# Onshore spread and swap spread: Chilean money market liquidity indicators

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## Introduction

Over the last few years, the Chilean derivatives market has reached a greater level of sophistication and development, in line with a larger and open capital market. Under this scenario, it is possible to obtain derivative prices and rates that are useful for liquidity analysis, among other purposes. In this paper we analyse how the information contained inside exchange and interest rate derivative prices can be used. We chose these two underlying assets because it is possible to find, in the data available, significant information in terms of quality, data length and periodicity. This price information, together with other related financial variables, enables us to build two money market liquidity indicators: the US dollar onshore spread and the swap spread. In practice, they have proved to be a useful complement to other market indicators, especially when they are not providing clear information about the illiquidity sources or their origins.

For such purposes, we use the data provided by Bloomberg, la Bolsa de Comercio de Santiago (local stock exchange), the local banking system and some brokers, as well as data collected by the Central Bank of Chile. The majority of the database is publicly available.

The rest of the paper is structured as follows. The first section describes the data used in this paper. The second section looks at the onshore spread, reviewing its evolution, with special attention given to the current financial crisis and the differences in onshore spread behaviour by comparing the indicator with alternative rates and price sources. The third section explores the swap spread concept, its evolution and some of its characteristics, as well as a comparison of the local swap spread with other economies. The fourth section concludes.

## 1. Data description

### 1.1 Onshore spread data

In the onshore spread construction we use: dollar-peso forward rates for 90, 180 and 360 days; the spot exchange rate; the time deposit rates (CLP); and Libor also for 90, 180 and 360 days. We have daily series from 2006 onwards. The start date is determined by the CLP swap rate availability. Prior to 2006, the Chilean interest rate swap market did not show minimum liquidity and development levels, so the previous 2006 rates are not market representative.

The data sources are: Bloomberg, the Central Bank of Chile, the local banking system and the British Bankers' Association. For time deposit rate series, the central bank conducts a daily survey of local commercial banks, in which they indicate time deposit information such as amounts, rates and terms captured. This information, which is not publicly disclosed, is

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then tabulated to obtain weighted average time deposit rates. These rates are called *prime* rates.

On the other hand, the central bank can, alternatively, use Chilean peso rates (nominal) taken from the overnight index swap (OIS) market.[3] This is a useful funding benchmark for non-commercial banks (investment banks), due to the fact that the prime rates are non-observable to them. For the purposes of this document, the source of the CLP OIS rates is Bloomberg.

We will demonstrate below how an onshore spread is calculated using both rates, and how, in certain periods, there is a significant divergence between them (turmoil periods).

### 1.2 Swap spread data

Conversely, swap spread construction is much easier than onshore spread construction: we only use nominal (CLP) and real[4] (CPI-linked) OIS long-term rates (two, five and 10 years), and nominal (BCP) and real (BCU) bonds, also for two, five and 10 years. The data periodicity is daily and without lags. The series also began in 2006 and the data sources are Bloomberg, local brokers, la Bolsa de Comercio de Santiago and the Central Bank of Chile.

Despite the simplicity of the series construction, it contains several interesting details which should be highlighted. In the OIS rate series, there is asymmetric liquidity between nominal and real rates; while the nominal OIS rate market has a fine liquidity, the real OIS rate market frequently experiences problems such as wide bid-ask spreads or no rates for specific terms (especially for terms up to two years). This asymmetric liquidity is a consequence of the market participants, where most are offshore players who deal mainly in nominal OIS. In fact, one reason for the OIS market creation was to facilitate the participation of offshore agents in the local fixed income market. The current tax regulation on capital gains creates a disincentive for the presence of these kinds of players (derivatives such as OIS do not need capital).

Through derivatives, they can speculate about future monetary policy rate movements[5] or hedge interest rate positions. Moreover, this tax condition generates another important issue: the inability of offshore agents to arbitrage significant differences between bonds and OIS rates. This issue and its consequences are discussed in further detail by Alarcón and Bernier (2009).

Another interesting point is that the local market trades OIS with terms of up to 20 years, while the common financial market trades OIS only for terms of up to one year. For longer terms, the underlying OIS is usually one- or three-month time deposits (interbank).

