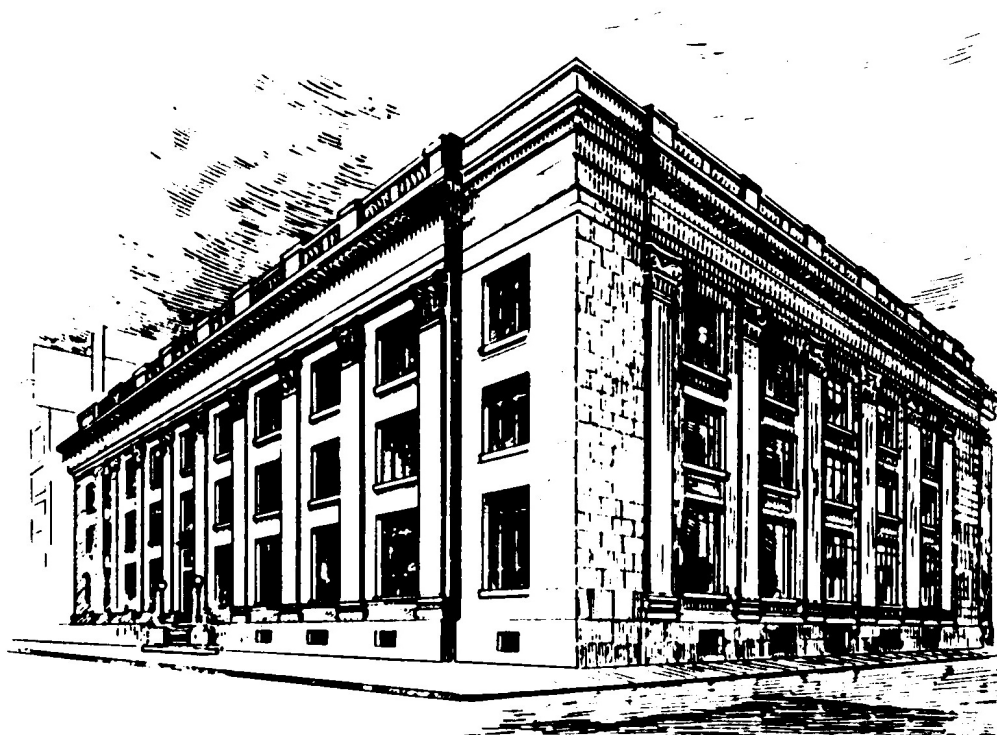# DOCUMENTOS DE POLÍTICA ECONÓMICA

BANCO CENTRAL DE CHILE

Exchange Rates, Real Adjustment and Monetary Policy

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EXCHANGE RATES, REAL ADJUSTMENT AND MONETARY POLICY

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Abstract

The exchange rate is a crucial variable in all open economies. It plays a key role in the transmission of external shocks to the domestic economy and in the transmission of monetary policy actions. Prolonged exchange rate misalignments have been associated with many crises that have struck emerging economies. Flexible exchange rates and credible monetary policies have reduced the impact of exchange rate fluctuations on inflation. However, as this paper argues, this has not reduced the expenditure-switching effect by which exchange rate fluctuations affect resource allocation and external adjustment. The discussion is illustrated with evidence for the Chilean economy.

1. Introduction

The exchange rate is a crucial variable for any open economy, particularly for emerging market economies. In an open economy, the exchange rate plays a key role in the transmission of external shocks to the domestic economy and in the transmission of monetary policy actions. Moreover, the fact that prolonged real exchange rate misalignments have been associated with many of the crises that have struck emerging markets in recent decades indicates that monetary authorities should pay special attention to its evolution.

A central channel through which the exchange rate operates in an open economy is the expenditure-switching effect. By raising the price of foreign goods with respect to domestic goods, a real depreciation causes an increase in local and world expenditure on domestic products. The usual assumption in the Mundell-Fleming-Dornbusch model is that domestic import prices are sticky—set in the currency of the exporter—. In other words, the pass-through of an exchange rate depreciation to import prices is equal to unity and occurs rapidly, shifting demand towards the domestically produced good.

The exchange rate also affects inflation directly. Domestic households consume both domestically-produced and imported goods, which are included in the consumer price index (CPI). Changes in the exchange rate affect the domestic currency price of imported goods and, through them, the inflation rate. Additionally to the extent that some domestic goods are produced by using imported intermediate goods, the exchange rate depreciation cause their prices to rise as well, provoking a further increase in the CPI index.

