Spreads Determinants of Corporate Bonds in State-Owned Companies. The CODELCO Case

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Abstract

This article aims to measure the impact on CODELCO debt financial spreads as a result of the changes in various factors, mainly resulting from the fall in copper prices. In this sense, the article addresses a public policy issue in todays Chile, because of the low copper prices, that have reduced the company's contributions to the treasury. The analysis is performed with a sample of data that is quarterly arranged and range from 2003 to 2015, and the goal is to measure the debt spread determinants from a credit risk perspective. As expected, the relationship between the average maturity of the bonds and the spread is inverse, the probability of "default" and the bond spread relate positively and the price of copper is related negatively with the bond spread. Contrary to what is expected risk classification is not statistically significant and the cash to total assets is positively related with the bond spread

JEL Classification: G38.
Key Words: Bond Spread, State owned Enterprise, Copper Price, Credit Risk, Under-Capitalization.

Determinantes del spread de los bonos corporativos de compañías estatales. El caso de CODELCO.

Resumen

Este artículo busca medir el impacto en el spread de la deuda financiera de CODELCO como resultado del cambio en varios factores, especialmente la caída del precio del cobre. En este sentido, el artículo aborda un asunto relacionado a las políticas públicas de Chile, ya que la baja en el precio del cobre ha reducido la contribución de la compañía al estado. El análisis es llevado a cabo con una muestra de datos trimestral que comprende un periodo entre 2003 y 2015, y el objetivo es medir los determinantes del spread desde la perspectiva del riesgo de crédito. Como se esperaba la relación entre la madurez promedio de los bonos y el spread es inversa, la probabilidad de default y el spread se relacionan positivamente y el precio del cobre se relaciona negativamente con el spread. Contrario a lo esperado, la clasificación de riesgo no es estadísticamente significativa y la razón entre caja y activos totales se relaciona positivamente con el spread de los bonos.

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Palabras clave: Spread de bonos, Emprea estatal, Precio del cobre, Riesgo de crédito, Sub capitalización.
Clasificación JEL: G38.

1. Introduction

The beginnings of the massive exploitation of copper in Chile are associated with the arrival of capital from the United States in the early twentieth century. Between 1904 and 1910, two companies, began the exploitation in the mines of El Teniente and Chuquicamata, respectively. In the 1920s new American actors entered the market (Vergara, 2015: 229).

The copper business gained a major importance in the Chilean economy between 1930 and 1970, copper sales represented 70% of Chilean exports (Nazer, 2004: 3). This situation generated a broad political debate about what to do with this industry. During the 1950s there were voices criticizing the fact that copper were in foreign hands. In 1951, the so-called Washington Agreement was signed. This agreement made available a 20% of the production for Chile. In 1955, the state created the Department of Copper, to conduct studies on production and sales as well as exercise control in the industry (Correa *et al.,* 2001).

There were two approaches among those who raised the need to increase national participation in the copper industry: the Chilenization, which indicated that the state should take the 50.1% of the property, and the nationalization, which advocated a complete statization. The discussion took power under President Eduardo Frei Montalva (1964-1970). The sharp increase in copper prices during the 1960s increased profit margins in the industry. In this new scenario, the taxation scheme proved disadvantageous for Chilean interests. Thus, a favourable environment was generated and this led to the adoption of the law 16,425 of "Chilenization of Copper" resulting that state could control the 51% of the most important sites in the country (Correa *et al.* 2001).

The focus of the Chilenization of copper, promoted by President Frei Montalva, will be replaced by the nationalization. In September 1970, Salvador Allende (1970-1973) won the Presidency of the Republic. Allende's economic program contained among its measures to move towards full control of the copper industry. That was materialized with the enactment in 1971 of the law 17,450 (see, for example, Correa *et al.,* 2001).

During the military dictatorship of Augusto Pinochet (1973-1990), characterized by the implementation of a neoliberal economic model, the agenda related to the copper moved in several directions. On the one hand, in 1976, through the acts 1,939 and 1,940, an institutionality capable to manage and exploit the deposits nationalized at the time of Allende was established. This through the creation of the National Copper Corporation (CODELCO) as a state enterprise with legal personality and its own assets (CODELCO, 2015). Since its inception, the company has been conceived as a SOEs that aims to generate resources for the treasury (see Camacho, 2010; Barría, 2015). The military also associated their fate to the company when reforming the law 13,196 in 1975 through Decree Law 984, rules of confidential nature which states that 10% of the gross sales of CODELCO should go to the Armed Forces.

On the other hand, progress was made to develop an agenda that was intended to allow foreign investment in general, and particularly in the mining industry. On the first point, in 1974 a general regulatory framework (Decree Law 600) was issued. In 1981, an Organic Law on Mining Concessions was passed beginning to have an effect of attracting foreign investment late in that decade. Between 1985 and 1989, investment reached US $ 6 billion (Nazer, 2004: 8-10).

