Alternative measures of liquidity on the Chilean government fixed income market

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Differences in long-term swap spreads measures monetary and fixed income markets, both in nominal and in real terms, have been very volatile and even negative in recent periods, since the data began to be registered four years ago. Various authors have attributed the discrepancies to some economic factors that have an impact on the degree of liquidity in these markets. This article empirically tries to identify changing conditions in the liquidity of these markets using high-frequency data from several sources. The validity of such hypothesis could help to build alternative liquidity indicators for central bank benchmark markets.

1. Introduction

Swap spreads in monetary and fixed income markets, typically defined as the difference between fixed-float swap derivatives interest rate contracts and the market interest rate of bonds issued by the central bank with similar maturities, are considered a proxy of funding liquidity conditions. Closely related measures of break-even inflation are typically used as indicators of inflation expectations for future periods. In both cases, the use of fixed-float swap derivatives interest rate contracts to extract information on the Chilean monetary market is relatively recent.[3] Its development has been attributed to a number of observable factors, such as the impediments created by current tax regulation that imposes a tax on capital gains for bond trading. This regulation created a disincentive for foreign investment in the domestic monetary market and eventually led to development of the alternative swap market (Alarcón and Malandre, 2008), along with a number of administrative barriers that also preclude foreign investment in the central bank instruments market. These authors argue that these barriers do not allow offshore agents to fully arbitrage differences between physical bond market rates and the swap rates, although there is no concrete evidence in this regard.[4]

After the subprime crisis, several studies attempted to identify the factors behind the sharp increase in the Libor-OIS spread and its counterpart in other developed markets. These factors are, basically, funding liquidity risk and counterparty risk, or a proxy of credit risk among large financial institutions, which are usually motivated by arbitrage models of interest

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[3] Registries of interest rates from these derivatives operations at the central bank date back to January 2005.

[4] There are no official records of trading volume, but inter-dealer brokers operating in the Chilean market have estimated the size of the peso swap market at about 3 trillion pesos, on average, per month. They indicate that around 10 local banks (the local banking system has 25 banks) and a similar number of foreign banks, operating mainly in the New York market, participate in the peso and inflation-linked swap market, with each group representing nearly half of the trading activity.

rates. Taylor and Williams (2008) found that the main driver of the deterioration in financial conditions was associated with an increase in counterparty risk and, to a much lesser extent, with funding liquidity risk.

The purpose of this article is to identify whether the traditional factors mentioned in the literature had a significant impact on our measures of financial conditions in the monetary market and the swap-fixed income market. The article briefly reviews the current and past literature on the subject, which to date refers only to international markets. Then we present some evidence on the behavior of swap spreads in the Chilean market and discuss the results of the estimation exercise.

2. Literature review on liquidity measures in developed markets

An earlier contribution to this topic was provided by Brown et al (1994), who relate swap spreads with various measures of credit (counterparty) risk and hedging costs of market-makers. They find that swap spreads are a function of a coupon bias and TED spread expectations. Grinblatt (1995) models swap spreads as a compensation for a liquidity yield associated with holding treasury notes, defined as a convenience yield. The yield in this case depends on short-term rates and a liquidity advantage of holding long positions in treasuries during tight market conditions. Credit risk is found to be less important in explaining swap spreads. Duffie and Singleton (1997) showed that changes in swap spreads are related to changes in counterparty and liquidity risk. More recently, Liu et al (2006) found results similar to those of Duffie and Singleton: ie swap spreads are characterized by a persistent liquidity process and a mean reverting default process.