Meanwhile, in terms of relative liquidity, the local bond market is the exact opposite: it has greater liquidity than the nominal bond market. The explanation for this is the long tradition of Chilean inflation, which has encouraged capital market development based on CPI-linked assets. Nevertheless, with the economy nominalisation process, which began in 2001, most money market operations (up to one year) are nominal (CLP). Longer-term operations (fixed income) are still dominated by CPI-linked instruments.[6]

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[3] The underlying OIS is the official interbank overnight deposit rate published daily by the Central Bank of Chile. The OIS floating leg is then determined by the average overnight rate between the beginning and the end of the agreement.

[4] Real OIS or bond rates are instruments denominated in UF, which is a CPI-linked unit account.

[5] Monetary policy, conducted by the Central Bank of Chile, is made through a nominal target rate (overnight).

[6] Including: the Central Bank of Chile, government and corporate bonds, and mortgage-backed securities.

## 2. Onshore spread

According to Alarcón et al (2008), the onshore spread is the difference in rates between the local market dollar rate, implicit in the forward exchange rate operations (CLP/USD), and Libor. The implied rate on US dollars is obtained from the non-arbitrage condition or covered parity rates, a condition in which the forward exchange rate is quoted by the market. Equation (1) describes the non-arbitrage condition. We assume that there are no restrictions, intermediation margins or risk premia:

$$F_T = S_t \frac{(1+i_{T-t})}{(1+i^*_{T-t})} \tag{1}$$

Where: $F_T$ is the CLP/USD forward rate at time T, $S_t$ is the CLP/USD spot rate at time t, $i_{T-t}$ is the CLP T-t term interest rate and $i^*_{T-t}$ is the implicit US dollar T-t term rate.

Separating $i^*_{T-t}$ from (1) gives the Chilean market implied US dollar rate:

$$i^*_{T-t} = \frac{S_T}{F_T}(1+i_{T-t}) - 1 \tag{2}$$

The onshore spread will then be the difference between (2) and Libor, at the same term.

$$i^*_{T-t} - i^L_{T-t} \tag{3}$$

As background information to this article, Alarcón et al (2008) show the theoretical patterns in which the onshore spread should move. Those patterns include taxes, external spreads and other frictions. Alarcón et al also include an analysis of the effects on the onshore spread following the increase in the external investment limit for local pension funds. Furthermore, Opazo and Ulloa (2008) analyse the speed at which this indicator is in line with their theoretical patterns, comparing it with other external references.

A quick historical data review shows some periods during which the US dollar onshore rate departed significantly from its natural benchmark, the Libor. These episodes are discussed in the next section.

### 2.1 Onshore spread behaviour: swap rates vs prime rates

As discussed above, the onshore spread can be calculated with two different CLP rates: prime rates and OIS rates. Prime rates are more useful in determining the US dollar onshore rate for commercial banks that use prime time deposits to finance part of their normal operations (loans). On the other hand, OIS rates are useful in estimating the onshore spread for investments banks, whose time deposit market share is insignificant or non-existent. Additionally, investment banks tend to be active OIS market players. Therefore, prime rates are not their relevant benchmark for CLP funding or onshore spread calculation. Finally, prime rates are not publicly available, thereby making this variable non-observable to all market participants.

The onshore spread evolution, calculated with both interest rates, is very similar, showing differences only in terms of level (basis points), but their movement pattern is normally the same (Figure 1).

Figure 1 shows some illiquidity episodes reflected by onshore spread increments; the first began in August 2007, when the Central Bank of Chile decided to increase the external investment limit for local pension funds (PFs). In practice, this measure meant a liquidity tightening in CLP and US dollars. As a result of this new limit, PFs quickly unwound positions invested in time deposits, increasing prime rates. At the same time, they bought US dollars (spot) in the exchange market and simultaneously sold forward similar amounts, in order to

hedge their new positions invested abroad.[7] This last movement forced banks (PF counterparts) to take short positions in US dollars (short-term liabilities) so as to keep their foreign exchange balance, causing an increase in the US dollar onshore spread.