In the 1990s, under the governments of Concertación, a centre-left coalition that replaced Pinochet, a third wave of privatizations was held, instead of promoting the development of the SOE. In this context, the copper industry has grown thanks to the emergence of fields operated by international companies. Although this has led to a process that some call denationalization of copper (see Nazer, 2004), CODELCO continues to be a major player in this activity.

Currently, the corporate governance of CODELCO is ruled by law 20,329, which sought to make some innovations to the way the company was managed. On the one hand, the proposal explicitly stated the desire of the Executive to incorporate the OECD guidelines for the management of SOEs. Among them, it considered subjecting CODELCO to the rules of private enterprises (except in matters that were incompatible with the rules established in 1976), setting a mechanism of board selection that would meet an eligibility criteria. Similarly, it separated the functions between the board and the CEO of the company. Currently, the board is composed of nine members: three are directly appointed by the President of the Republic, four were selected via the Senior Public Management System (the mechanism through which the highest public managers are selected) and two members nominated by workers ' associations (BCN, 2009)

The importance of the copper industry for the economy and CODELCO for the treasury makes the budget formulation process depends heavily on earnings projections of the company (which in turn depend on the price of copper). Since 2001, Chiles fiscal policy is based on a rule of structural adjustment, called Balance Cyclically Adjusted (BCA). This makes it even more necessary that financial organization of the company in terms of corporate governance may be well defined so that it can match its contribution to the Chilean State and its financial sustainability that clear rules should consider reinvestment of profits.

2. CODELCO. A Brief History and the Institutional Framework.

The state owned company (SOE) is currently playing a visible role in world economies. The privatization wave that the world experienced, with different intensities depending on the region since the 1970s, failed to eliminate the state corporate action in the economic sphere. Large companies survived and now they control important resources. Thirteen SOEs control 74% of oil reserves in China (Guajardo, 2013) playing an active role in the economic development. Russian state - controlled companies such as Gazprom, have been vital in Russia's return to centre stage of international politics. In Latin America, the states continue to control major companies for their national economies apart from the phenomenon of the renationalisation of previously privatized companies (see, for example, Serrani, 2013).

In the academic sphere, renewed interest in studying SOEs is also seen.

In Latin America there have also been studies that account for the persistence and renewed air of the state enterprise (for example, Cortes and Chavez, 2013; Chavez and Torres, 2013; Lustosa and Miano, 2013; Guajardo and Labrador, 2015; Guajardo, 2016). As Guajardo (2013) points out, the SOE is a leviathan that refuses to disappear.

Some SOEs aim to provide public services, others seek to regulate markets, while a third type of companies are created to boost economic activity in territories and/or specific industries. Finally, there are companies whose function is to generate revenues for the state, and thus help finance social spending (see Camacho, 2010). In the latter type of companies, the most important in Latin America, such as PEMEX in Mexico, PDVSA in Venezuela, PETROBRAS in Brazil and CODELCO in Chile are found. These SOEs are mainly engaged in the sale of resources (usually commodities) that are traded on international markets. This makes them be exposed to international economic cycles. Similarly, since they have the pressure of state authorities to generate resources, the way of financing investment become crucial for the sustainable development of this activity.

CODELCO is therefore an important player in the Chilean economy, geared to international trade and is dependent on the exports of raw materials. From the 1960s until now, exports represented 21.1% of Chiles GDP, reaching in recent years to about 30% (Graph 1, Appendix). Within exports, the ones corresponding to copper have a ponderous weight. In the period 2010-2014, they reached 54% of total exports (Graph 2, Appendix). Of these, approximately one third of the production, corresponds to CODELCO (Graph 3, Appendix). Also plays a key role in tax collection. As shown in another study, the company fulfils the role of generating revenues to the treasury and, in fact, there is no other company that delivers such amount resources (see Barría, 2015). They are derived from taxes on profits that every company must pay (20%), a tax of 40% for SOEs (Decree Law 2,398), along with a variable royalty payment (between 5 and 14 %, law 20,469) and a 10% tax on exports (law 13,196). To this the contributions established by the Copper Reserved Law must be added. (Graph 4, Appendix)

The end of the super-cycle of raw materials, which has been accompanied by a slowdown in China in recent years, have adverse effects on the liquidity of the company affecting the normal operational cycle. This added to the fact that the contributions provided by the government to CODELCO are non-systematic and are not defined in a clear rule of profits reinvestment, therefore, sporadic capitalizations are the product of political pressure from various current situations, rather than based on a clear long - term investment policy, which should be originated taking in account the profits of this company. This affects the risk perception of financiers who hold positions in the company and accompanied of the high level of debt that CODELCO shows due, among other reasons, to a nonexistent political capitalization of profits for the development of new structural and long - term projects, induce changes in credit risk, which lead to an increase in spreads on corporate bonds (financial cost of debt) that the company has issued in all past periods.