There are also several articles that try to identify the influence of liquidity and credit risk premia on the short-term Libor-OIS spread and similar measures in other developed countries. The interest in understanding the behavior of the Libor-OIS spread increased markedly after the sharp increase in the spread at the onset of the crisis. Taylor and Williams (2008) found that during the subprime crisis counterparty risk emerged as an important factor in the surge in the Libor-OIS spread, while liquidity risk played a minor role. Their results generated an intense debate, because others questioned the result on liquidity risk. However, they present the high correlation observed between secured (Libor-Repo spread) and unsecured (Libor-OIS) funding as evidence that liquidity was less of a problem in the interbank market. Similar results are obtained by Hui et al (2009) in the sense that, prior to the crisis, funding liquidity risk was the main determinant in swap spreads, but when the crisis was in place, counterparty risk was also an important factor.

3. Evidence on swap spreads in the Chilean markets

A number of stylized facts are worth mentioning about swap spreads measures in the Chilean case. First, it has been noticed that up until the end of 2007, swap spreads in pesos and in contracts linked to past inflation showed a persistent negative trend (see Graph 1). There is also no significant premium for longer-term contracts and no significant difference in the volatility pattern (see Table 1).[5]

[5] For a detailed description of the Chilean swap markets, see Varela (2007) and Sotz and Alarcón (2007).

Table 1. Summary statistics of swap spread measures

	Pre-Crisis				Post-Crisis			
	mean	sd	min	max	mean	sd	min	max
Swap-Spread 5y	17	25	-36	70	-26	30	-83	52
Swap-Spread 10y	24	32	-44	100	-35	26	-80	28
Prime-Swap 3m	36	20	0	100	49	48	-20	300
Prime-Swap 6m	42	19	0	90	74	51	10	300
Prime-Swap 12m	57	21	20	110	91	57	0	330

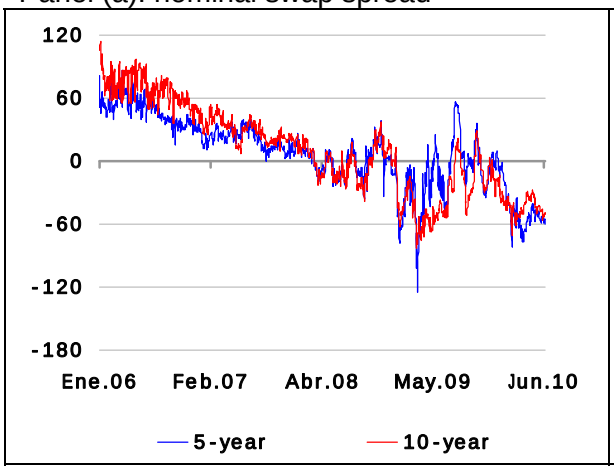
Source: Authors' calculations.

The behavior changed in 2008, around the time of the bankruptcy of Bear Stearns. Swap spreads started to oscillate around zero for nominal contracts and set below zero for inflation-linked contracts. This behavior presents a puzzle since it implies that bank counterparty risk is lower than rates on central bank paper that is supposed to be risk-free or, instead, that is viewed as a lower bound for pricing instruments at the terms. The negative values of swap spreads were observed until the end of 2008, a feature that was peculiar to the Chilean derivatives markets and to Greece. However, since 2009, swap spreads in Spain and even the United Kingdom have shown negative values at similar maturities (see Graph 2). In the case of these European countries, a plausible explanation for the negative values has been the large deficits incurred in the attempt to rescue their financial systems, which, in turn, has had a negative impact on interest rates on government securities.[6] In contrast, in the Chilean case the dynamic has been more of changes in the swap rates, explained by some authors as due to the lack of financial integration in the fixed income market because of a number of tax issues and the low stock of central bank instruments, which had led foreign investors to prefer to take positions in the curve through the swap market.

