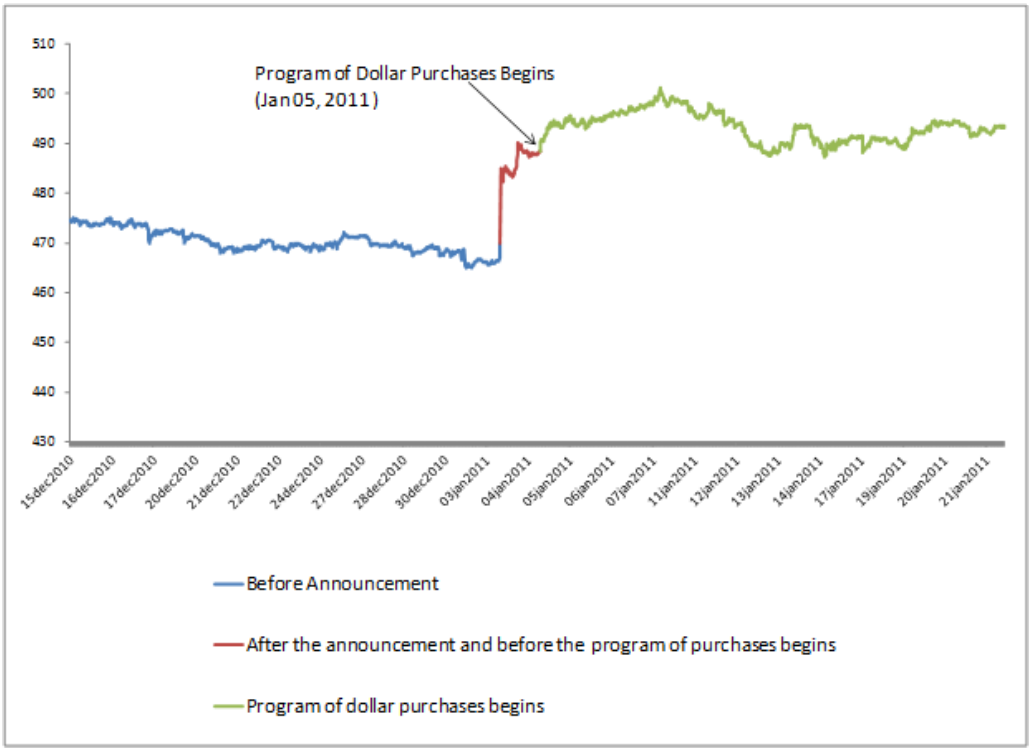


Figure 17: The 2011 intervention announcement impact on the level of the Chilean peso–US dollar parity



We also estimate the following simple and basic expression with the aim of shedding some quantitative light in terms of the effectiveness of the intervention programs in Chile. We give special attention to the role that the announcements may play:

$$r_t = c + \rho r_{t-1} + \beta_{2008} I_{t-1}^{2008} + \beta_{2011} I_{t-1}^{2011} + \gamma A_{t-1} + \varepsilon_t - \theta \varepsilon_{t-1} \qquad (6)$$

Where

r_t: Daily exchange rate log return
I_t^{2008}: Daily interventions during the 2008 program in millions of US dollars
I_t^{2011}: Daily interventions during the 2011 program in millions of US dollars
A_t: Interventions announcements or interruptions in billions of dollars
ε_t: Conditionally heteroskedastic white noise following a GARCH(1,1) process

We notice that A_t is a variable of zeroes except for the days of the announcements. Therefore A_t takes the value of 8 on April 10, 2008, the value of –2.25 on September 29, 2008 and the value of 12 on January 3, 2011. These numbers correspond to the total size of the intervention programs announced. In the case of the negative number, it corresponds to the sudden interruption of the 2008 intervention program. Let us recall that the 2008 program was supposed to buy US$8,000 million. It only purchased US$5,750 million, so we assume that the market was surprised by the interruption of the program in terms of the US$ 2,250 millions that were not fulfilled.

Table 14: The impact of exchange rate interventions on daily exchange rate returns

Dependent	(1)	(2)	(3)	(4)	(5)	(6)
Variable	c	ρ	β_{2008}	β_{2011}	γ	θ
r_t	-0.032***	0.349***	0.003**	0.0003	0.328***	0.364***
	[-3.25]	[5.73]	[2.01]	[0.521]	[27.14]	[5.466]
No. Obs.	1,757					
R^2	0.026					
Durbin-Watson	1.966					

t-Statistics are shown in [...]. (*) (**) (***) significant at the 10%, 5% and 1% level.

Table 14 shows the results of the maximum likelihood estimation of (6). This table indicates that the direct purchases of dollars carried out in 2008 had a statistically significant effect on daily exchange rate returns. The similar dollar purchases carried out during the 2011 intervention are not statistically significant, however. Nevertheless, our announcement variable is statistically significant, suggesting that the intervention announcements shifted upwards exchange rate returns, which is consistent with the evidence depicted in Figures 15–17.