A second illiquidity episode, also shown in Figure 1, was associated with the sharpening of the subprime crisis, when international and local US dollar liquidity fell quickly. The peak of this episode was closely related to the Lehman Brothers collapse (September–October 2008), an event which affected a significant part of the US banking system. In line with this issue, the illiquidity transmission channel to the local market was via a freezing of short-term credit lines by US banks to local banks,[8] forcing local banks to seek alternative US dollar funding and pay higher onshore spreads over Libor.

The tighter US dollar liquidity was reflected in terms of onshore spread increases (right-hand grey area of Figure 1), which were even higher than during the PF episode. However, this time, the onshore spread calculated with prime rates was significantly higher than when calculated with OIS rates.

The gap between both spreads was explained by significant CLP time deposit sell-offs carried out by mutual funds, which, together with PFs, are the most important source of short-term banking funding. In line with this, CLP prime rates jumped more than 250 basis points in only one week (Figure 2), while CLP OIS rates fell.[9] Following equation (2), the local implied US dollar rate is higher if CLP rates are also higher (ceteris paribus), and prime rates that are greater than OIS rates imply a higher onshore spread.

Another way to explain the differences between both onshore spread indicators is through the prime-OIS spread[10] approach, an indicator which also helps to estimate money market liquidity. When there is low liquidity in this market, in other words, a high prime-swap spread, the deviation between the two onshore spread indicators is also high (Figure 2).

Figure 1

**US dollar onshore spread: prime vs OIS rates**

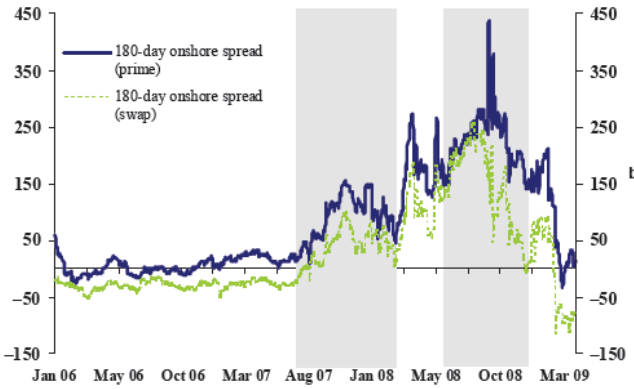
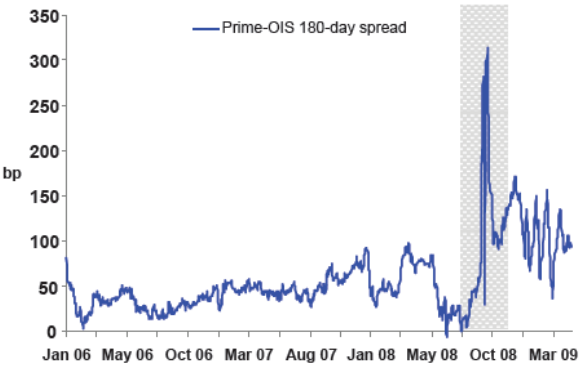



Figure 2

**Prime-OIS spread**




Sources: Central Bank of Chile; local banks; Bloomberg.

[7] Pension funds must, by law, hedge a fixed portion of their foreign exchange exposure.

[8] Even though the funding share in US dollars of the total local bank funding is small.

[9] By this time, the market began to expect cuts in the MPR.

[10] In Chile, the interbank market of uncollateralised debt is not deep. The prime-swap spread is a better proxy to the Libor-OIS spread of the US market.

In such cases, investments banks have access to lower implicit US dollar rates than commercial banks because they do not use cash to perform their activities (prime rates) – they mainly use derivatives.

The onshore spread depends not only on US dollar liquidity conditions, but also on CLP liquidity conditions (prime rates) or expectations over future monetary policy rate (MPR) movements (OIS rates). Finally, the use of either rate will depend on the bank type: commercial banks (prime rates) or investment banks (OIS rates).

After October 2008, the onshore spreads began to converge towards pre-crisis levels, even though the gap between both onshore spread indicators remained high (explained by the prime-OIS spread).