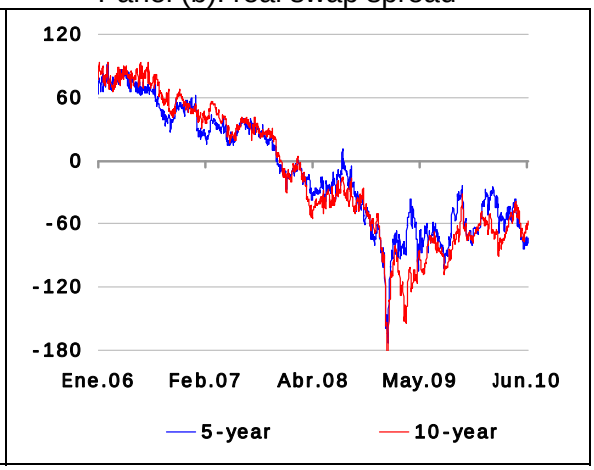
Graph 1
Chilean swap spreads

Basis points; updated as of June 2010

Panel (a): nominal swap spread



Panel (b): real swap spread



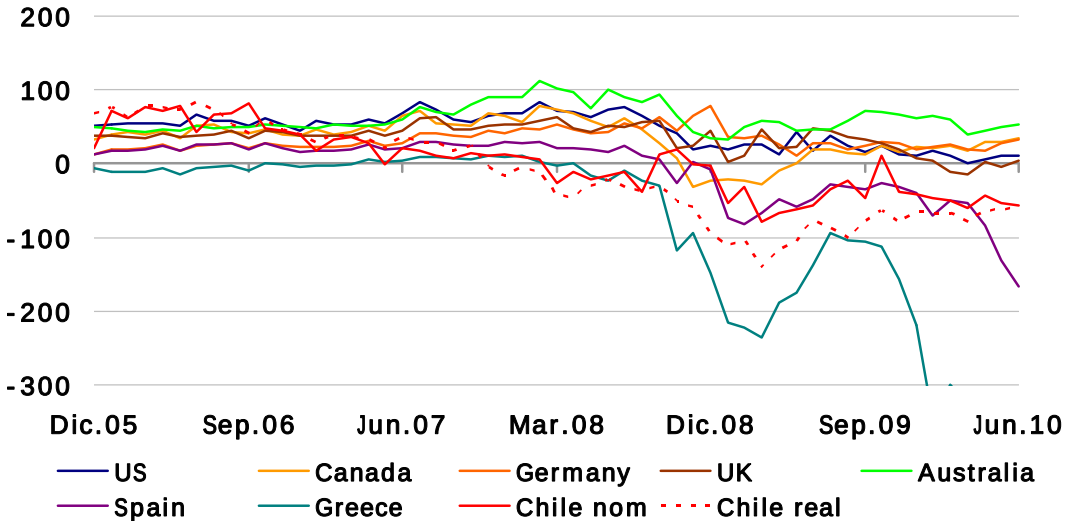
Source: Central Bank of Chile and Bloomberg.

[6] Preliminary panel cross-country regression shows that the fiscal deficit is a significant factor in explaining the negative values in swap spreads.

Graph 2

International comparison: 10-year swap spread

Basis points; updated as of June 2010



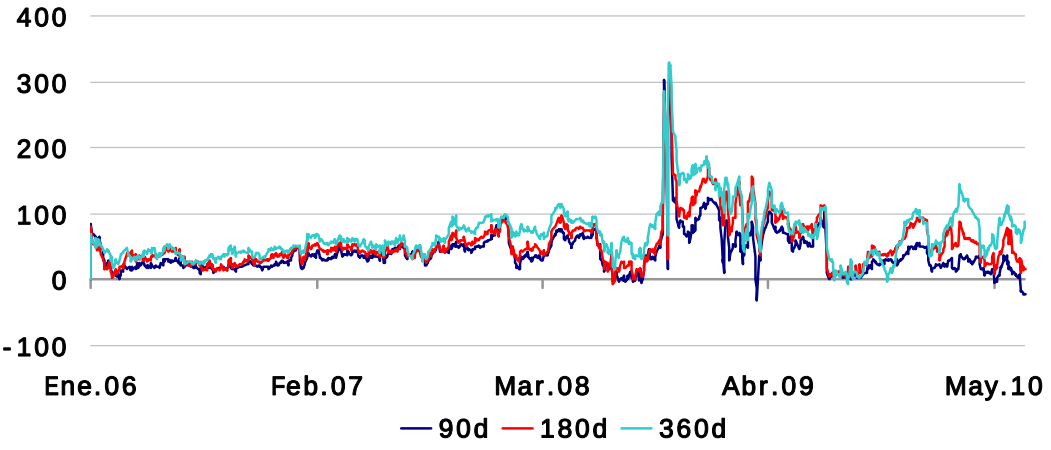
Source: Central Bank of Chile and Bloomberg.