Beyond the input channel, exchange rate depreciations may directly affect the price of domestically-produced goods due to lack of credibility of monetary policy. If the main source of exchange rate movements is nominal disturbances, agents will likely increase the price of domestic goods in response to a nominal depreciation. Closely related, if inflation expectations are not well anchored, initial increases in some imported-goods prices may propagate to the other domestic prices in the economy, generating a widespread increase in prices. In this type of situation, we will observe a high pass-through from exchange rate depreciations to CPI inflation.

Reducing the credibility problem has been a major goal in the design of optimal monetary policies, particularly in the context of inflation targeting and flexible exchange rates. Better monetary policy institutions are considered a central element for generating a virtuous circle. The more credible the central bank, the lower the pass-through to the CPI, and the lower the volatility of inflation. This, in turn, reinforces credibility.

With this in mind let me return to the expenditure-switching effect. If higher credibility of monetary policy reduces the frequency of price adjustments and affects the incentives to set import prices in the currency of the buyer, the magnitude of the expenditure switching-effect may be reduced significantly. In particular, if import prices are denominated in the buyer's currency and are sticky, changes in the nominal exchange rate will have no effect in the relative price of imported goods with respect to the price of domestically-produced goods[1]. Therefore, there is no change in global expenditure towards domestic goods, limiting expenditure-switching.

Recent evidence for industrialized countries indicates that the pass-through to import prices has decreased significantly in recent years. Nevertheless, while evidence from some emerging market economies indicates a reduction in the pass-through from exchange rates to import prices, the decrease in the pass-through from exchange rates to the CPI seems to have been larger, and therefore the change in relative prices would be greater, reinforcing expenditure-switching.

Now, more credible monetary policy regimes have been associated with higher flexibility in the exchange rate. Some have argued that higher flexibility of the nominal exchange rate has increased the volatility of the real exchange rate, which has been the case for Chile (figure 1), and therefore has been counterproductive for competitiveness. The key to evaluating the effect of a flexible exchange rate regime on the competitiveness of an economy is to distinguish between short term and medium-long term volatility. I will show

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[1] The situation in which export prices are set in the currency of the buyer and are rigid in nominal terms is referred in the international business cycle literature as local currency pricing.

that the evidence tends to support the view that, in the case of the Chilean economy, higher flexibility of the exchange rate has been associated with lower volatility of the real exchange rate with respect to its fundamental value and less persistence of real exchange rate misalignments. These are elements that certainly tend to bolster the competitiveness of the economy.

Even under flexible exchange rate regimes, episodes of significant real exchange rate misalignments may occur. There is strong evidence from many emerging market economies linking episodes of severe misalignments and macroeconomic vulnerability. In this situation moving the interest rate may not be sufficient or even appropriate. In such a case, monetary policy may use additional instruments to reduce the misalignment and vulnerabilities of the economy.

The outline of this paper is as follows. First, I will discuss the main elements of the relationship between better monetary policy and lower pass-through to CPI. Then, I will discuss and provide evidence for the decline in pass-through to import prices and relative price adjustment. Third, I will address the relationship among exchange rate flexibility, volatility of the real exchange rate and persistence of real exchange rate misalignments. Finally, I will talk about exchange rate misalignments and the appropriate monetary policy strategy for dealing with them.

2. Declining Exchange Rate Pass-through and Credibility of Monetary Policy

Exchange rates influence inflation dynamics directly. A depreciation of the exchange rate may affect the CPI through the prices of imported goods and the other prices considered in the index. The implications of a change in the pass-through to import prices go beyond its direct impact on inflation, and involve potential changes in the expenditure-switching mechanism as well. I will focus on the effect of the exchange rate on total CPI in this section, leaving the import prices dimension for the next section.

Recent macroeconomic evidence indicates that the exchange rate pass-through to consumer prices (CPI) has declined in recent years in industrialized economies[2]. One explanation for this lower pass-through at the macro level is the implementation of credible monetary policy frameworks[3]. In particular, the decline of the pass-through in industrialized countries can be attributed to the shift towards a low inflation environment, due mainly to the implementation of a credible nominal anchor.

Credible monetary policy regimes are characterized by a well defined objective and higher degrees of central bank independence in the conduct of monetary policy. All of these elements have reduced the sources of nominal shocks. Monetary policy has become more predictable and less volatile. This implies that the sources of exchange rate variations are

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[2] See Campa and Goldberg (2005), Gagnon and Ihrig (2004), Bailliu and Fujii (2004) and Bouakez and Rebei (2008).
[3] See Taylor (2000) and Mishkin (2008).

associated mainly with real disturbances. In this context, the effects of nominal depreciations on inflation are reduced, since inflation expectations are well anchored.

It can be claimed that firms will adjust their prices more often (that is, a larger share of firms will optimally adjust prices each period) when future inflation is more uncertain and the central bank's commitment to its inflation target is perceived to be weak. Therefore, a more stable and low inflation environment reduces the incentives for frequent price adjustments. But now, less frequent price adjustments reduce the pass-through from exchange rate to CPI[4].