## 2.2 Other relevant economies: a comparison

For simplicity purposes, we have chosen only two relevant countries for Chile: Brazil and Colombia. In general terms, the shape of the onshore spreads is dissimilar between the three countries, which is explained by the local US dollar availability in each economy (flows). However, when US dollar liquidity is globally thin, as in the current financial crisis, onshore spread behaviour should become equivalent. We find that, up to April 2008, there is no great coincidence in the spread evolution, but with the sharpening of the financial crisis, the peaks and dips tend to occur at the same time, especially between Chile and Brazil.

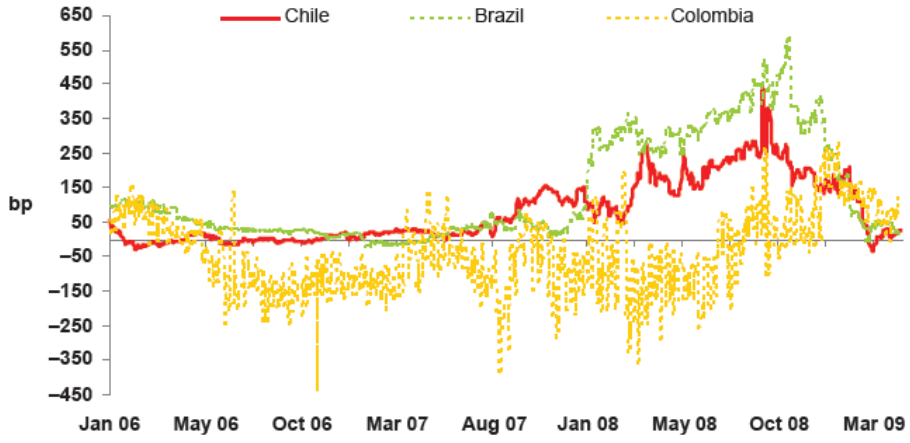
In the case of Colombia, the onshore spread level is different compared to Chile and Brazil, but during the crisis period the maximum and minimum levels tend to coincide.

Figure 3 shows the onshore spread behaviour of Brazil, Mexico and Chile. In general terms, the onshore spread volatility shows a strong increase in the period between April 2008 and February 2009.

In Chile, as a way of mitigating the low US dollar liquidity, the Central Bank implemented a USD 500 million weekly facility for foreign exchange (FX) swap operations, with terms from 30 to 180 days, where banks could obtain US dollar liquidity with CLP as collateral, and with the possibility of periodical rollover. Until complete, this facility offered a maximum amount of USD 5,000 million. In practice, however, the total FX swap outstanding has not exceeded USD 900 million. Nevertheless, this measure provided the market with an explicit liquidity guarantee, causing a fast drop in the onshore spread, from a maximum of 438 basis points (October 2008) to levels of around 20 basis points (April 2009).

Figure 3

**US dollar 180-day onshore spread**




Sources: Central Bank of Chile; Bloomberg.

## 3. Swap spread

We define the swap spread as the difference between a swap rate and a bond rate, which is usually risk-free.

Regarding the swap spread literature, Lang et al (1998) suggest that the level of this indicator is influenced by changes in the relative demand for hedging instruments (eg swaps), the spread of corporate bonds and the economic cycle. In a supplementary analysis, Duffie and Singleton (1997) show that the variation in the swap spread is attributable to credit risk and liquidity. Liu et al (2002) achieved similar results and concluded that most swap spread volatility is associated with changes in the liquidity premium of risk-free bonds (treasuries).

In the local swap spread case, this is defined as the difference between the OIS rate and a bond rate issued by the Central Bank of Chile, for a similar term. There are two types of swap spread: nominal (CLP) and real (UF).

$$Swap\,spread\,UF = r_{0,t}^{OIS} - r_{0,t}^{BCU} \tag{4}$$

$$Swap\,spread\,CLP = i_{0,t}^{OIS} - i_{0,t}^{BCP} \tag{5}$$

With $t \geq$ 2 years for both equations.

Where $r_{0,t}^{OIS}$ is the real OIS rate at time 0 for a t term, $r_{0,t}^{BCU}$ is the real bond rate at time 0 for a t term, $i_{0,t}^{OIS}$ is the nominal bond rate at time 0 for a t term and $i_{0,t}^{BCP}$ is the nominal OIS rate at time 0 for a t term.