We now focus on the estimation of the effect of exchange market interventions on a measure of break-even inflation rate. We consider a measure that should be interpreted as an expectation of the inflation that will be accumulated over one year, starting 12 months from the current period. We use this variable as a proxy of the two-years ahead inflation expectations. We consider the following specification:

$$\Delta\pi_t^e = c + \rho\Delta\pi_{t-1}^e + \beta_1 I_{t-1}^{2008} + \beta_2 I_{t-1}^{2011} + \gamma A_{t-1} + \delta\Delta\pi_{t-1} + \alpha rr_{t-1} + u_t - \theta u_{t-1} \qquad (7)$$

Where

π_t^e: Daily break-even inflation rate at day *t*
I_t^{2008}: Daily interventions during the 2008 program in millions of US dollars
I_t^{2011}: Daily interventions during the 2011 program in millions of US dollars
rr_t: Residuals of the exchange rate return regression in (6)
A_t: Interventions announcements or interruptions in billions of dollars
π_t: Daily inflation rate at day t
u_t: Conditionally heteroskedastic white noise following a GARCH(1,1) process
Δ: Differencing operator

Our maximum likelihood estimates are shown in Table 15 for six different variations of the main specification (7).

Table 15: The impact of exchange rate interventions announcements on break-even inflation rate

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	$\Delta\pi_t^e$	$\Delta\pi_t^e$	$\Delta\pi_t^e$	$\Delta\pi_t^e$	$\Delta\pi_t^e$	$\Delta\pi_t^e$
c	0.001	0.001	0.001	0.002	0.001	0.001
	[0.302]	[0.296]	[0.290]	[0.248]	[0.131]	[0.221]
$\Delta\pi_{t-1}^e$	0.315***	0.313**	0.319***	0.323***	-0.286***	-
	[7.433]	[7.351]	[7.429]	[7.722]	[-12.970]	-
I_{t-1}^{2008}	0.0003**	-	0.0003**	0.0002**	0.0006	0.0004**
	[2.07]	-	[2.10]	[2.10]	[1.54]	[2.08]
I_{t-1}^{2011}	-0.0001	-	-0.0001	-0.0001	-0.0002	-0.0002
	[-1.33]	-	[-1.46]	[-1.48]	[-0.91]	[-1.22]
$I_{t-1}^{2008} + I_{t-1}^{2011}$	-	-0.0001	-	-	-	-
	-	[-1.087]	-	-	-	-
A_{t-1}	0.024***	0.025***	0.024***	0.024***	0.059***	0.041***
	[2.87]	[3.01]	[2.88]	[2.93]	[3.31]	[3.97]
$\Delta\pi_{t-1}$	-0.024	-0.024	-0.024	-	-	-
	[-0.881]	[-0.882]	[-0.919]	-	-	-
rr_{t-1}	-0.009	-0.009	-	-	-	-
	[-1.589]	[-1.637]	-	-	-	-
θ	-0.711***	-0.708***	-0.714***	-0.718***	-	-0.452***
	[-22.32]	[-21.87]	[-22.184]	[-22.855]	-	[-20.502]
No. Obs.	1,755	1,755	1,755	1,755	1,755	1,757
R^2	0.172	0.171	0.171	0.171	0.090	0.142
Durbin-Watson	2.059	2.061	2.06	2.06	2.13	1.91

t-Statistics are shown in [...]. (*) (**) (***) significant at the 10%, 5% and 1% level.

From Table 15, we see that in all our specifications the announcement variable is statistically significant at high confidence levels. The sign of the estimated coefficient is also easy to interpret, as the announcement of a dollar purchase program may generate a rise in inflation expectations. These results suggest that an intervention announcement for $10 billion tends to raise inflation expectations between 24 and 59 basis points on the day after the announcement takes place.

Direct dollar purchases in 2008 are sometimes statistically significant with a positive sign, whereas the variable capturing direct dollar purchases in 2011 is not statistically significant at usual levels.

This analysis suggests that forex interventions in Chile had an impact on the break-even inflation rate, especially at the moment of the announcement of the intervention programs. To the extent that break-even inflation rate may be consider a good proxy of inflation expectations, the results in Table 15 corroborate those reported in previous sections when working with survey-based measures of inflation expectations.

4 Conclusions

Sterilised exchange rate interventions are controversial for a number of reasons. Part of this controversy is related to the huge amount of resources that are typically involved. They are also controversial because it is not entirely clear if they are successful in fulfilling the implicit or explicit goal they are designed to satisfy, and the empirical evidence provides mixed results in this respect. In the case of inflation targeting countries, there is an additional source of controversy: irrespective of their effectiveness, interventions may have the collateral effect of an undesired impact on the distribution of inflation expectations. This may happen because it may be not entirely clear whether monetary policy actions are focused on the inflation target or on any other implicit target related to the exchange rate.

As in many small open economies with an inflation target, Chile's monetary authorities have decided to intervene the exchange rate market in several occasions. Using data from the last two intervention periods in Chile, we have focused our attention on the linkage between the amount of exchange rate interventions and the distribution of inflation expectations in Chile. Using a multiple equation method, we have found that the amount of the intervention Granger-causes several deciles of the distribution of inflation expectations at longer horizons.