In the case of the Chilean economy the evidence indicates that in recent years, particularly since the adoption of a fully-fledged inflation targeting framework, the pass-through of the exchange rate to the CPI has declined significantly (figure 2)[5]. Estimations of structural and semi-structural Phillips curves also show that price adjustments have become less frequent in recent years[6].

Other things equal, a lower pass-through from exchange rates to CPI allows for a larger degree of exchange rate flexibility. Higher flexibility allows the economy to deal with shocks in a more efficient way. The source of economic disturbances in monetary-stable economies is mainly real shocks. Now, when dealing with real shocks, a credible monetary policy may respond in a more flexible way, reducing the impact of those disturbances on the economy. But a more stable economy allows for a better anchoring of inflation expectations, which increases the credibility of monetary policy and reinforces the effectiveness of monetary policy when dealing with real disturbances.

3. Declining Pass-through and Relative Price Adjustment

As mentioned in the introduction, a key channel through which exchange rate operates in an open economy is the expenditure-switching effect. If domestic import prices are sticky—set in the currency of the exporter—, a nominal depreciation will increase the relative price of imported goods. As imported goods become relatively more expensive, agents will switch consumption towards domestically-produced goods[7].

The discussion in the previous section was referred to the exchange rate pass-through to CPI. To see the relevance of the expenditure switching effect, we must concentrate in the exchange rate pass-through to import prices.

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[4] See Fernandez-Villaverde and J. Rubio-Ramirez (2007) on the relationship between credibility and the frequency of price adjustments.

[5] The pass-through is the coefficient on the yearly exchange rate depreciation from a regression for yearly inflation, without other regressors, using monthly data and a 10 year rolling regression. Periods of negative inflation yield negative pass-through, which has no clear meaning. For additional evidence on pass-through in Chile see Bravo and García (2002) and Córdova and Saavedra (2008).

[6] See Caputo, Liendo and Medina (2006) and Céspedes and Soto (2007).

[7] In particular, world expenditure (domestic and foreign) shifts towards domestically-produced tradable goods. If we allow for non traded goods, we must consider an additional switching effect. The relative increase in import prices increases domestic expenditure in non-tradable goods.

The evidence for the pass-through from exchange rate to import prices at the retail level indicates that this is almost zero in the US[8]. Moreover, evidence for many industrialized countries indicates that exchange rate pass-through to import prices has fallen markedly in recent years[9].

The combination of pricing to market, as in Krugman (1987), and nominal rigidities in the price of final goods have become a solid theoretical explanation to the near zero exchange rate pass-through to import prices[10]. In this setup, export prices are set in the buyer's currency and are rigid in nominal terms, what is called local currency pricing (LCP). The most significant policy implication of this LCP is that it completely eliminates the expenditure-switching effect. In fact, as a nominal depreciation of the exchange rate does not alter the relative price between domestic and imported goods, it has no effect on relative demands[11].

Despite the fact that the evidence for industrial countries shows almost zero pass-through from exchange rates to final consumer import prices, the evidence regarding wholesale import prices is less conclusive. Obstfeld and Rogoff (2000) present evidence that is contradictory to the claim of zero pass-through at the wholesale level. In effect, if LCP dominates international trade, the correlation between nominal exchange rates and terms of trade should be clearly negative[12]. The evidence indicates that this correlation is significantly positive for many industrialized countries. The implication is that despite the fact that the pass-through may be close to zero at the retail level, the expenditure-switching effect may still occur in trade between firms.

In the case of Chile the correlation between nominal exchange rates and terms of trade is also positive (and statistically significant) (table 1). As a consequence, the exchange rate would induce an expenditure-switching effect.

The same factor behind the reduction in the pass-through to CPI, a more credible monetary policy regime, may be influencing the recent evolution of the pass-through to import prices in developed and emerging market economies. In particular, higher credibility of monetary policy could have generated a more intensive local currency pricing and therefore, a reduced pass-through to import prices[13].

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[8] See Engel (1999).

[9] See Marazzi and Sheets (2007) and Gust, Leduc and Vigfusson (2006).

[10] See Devereux (1997), Betts and Devereux (1996, 2000), and Engel (2003).

[11] See Obstfeld and Rogoff (2000) and Obstfeld (2001) for further discussion.

[12] This is defining the terms of trade as the relative price of home imports in terms of home exports. Under LCP a depreciation of the exchange rate will generate an improvement of the terms of trade, or a reduction in the terms of trade defined this way.