As BCU and BCP are risk-free bonds and the OIS are not, the swap spread should aim, at least theoretically, at positive values over time, and its size should be closer to what is considered a market-participant systemic risk (mainly banks). In practice, however, BCU and BCP implicitly contain other kinds of risk (inflation, liquidity, etc) that may lead the swap spread to negative values. Besides, market imperfections, such as taxes and hedge flows, can also produce distortions in swap spreads.

$$r_{0,t}^{BCU} = r_{0,t}^{SPC} - \phi \quad \wedge \quad i_{0,t}^{BCP} = i_{0,t}^{SPC} - \phi \tag{6}$$

Where $\phi$ is the systemic and other risk premia.

### 3.1 Swap spread: evolution over time

Empirical evidence shows that equation (6) was valid for periods prior to December 2007. However, subsequent periods show a significant decrease in the real swap spread, even reaching negative values, and staying in the negative area for several months (Figure 4). On the other hand, nominal swap spreads have also reached negative values, but have tended to return to positive values (Figure 5).

Consequently, and according to the swap spread literature, by the end of 2007 some of the variables that affect the swap spread could have led it to levels beyond its fundamentals: demand for hedging instruments, credit risk, liquidity, etc. Once again, PFs played an important role.

Figure 4

**Real swap spread (UF)**

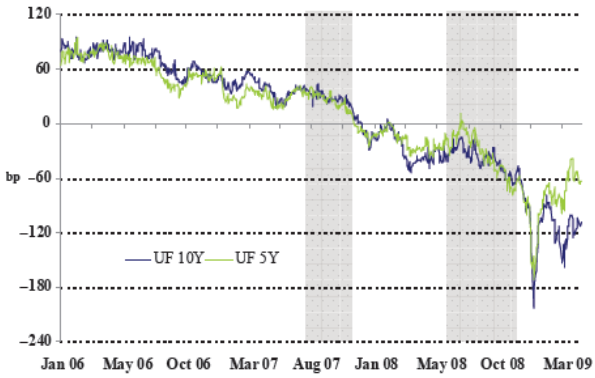
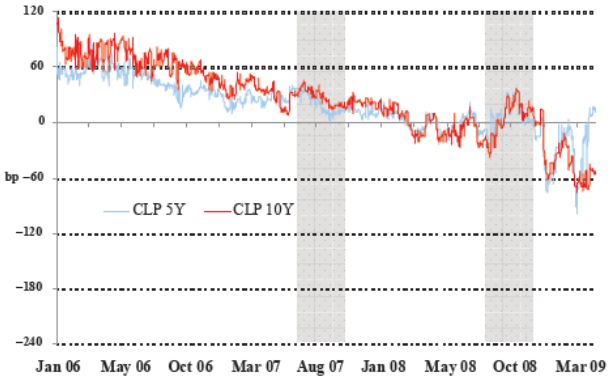



Figure 5

**Nominal swap spread (CLP)**




Sources: Central Bank of Chile; local stock exchange; Bloomberg.

At that time (left-hand grey area of Figures 4 and 5), PFs and some insurance companies decided to invest part of their portfolios in foreign corporate bonds, in order to obtain better returns than local bonds. But these investments needed foreign exchange and interest rate hedging, resulting in a sharp fall in OIS rates, even beyond bond rates. The swap spread most affected was the UF swap spread, due to the fact that PFs conduct a large part of their investments in this unit of account. In this episode, the fall in the UF swap spread was explained mostly by the demand for hedging – other factors, such as changes in liquidity conditions, were not present.

A second significant episode was during the current financial crisis, where both swap spreads, nominal and real, showed an important fall (right-hand grey area of Figures 4 and 5). The problem was also associated, in part, with demand for hedging, but not from PFs. This time local corporations decided to issue bonds locally in order to obtain spreads lower than the external market. But a significant part of these problems were created by corporations whose assets are denominated in US dollars (exporters); they had to carry out hedge operations to match their balance sheet, pressing UF OIS rates to lower values than BCUs, resulting in negative UF swap spreads which were even lower than during the first episode.

This was followed by a fall not only in UF swap spreads, but also in nominal (CLP) swap spreads. On that occasion, the greater demand for hedging, combined with a strong fall in CLP liquidity conditions (already described in Section 2.1 above), caused higher bond rates than OIS rates, due to the increase in cash cost. Agents prefer to take positions over the yield curve through derivatives (OIS) rather than bonds because derivatives do not need capital. Finally, both swap spreads fell to negative values (Figures 4 and 5).