With respect to swap spreads for maturities of a year or less we use what we call the prime-swap spread, which is negotiable at 90, 180 and 360 days. The prime rate corresponds to time deposit rates paid by banks to pension funds, mutual funds and other banks. It is the Chilean equivalent of the Libor rate quoted in developed markets, since there is only a daily interbank market in Chile. The prime-swap spread has shown high volatility when compared to its international equivalents, in particular after the bankruptcy of Lehman Brothers (see Graphs 3 and 4). Also, before the crisis there were no sizeable distinctions between contracts at different maturities (also see Table 1), suggesting a liquidity premium was not very relevant. However, after the crisis, in particular after the second semester of 2009, this changes, and there is, on average, a 25 basis point difference between the 90-day prime-swap spread and the 180-day contract, even though the central bank put in place a standing facility for 180-day repos using central bank instruments and banks' time deposits as collateral.

Graph 3

Chilean prime-swap spread

Basis points; updated as of June 2010

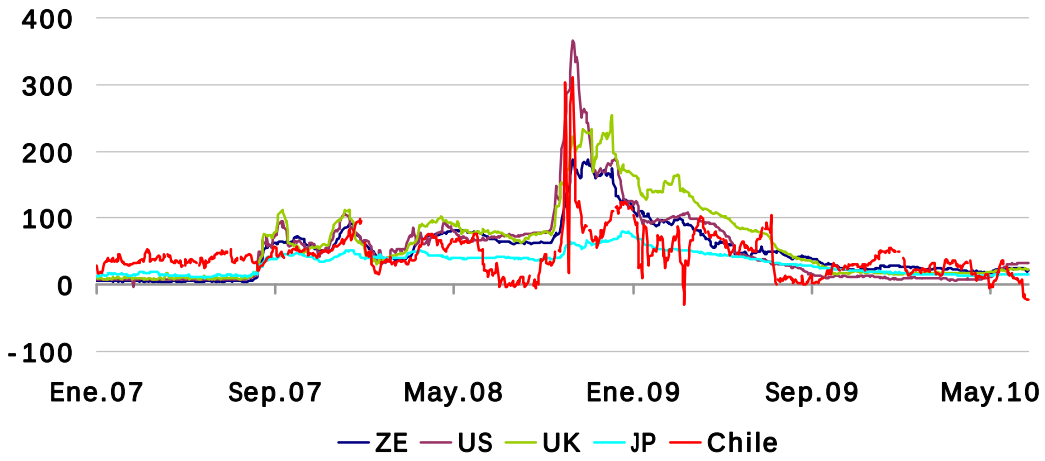


Source: Central Bank of Chile and Bloomberg.

Graph 4

International comparison: Libor-OIS three-month spread

Basis points; updated as of June 2010



Source: Central Bank of Chile and Bloomberg.

4. Empirical evidence on determinants of swap spreads

The estimation of swap spreads at different maturities is required to explore the volume of transactions in each market, to control for potential lack of trading liquidity at particular points in the curve. As a result, we estimate only the behavior of swap spreads for nominal 10-year maturities, and six-month maturities in the case of the prime-swap spread, which undoubtedly are the deepest and most active markets.