[13] Literature on currency denomination of international trade has stressed the role of openness and competition. Bacchetta and Van Wincoop (2005) present a model in which the less competition firms face in foreign markets, the more likely they will price in their own currency. This may be a very significant factor behind reduced pass-through combined with higher price stickiness in countries that have open their economies in a significant way recently.

That export prices are denominated in terms of the exporter currency may not be a realistic assumption for developing economies. International trade for these countries is usually set in foreign currency. Moreover, the assumption that export firms have some degree of monopolistic competition in foreign markets may also be unrealistic. Usually these countries are price takers. These aspects, not discussed in the academic literature, are quite relevant in small open economies. Combining these assumptions, it can be argued that a nominal depreciation may have a significant expenditure-switching effect. The pass-through from exchange rates to CPI could be small, but to export prices could be equal to one. A nominal depreciation increases the price in domestic currency that an exporter receives from abroad, increasing its production[14].

Now, even if there is a reduction in the pass-through from exchange rates to import prices, the decrease in the pass-through from exchange rates to the CPI could compensate it. From a relative price perspective, if the exchange rate pass-through to CPI has decreased because the pass-through to non import prices in the CPI has decreased, probably because of more credible monetary policy regimes, then the expenditure-switching effect may have even been strengthened.

In Chile, the exchange rate pass-through to a measure of retail import prices (tradable goods in the CPI) has remained fairly constant since 1998 (figure 3)[15], although, there is evidence that it has declined since 1990, when the economy was experiencing two-digit inflation. Nevertheless, the pass-through to CPI has declined much more than the decline in the pass-through from exchange rates to imported prices. In particular, the difference between the exchange pass-through to core tradables and total CPI has increased since 1998 (figure 4).

Consistent with the evidence on the correlation of real exchange rate and terms of trade, the exchange rate pass-through to wholesale import price inflation is significantly positive and it has slightly increased in recent years in Chile (figure 5)[16]. Therefore, the local currency pricing at the wholesale level would have been limited. Hence, a depreciation of the exchange rate would be capable of inducing relative price adjustments.

The conduction of monetary policy in a more predictable and stable framework has been a key determinant of diminishing pass-through as discussed previously. But there are other factors that may affect the pass-through. Let me just name three factors that may affect it: the exchange rate misalignment, current account deficit and the output gap.

Regarding the current account deficit and the output gap, these may reflect excessive aggregate demand. In periods of high aggregate demand, retailers can increase prices

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[14] Alternatively, a nominal depreciation reduces production costs expressed in foreign currency units, increasing production given the international price.

[15] This measure of tradable CPI represents nearly 15% of the CPI basket and contains, mainly, imported goods. This is constructed by Córdova and Saavedra (2008). The pass-through is computed in the same way as in the case of total CPI inflation (see footnote 5 for more details).

[16] This result is consistent with the one obtained by Fuentes (2007) and Álvarez, Jaramillo and Selaive (2008). The pass-through is computed in the same way as in the case of total CPI inflation (see footnote 5 for more details).

rapidly when facing a nominal depreciation. If the economy is in a slowdown, with an improving current account balance, and a negative output gap, when facing a nominal depreciation, retailers will be more likely not to pass-through the depreciation into domestic prices.

A nominal depreciation when the exchange rate is far from equilibrium (or its fundamental value) should have a lower impact on inflation, since the depreciation helps to restore the equilibrium. The real exchange rate misalignment may be associated to excess production in the non tradable sector which is eliminated with a real depreciation. I will discuss most on the link between exchange rate misalignments and monetary policy in the next section.

Evidence for Chile shows that nominal depreciations when the real exchange rate has exhibited a significant deviation from its fundamental value have tended to be less inflationary (table 2). The same is the case for measures of excess capacity of the economy. A depreciation in periods of higher output increases the pass-through[17]. The converse is also interesting, although beyond the scope of this discussion, because when the exchange rate is not allowed to adjust, most of the relative price adjustments are achieved via changes in inflation and output.

4. Facing Volatility and the Persistency of Exchange Rate Misalignments

As I mentioned earlier, a crucial factor behind the declining effect of the exchange rate on inflation has been the introduction of an improved monetary policy framework. One of the pillars of this monetary policy framework is the implementation of a flexible exchange rate regime. A credible price stability goal requires a framework that is internally consistent, and an independent monetary policy with financial integration is unable to control the nominal exchange rate. This is the well known "impossible trinity". However, allowing for exchange rate flexibility raises issues of volatility and misalignment that I will discuss now.

For small open economies, the tradable goods sector plays a key role in the development process, and hence one needs to consider potential effects of exchange rate flexibility. Although fixed exchange rate regimes are usually abandoned with costly consequences, flexibility raises concern regarding volatility. The introduction of a flexible exchange rate regime has been associated with more volatility, which is certainly the case. A more volatile exchange rate, in the short run, could be associated with greater exchange rate uncertainty, which, in turn, might affect investment decisions.