The description of these two episodes reveals the relative fragility of the swap spread as an exclusive liquidity indicator, because there are many factors or variables affecting swap spread behaviour, not just liquidity. An important conclusion would be to combine this indicator with other liquidity indicators in order to get a better liquidity signal.

### 3.2 Swap spread: Chile vs selected countries

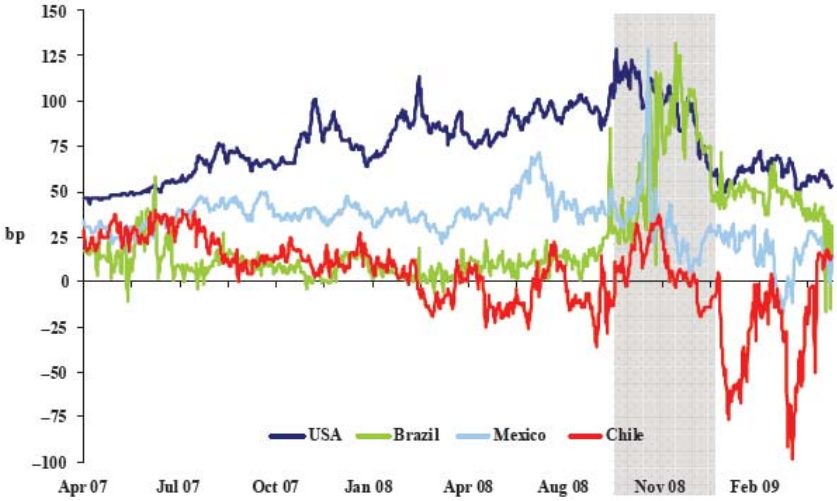
As already noted in the data description (Section 1.2 above), local interest rate swaps (IRS), which are used to build swap spreads, are derivatives whose underlying asset is the average of the interbank overnight rate. This issue is quite important when we compare local swap spreads with others economies because, in most countries IRS are used, whose underlying assets have a longer-term maturity; consequently, these swap rates should include a spread comparable to those commonly observed in operations between different maturities, affecting

swap spreads to a greater extent in those economies where the underlying asset maturity is longer.

This is an important topic which could explain some difference in the swap spread shape among selected countries. Indeed, Figure 6 shows the swap spread (five years) for Chile (nominal), Brazil, Mexico and the United States. It is possible to observe a clear difference in terms of level: Chile and Brazil tend to have lower values than Mexico and the United States. Chile and Brazil have an overnight underlying asset, while Mexico and the United States have a one- and three-month underlying asset, respectively.

Figure 6

**Swap spread: Chile, Brazil, Mexico and the United States**




Sources: Central Bank of Chile; local stock exchange; Bloomberg.

On the other hand, the behaviour of each swap spread does not appear to have a common pattern, except when the financial crisis reached its maximum impact (grey area in Figure 6): at this point the swap spreads tend to fall, but with high volatility. The reasons behind this behaviour are not easy to explain because the variables (liquidity, credit risk, demand for hedging changes, bonds issues, etc) affecting swap spreads are not clear.

## Summary

The aim of this paper has been to demonstrate how to obtain useful financial information from the local derivatives market and how to transform this information into liquidity indicators. We have considered two indicators: the onshore spread and the swap spread, describing their construction, evolution and background. In this regard, we have discovered several issues concerning the databases used, which are closely related with local market characteristics. In general terms, both indicators have strengths and limitations, especially when they are used alone with no other relevant information.

The onshore spread has proved to be a very useful indicator for liquidity proposes (US dollar liquidity), but it is highly sensitive to other variables such as local currency liquidity. Nevertheless, this issue can be fixed by using OIS rates.

The swap spread seems to experience even more problems as a liquidity indicator, because it depends on more variables which are difficult to measure or find.

An important conclusion to be drawn is that a better liquidity signal can be obtained by combining this indicator with other liquidity indicators.

Finally, we emphasise the importance of maintaining a database with good-quality information, along with a full understanding of its characteristics.

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