The model estimation adopted the following general specification,

$$y_t = \alpha + \beta_1 y_{t-1} + \beta_2 x_t + \beta_3 z_t + \varepsilon_t \qquad (1)$$

where y_t takes the following definitions:

$$swap\ spread = r_{0,10}^{SPC} - r_{0,10}^{BCP} \qquad (2)$$

$$prime - swap = i_{0,6}^{dp} - i_{0,6}^{SPC} \qquad (3)$$

The variable x_t comprises the set of determinants of interest for the different measures of swap spreads: (i) funding liquidity in the interbank market, proxied by the spread between daily interbank rates and the monetary policy rate;[7] (ii) banking counterparty risk, proxied by the spread of bank senior and subordinated bonds over a central bank benchmark of similar duration; and (iii) trading liquidity, proxied by the ratio of transactions of the corresponding instrument to the total stock of the same instrument, which in the case of the definition of swap spreads in equation (2) includes treasury and central bank instruments.

[7] The motivation for including this variable is to control for liquidity pressures in the interbank market that could eventually be transmitted to these other markets. Despite the active participation of the central bank through repo transactions and the existence of a 25 basis point upper and lower bound, there are periods when the interbank rate diverges significantly from the monetary policy rate.

The variable z_t contains several control factors, including the Libor USD-OIS spread, to control for liquidity pressures in international markets; the VIX index, to control for global volatility; and a set of dummy variables to control for the term facility implemented by the central bank from July 2009 to May 2010.It has been noted that the term facility helped to tighten prime-swap spreads right after its introduction. We also included a dummy variable that takes into consideration the period after the bankruptcy of Lehman Brothers; it has a value of 1 from the second week of September 2008 until the second week of December 2008, and zero elsewhere. Data are sampled weekly.

The results for the estimation of the prime-swap spreads suggest that counterparty risk in the Chilean case is not important, especially not when interacted with the crisis dummy (see Table 2). Trading liquidity also seems to be insignificant, except during the crisis when it takes a positive value, suggesting that during that period an increase in the volume in time deposits caused an incremental increase in the spread. It is important to notice that during the second semester of 2008 and for most of 2009, pension funds, which at some point represented 35% of total banking time deposits, substantially decreased their positions in time deposits and expanded their positions in foreign investment. It is also important to highlight that during more turbulent periods, such as the third quarter of 2008 and the second quarter of 2010, pension funds did come back to the local time deposit market.

Table 2. Estimation Result for 6 month Prime-Swap spread

Variable	[1]	[2]	[3]	[4]	[5]
Lag 1	0.83	0.80	0.79	0.71	0.65
	9.88 (***)	9 (***)	8.56 (***)	5.96 (***)	5.23 (***)
Lag 2	-0.2	-0.3	-0.2	-0.1	-0.2
	-3.62 (***)	-3.55 (***)	-3.29 (***)	-1.8 (*)	-2.29 (**)
Spread (Libor-Ois) 6m	0.2	0.1	0.1	0.1	0.2
	1.18	1.07	1.41	1.38	1.86 (*)
Dummy Subprime Crisis	14.1	13.3	57.6	-47.5	-60.5
	0.76	0.71	0.62	-0.44	-0.61
VIX	-0.1	0.3	0.2	0.1	0.2
	-0.08	0.7	0.59	0.34	0.55
Lag Spread (Tib-Tpm)		0.2	0.3	0.3	0.3
		1.6	2.07 (**)	1.6	2.04 (**)
Crisis Interaction - Lag Spread (Tib-Tpm)		5.5	2.9	-0.5	0.3
		1.1	0.7	-0.2	0.1
Counterparty risk			0.1	0.1	0.0
			1.7	1.4	0.8
Crisis Interaction - Counterparty risk			-0.3	-0.2	-0.2
			-0.6	-0.5	-0.4
Trading Liquidity				511	386
				1.5	1.2
Crisis Interaction - Lag Trading Liquidity				5,698	5,738
				1.6	1.76 (*)
Pension Fund - Bank Deposits exposure					-46.9
					-3.17 (***)
Constant	13.7	9.8	2.3	-3.0	753
	1.6	1.4	0.4	-0.4	3.14 (***)
R-sq	0.75	0.75	0.75	0.77	0.78
Observations	225	225	225	222	221