However, short term volatility does not imply longer term uncertainty. Volatility, in the context of a well-functioning financial market, leads to the development of the foreign exchange derivatives market. This market makes it possible to hedge against short term fluctuations of the exchange rate, reducing the costs of volatility.

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[17] See Céspedes and De Gregorio (1999). See also Goldfajn and Werlang (2000) for evidence for industrialized and emerging market economies.

In the case of Chile, the higher exchange rate volatility since the introduction of a fully flexible exchange rate regime has been associated with the development of a much deeper foreign exchange derivatives market. The size of this market was 1.7% of GDP in 1999 whereas today it represents nearly 4% of GDP (table 3). A relevant proportion of this market is made up of offshore operations.

An additional effect that has been observed in the Chilean economy is the reduction in balance sheet vulnerabilities. They were already low prior to the introduction of the floating exchange rate in 2000, and have declined further since the transition. In effect, the corporate sector has made a significant reduction in their exposure to currency fluctuations since the introduction of the flexible exchange rate regime. This is certainly a key development that has granted more flexibility to monetary policy in the face of large external shocks, as has been the case in recent months[18].
With low exchange rate pass-through to CPI, movements in the nominal exchange rate will translate in movements in the real exchange rate. One potential consequence of this greater correlation is that, when responding to a real shock, the real exchange rate will converge faster to its equilibrium level. This helps to avoid "long run" volatility of the real exchange rate.

The evidence for the Chilean economy supports this claim: deviations of the exchange rate from its fundamental value tend to last significantly less than they did prior to the implementation of the flexible exchange rate regime. The coefficient associated to the error correction term (real exchange rate misalignment) in a Vector Error Correction Model for the real exchange rate has increased (in absolute value) since 1999 (table 4). For the period 1977-1999, the error correction coefficient takes a value of -0.11, which means that real exchange rate misalignments lasted for an average of nine quarters. In contrast, after the adoption of a free floating regime (2000-2007), this coefficient declines to – 0.31. This implies that misalignments now last on average only three quarters. As a result, when hit by real shocks, the real exchange rate adjusts much faster to its fundamental value in a flexible exchange rate regime, so misalignments do not persist.

5. Exchange Rate Misalignments and Monetary Policy

Let me conclude with a brief discussion of the adequate response to significant deviations of the real exchange rate from its fundamental value.

In an inflation targeting regime, the exchange rate is considered when setting the policy interest rate. If the exchange rate appreciates persistently, this may induce deflationary forces. While the pass-through is small, it does not eliminate the effects of the exchange rate on inflation, especially when fluctuations are persistent. Monetary policy tends to correct this situation. For example, when an appreciation affects inflation perspectives, monetary policy may loosen, reducing the pressures on the currency. In this regard, monetary policy *leans against the wind.*

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[18] For further evidence on mismatches in the corporate sector and the development of the derivatives market, see De Gregorio and Tokman (2005).

However there are situations in which deviations may be excessive and therefore monetary policy may not be enough to stabilize the exchange rate. In this case, as we have explicitly stated in our flexible exchange rate framework, the central bank can intervene with sterilized intervention in the foreign exchange market.

In addition, in a volatile world, it is prudent to have an adequate level of international reserves. This is another reason why in exceptional circumstances the central bank can intervene. During 2008, the Central Bank of Chile decided to accumulate reserves in order to reduce the costs of facing a sudden stop of capital inflows. This was implemented during a period in which the exchange rate had deviated substantially from its fundamentals.

There has been a long discussion on the correct way to address asset price bubbles with monetary policy. The regular prescription is that if there is a bubble —for instance, in stock prices— monetary tightening may prick the bubble. I do not want to go into the details of these proposals[19], but in the context of an exchange rate bubble, the problem is more complicated. If there is a bubble in all domestic asset prices, this may be the result of an excessive appreciation of the local currency. Tightening monetary policy may have perverse effects, since it induces further capital inflows and strengthens the currency. In this case, the interest rate is not the most adequate instrument with which to prick the bubble. Therefore, sterilized intervention can play an important role in stabilizing the foreign exchange market.

It is certainly very difficult to assess the existence of persistent misalignments, which calls for a cautious approach. This is precisely the way in which exchange rate interventions have been introduced in the type of monetary policy frameworks I have described in this presentation. In particular, exchange rate interventions are limited to very special circumstances in which the exchange rate appears to be significantly deviated from its fundamental value. The recent experience of many inflation targeting regimes, and in particular Chile, points out the success of this strategy.