Notwithstanding the above, our results suggest that the interventions in 2008 and 2011 had different implications for the distribution of inflation expectations. Whereas the impact during the intervention program in 2008 was both economically and statistically significant, the impact during the 2011 program was almost negligible. This distinction is important as the macroeconomic conditions surrounding both interventions were very different. It is possible that the high levels of inflation preceding the 2008 intervention may have created an inappropriate environment for an intervention to take place without collateral damage. This is just a hypothesis. The precise reasons behind the different results associated to the two similar intervention programs are ultimately unknown, and are left as a subject for further research.

A daily exercise using the break-even inflation rate as a proxy for inflation expectations is roughly consistent with the analysis based on monthly data. Our results also suggest that the interventions did have an impact on daily exchange returns, especially in the days after the programs were announced.

These results seem to show that the side effects of exchange rate interventions over the distribution of inflation expectations may naturally depend on the economic environment in which they are implemented. Well aware of the possible conflict between an inflationary target and forex interventions, Chile's monetary authorities have explicitly left room for occasional interventions in exceptional circumstances of excessive depreciation or appreciation of the local currency. According to our results the last intervention episode in Chile posed no serious threat to the inflation target. Nevertheless, they also suggest that the intervention program carried out in the year 2008 may have shifted upward the distribution of inflation expectations two years ahead.

References

1. Adler, G. and C. Tovar (2011): "Foreign exchange intervention: a shield against appreciation winds?" IMF working paper 11/165.

2. Ades A, Buscaglia M. and M. Rumi (2002): "Inflation Targeting in Emerging Market Countries. Too much Exchange Rate Intervention? A test." Unpublished manuscript.

3. Aizenman, J. (2011): "The Impossible Trinity - from the Policy Trilemma to the Policy Quadrilemma", Santa Cruz Department of Economics Working Paper Series qt8cq7g4c9, Department of Economics, UC Santa Cruz.

4. Berganza C and Broto C (2012): "Flexible Inflation Targets, Forex Interventions and Exchange Rate Volatility in Emerging Countries." *Journal of International Money and Finance* **31**(2): 428-444.

5. Bordo M, O. Humpage and A. Schwartz (2012): "Epilogue: Foreign Exchange Market Operations in the Twenty-First Century". NBER Working Paper N°17984.

6. Broto C. (2013): "The effectiveness of forex interventions in four Latin American countries" *Emerging Markets Review*, forthcoming.

7. Contreras, G; A. Pistelli and C. Sáez (2013): "Efectos de Intervenciones Cambiarias Recientes en Economías Emergentes", *Journal of the Chilean Economy* **16**(1): 122-137.

8. De Gregorio J and A Tokman (2004): "Flexible Exchange Rate Regime and Forex Intervention." BIS Papers No 24: 127-138.

9. Dominguez K. (2006): "When do central bank interventions influence intra-daily and longer-term exchange rate movements? *Journal of International Money and Finance* **25:** 1051-1071.

10. Dominguez K. and F. Panthaki (2007): "The Influence of Actual and Unrequited Interventions" *International Journal of Finance and Economics* **12:** 171-200.

11. Dominguez K. (1999): "The Market Microstructure of Central Bank Interventions" NBER Working Paper 7337, September.

12. Fatum R. and M. Hutchison (2003): "Is Sterilised Foreign Exchange Intervention Effective After All? An Event Study Approach". *The Economic Journal* **113** (April), 390-411

13. Gnabo J, Mello L. and Moccero (2010): "Interdependencies between Monetary Policy and Foreign Exchange Intervention under Inflation Targeting". *International Finance* **13**(2): 195-221.

14. Holub T. (2004): "Foreign exchange interventions under inflation targeting: the Czech Experience", Research notes working paper series, No. 17, http://hdl.handle.net/10419/21879

15. Holub T. and A. Gersl (2006): "Foreign Exchange Interventions Under Inflation Targeting: The Czech Experience". Contemporary Economic Policy, *Western Economic Association International* **24**(4): 475-491.

16. Kamil (2008): "Is Central Bank Intervention Effective under Inflation Targeting Regimes? The case of Colombia ". IMF Working Papers 08/88, International Monetary Fund.

17. Mishkin, F. (2000): "Inflation Targeting in Emerging Market Countries". *American Economic Review*, **90**(2): 105-109.

18. Schmidt-Hebbel K and A Werner (2002): "Inflation Targeting in Brazil, Chile, and Mexico: Performance, Credibility, and the Exchange Rate ", *Economia* **2**(2): 31-89.

19. Obstfeld, M., Shambaugh, J. C. and Taylor, A. M. (2005): "The Trilemma in History: Tradeoffs among Exchange Rates, Monetary Policies, and Capital Mobility". *Review of Economic and Statistics* **87**:423-38.

20. Sarno L. and M. Taylor (2001): “Official Intervention in the Foreign Exchange Market: Is it Effective and, If So, How Does it Work?”. *Journal of Economic Literature* **XXXIX** (September 2001): 839-868.