T-statistic in parenthesis significance at 1% (***), 5% (**), and 1% (*)

On the other hand, the interbank-monetary policy rate spread is significant in two specifications. This suggests that liquidity pressures in this market might have been transmitted to longer-term monetary markets. Moreover, the Libor-OIS spread is also significant in specification [5], suggesting that concerns about access to adequate funding liquidity, either locally or internationally, were more relevant than the worsening credit risk

profile of domestic banks. This finding is consistent with the fact that the solvency of the Chilean banking system has never been put under strain since the beginning of the crisis.

The results for the 10-year swap spread are not very different from those for its short-run equivalents (see Table 3). There is a high and significant degree of persistence in the spread.[8] Although the crisis dummy is significant in specification [1], it is not robust to further changes in the estimation. Also, its interaction with counterparty risk, trading and funding liquidity risk is not significant. Unlike the previous results, counterparty risk by itself is significant in two specifications, [2] and [3]; however it loses its relevance when we control for the stock of central bank bonds available in the market. In fact, the swap spread can be explained quite well by its own lags. This finding possibly suggests that this market has been relatively immune to all the turbulence caused by the international crisis. The interbank spread was not significant under any specification, which could be explained by the facts that the capital requirements for entry into the swap market are very low, and that, at the end of the contract, only differences in interest rates are compensated.

Table 3. Estimation Result for 10 year Swap Spread

Variable	[1]	[2]	[3]	[4]
Lag 1	0.65	0.63	0.63	0.60
	8.74 (***)	8.23 (***)	8.26 (***)	8.04 (***)
Lag 2	0.25	0.23	0.23	0.20
	3.48 (***)	3.16 (***)	3.14 (***)	2.63 (***)
Spread (Libor-Ois) 3m	0.04	0.07	0.08	0.06
	1.24	2.03 (**)	2.05 (**)	1.39
Dummy Subprime Crisis	12.8	6.51	-86.26	-98.2
	1.99 (**)	0.53	-0.79	-0.88
VIX	-0.46	-0.75	-0.72	-0.54
	-2.7 (***)	-3.9 (***)	-3.59 (***)	-2.36 (**)
Counterparty risk		0.07	0.08	0.05
		2.72 (***)	2.74 (***)	1.6
Crisis Interaction Counterparty risk		0.06	0.16	0.17
		0.7	1.0	1.1
Trading Liquidity			-18.0	-29.9
			-0.9	-1.4
Crisis Interaction - Trading Liquidity			463.1	523.8
			0.8	0.9
Banks - Government bonds exposure				-16.1
				-1.6
Constant	7.2	4.1	4.1	232.1
	2.37 (**)	1.0	1.0	1.6
R-sq	0.91	0.91	0.91	0.91
Observations	208	208	204	204

T-statistic in parenthesis significance at 1% (***), 5% (**), and 1% (*)

[8] Traditional unit-root tests reject the null hypothesis of non-stationarity in the swap spread variables.

5. Final comments

This paper represents the first attempt to identify whether counterparty and funding liquidity risk have played a role in the evolution of swap spreads in the Chilean monetary and fixed income markets. The results suggest that counterparty risk was not very relevant during the most turbulent periods since August 2007, at least in the monetary market for funding liquidity. This result is consistent with the resilience shown by the domestic banking system throughout this entire period. In contrast, funding liquidity pressures in the overnight interbank market, despite active central bank involvement, seems to increase funding pressures in the market where most banks obtain funding from institutional investors.

These preliminary results show that, if there is any funding liquidity risk in swap spread markets in the Chilean market, its identification is a task that remains pending. Traditional factors used in the literature to explain the evolution of swap spreads play a relatively minor role, given the high persistence in the swap spread itself. It is important to bear in mind that swap markets in Chile are relatively recent and, therefore, there are not official statistics for the level of activity in these markets.

6. References

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