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[19] For a discussion on this issue see De Gregorio (2008).

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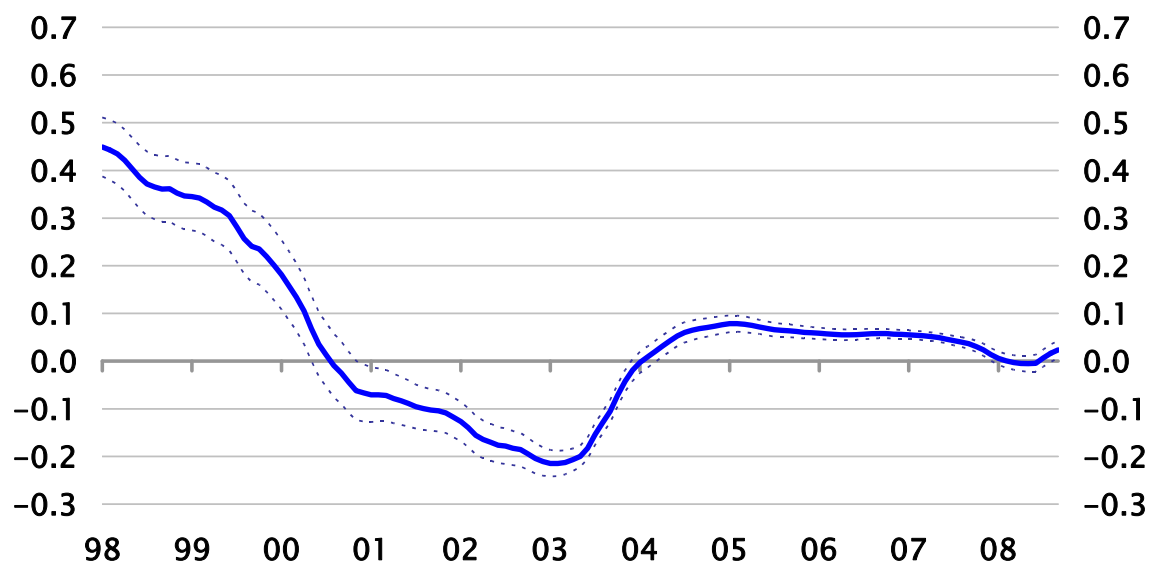
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Figure 1
Real Exchange Rate
(index,1986=100)
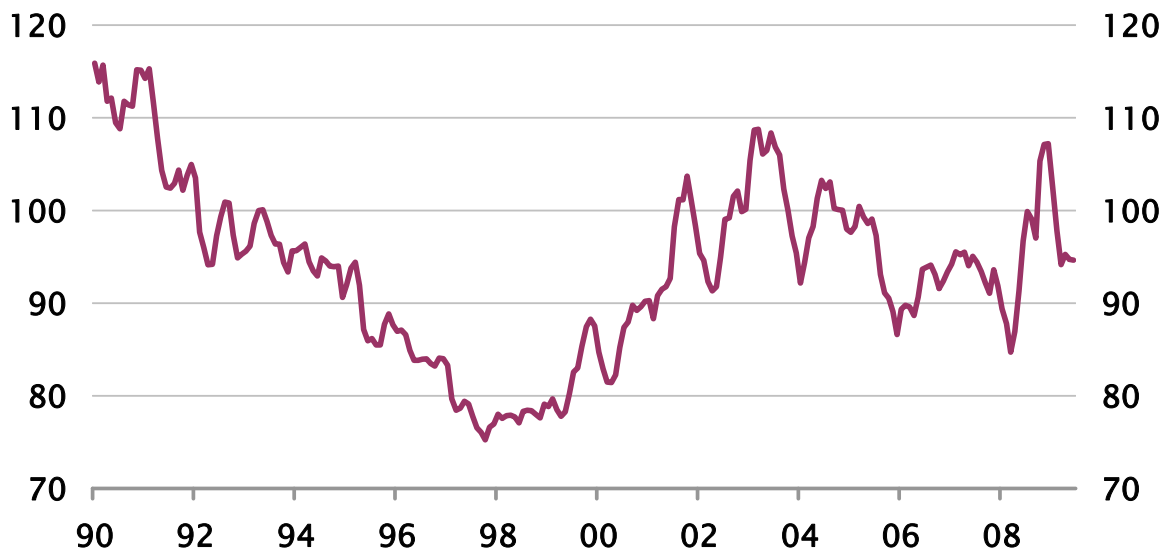
Source: Central Bank of Chile.

Figure 2
Pass–through to CPI
(10–year rolling regression)

Source: Author's calculation

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Table 1

Correlation Between Nominal Depreciation and Terms of Trade Variation 1/

(quarterly data)

	Correlation	t–test
1990–2009	0.35	3.28
1990–1999	0.38	2.50
2000–2009	0.47	3.18

[1/] As in Obstfeld and Rogoff (2000) a positive correlation indicates that a nominal depreciation has a positive impact on terms of trade, which are defined as the relative price of imports with respect to exports.
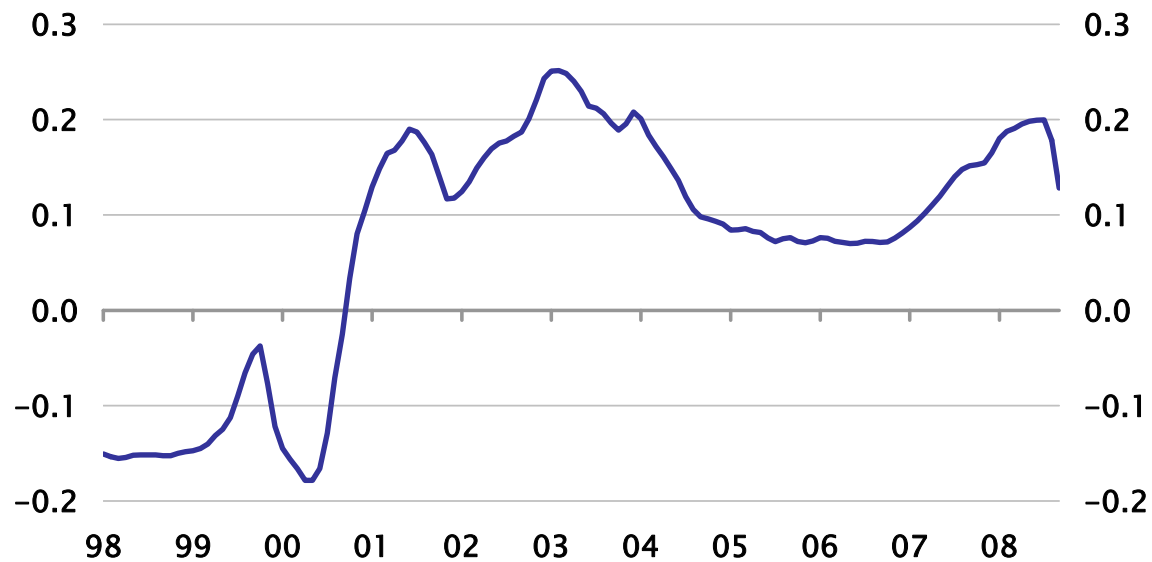
Source: Author's calculations

Figure 3

Pass–through to Core Tradable CPI

(10–year rolling regression)
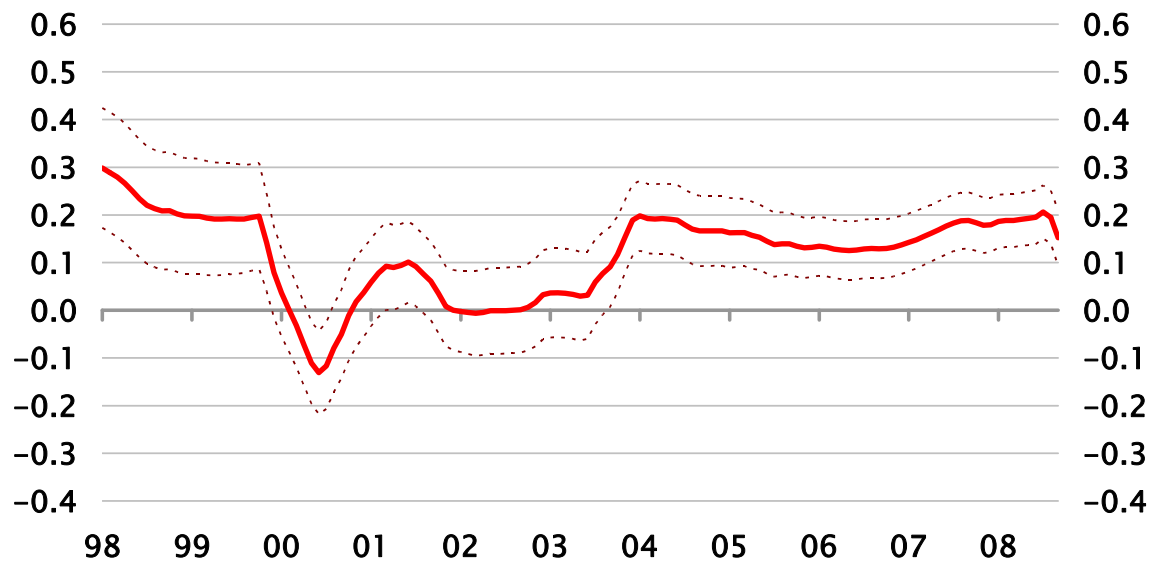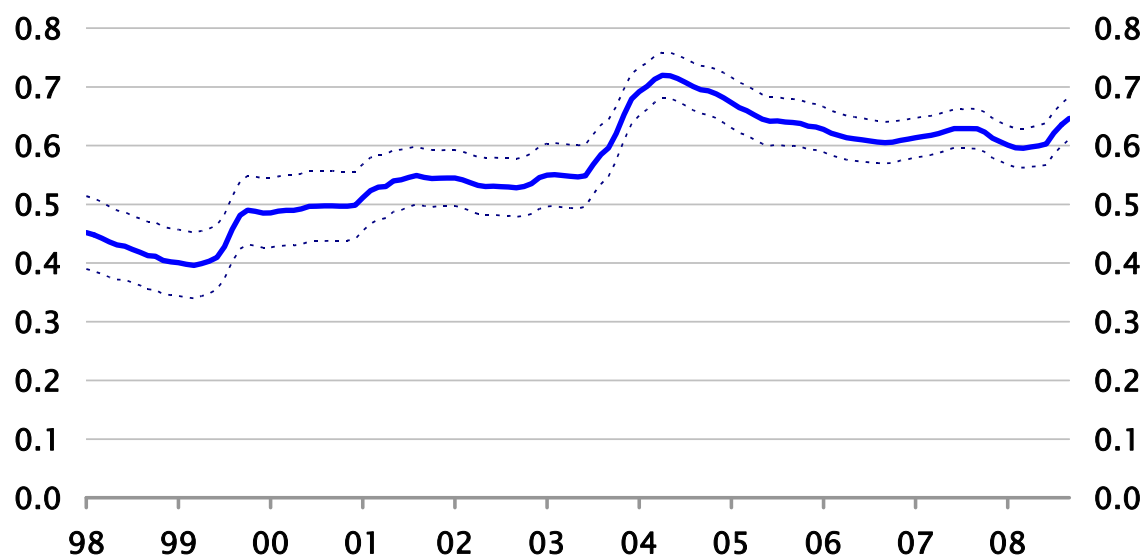

Source: Author's calculation

Figure 4
Difference Between the Pass–Through to Core Tradable and Total CPI
(percentage points)

Source: Author's calculation

Figure 5
Pass–through to Wholesale Import Price
(10–year rolling regression)

Source: Author's calculation

Table 2
Determinants of Nominal Exchange Rate Depreciation to Inflation Ratio 1/
(sample 1989.Q2–2009.Q1)

	Coefficient	Std. Error	t–Statistic
C	−0.30	0.89	−0.34
q (−1)	−0.07	0.07	−1.06
cc (−1)	−0.86	0.40	−2.15
ygap (−1)	−0.68	0.24	−2.79
Adj. R–squared	0.35		

[1/] The dependent variable corresponds to the exchange rate depreciation in period t divided by inflation in the same period. The explanatory variables correspond to real exchange rate misalignmeny (q); current account to GDP (cc) and the output gap (ygap). Quarterly estimation.

Source: Author's calculation.

Table 3
Exchange Rate Derivatives in Chile

Year (Dec.)	Market (millons of dollars)			Turnover as a % of	
	Local	Foreing	Total	GDP	Total trade
1993	2,822	–	2,822	0.06	0.11
1994	9,415	–	9,415	0.17	0.31
1995	21,124	–	21,124	0.29	0.52
1996	47,828	–	47,828	0.63	1.12
1997	112,050	–	112,050	1.35	2.4
1998	112,150	–	112,150	1.41	2.52
1999	125,494	20	125,514	1.71	3.02
2000	139,227	11,646	150,873	2.00	3.27
2001	143,192	20,298	163,491	2.36	3.64
2002	130,686	30,412	161,099	2.38	3.64
2003	165,830	41,592	207,422	2.79	4.06
2004	208,153	72,479	280,632	2.93	4.06
2005	254,341	129,020	383,361	3.23	4.36
2006	292,301	214,189	506,490	3.45	4.51
2007	345,418	316,844	662,262	4.04	5.01
2008	402,520	251,115	653,635	3.79	4.42

Source: Central Bank of Chile.

Table 4
Duration of Real Exchange Rate Misalignment

	Error correction coefficient	Duration real exchange rate misalignment (quarters)
1977–2007	−0.12	8.1
1977–1999	−0.11	9.0
2000–2007	−0.31	3.2

Source: Based on Caputo, Núñez and Valdés (2008).