From an institutional point of view, the legal nature of this CODELCO prevents the capitalization of profits for new investment projects. The Decree

Law 1,350, requires that all surplus of the company must be distributed to the Chilean treasury. In recent years, only 10% of company profits have been reinvested which corresponds to a quarter of what the industry internationally does (Source: Nelson Pizarro, CEO of CODELCO) to keep competitive in the company and make their structural projects.

Given these constraints on equity, the company has prioritized the issue of corporate bonds in the debt markets to finance their projects. In periods of relatively high copper price (until 2011, when it reached its peak), fears regarding high indebtedness of the company were minimal, since its equity is revalued on par with the increase in the price of copper. However, the fall in copper prices in the last year and a half has been about 80%. This reduction in the price of copper devalues the assets, generating a drop in operating income of the company and deteriorating the companys cash flow. Simultaneously, the credit risk of the company increases which is the result of these market events. Although ultimately CODELCO has a "lender of last resort" and assumes sovereign risk, the cost of financing abroad has begun to increase. This opens up a great debate in Chile about how to capitalize the company so that it can rush these structural projects that will maintain the competitiveness of the company in the international copper market. We will develop the econometric model of its results, showing how these variables focused mainly on the credit risk of CODELCO may have an impact on the financial cost of debt

The literature on the determinants of corporate debt spreads is relatively divided since different authors have reached different conclusions. On the one hand, results such as the ones by Elton, Gruber, Agrawal and Mann (2001) conclude that the spread of the debt is explained by the risk of default as well as specific state and local taxes that only affect corporate bonds rather than government bonds. The reason is that the latter internalizes the sovereign risk (the risk of default state) because there is a belief that the state in this case would be a "lender of last resort" in the event of financial problems in state owned enterprises. Also the spread of the debt is explained by macroeconomic factors such as the existence of systemic risk within the spread. While Longstaff, Mithal, and Neis (2005), through the analysis of Credit Default Swaps[1] to five years for a set of 68 firms, found that a significant proportion of the spreads on corporate debt are explained by the credit risk. In the same strand, Covits and Downing (2007) report similar results for their analysis to a set of short term US financing instruments, in which credit risk is a major determinant of the spread even in those with a maturity of less than one month.

On the contrary, Delianedis and Geske (2001), using data for US firms between 1991 and 1998, argue that the bond spread is determined in part by the credit risk, but another important part could also be explained by taxes, market liquidity and macroeconomic risk factors. In line with this, Huang and Huang (2012) analyzed data from US companies between 1973 and 1998, concluding that consistent estimates of the debt spread can be obtained by

[1] Credit default swaps (CDS) consists of a risk coverage financial operation that is materialized by a contract on a credit instrument (usually a bond), in this, the buyer of the CDS makes a series of periodic payments to the seller, in return, the latter receives an amount of money if the title that serves as the underlying asset at the CDS is not paid at maturity or the issuer incurs a cessation of payments.

various economic considerations, so credit risk corresponds to a small part of the spread for Investment Grade Bonds[2] and a somewhat larger ratio in the case of High Yield Bonds. Finally, Collin-Dufresne, Goldstein and Martin (2001), who studied a basis of monthly data for US companies in the period between 1988 and 1997, concluded that changes in the spread of corporate debt can be attributed to supply / demand shocks independently of credit risk and market liquidity risk. Also, when it is analyzed the issue of risk country and its impact on the corporate debt, Martell (2008) finds that that domestic spreads of the firms are related to the lagged component of sovereign spreads. Hence, given that CODELCO is a state enterprise, its debts spreads are highly correlated with the sovereign risk (sovereign bonds) and it is originated in a large influence of copper sector into the Chilean economy in terms of investment, sectoral GDP and production linkages.

3. Objectives

This article aims to measure the impact on CODELCO debt financial spreads as a result of the changes in various factors, mainly resulting from the fall in copper prices. In this sense, the article addresses a public policy issue in todays Chile, which is also interesting for other SOEs engaged in the sale of commodities, highly exposed to international economic cycle. CODELCO's financial situation became one of the main topics of political discussion in Chile, because the low copper prices have reduced the company's contributions to the treasury.

4. Theoretical Framework and Methodology.

Whereas there is no consensus in the literature regarding the credit risk factors are more important than the market liquidity risk factors as part of the debt spread, then probably both must to be took in account for a model, resulting in the following equation.

$$\text{yield spread} = \beta_0 + \beta_1^T \left(liquidity\ risk\ factors\right) + \beta_2^T \left(credit\ risk\ factors\right) + \varepsilon$$

Following the literature, the term "Liquidity risk factors" represents a set of possible proxies for liquidity risk. Similarly, the term "Credit risk factors" represents a set of possible proxies for the default risk of a bond issuer.

The liquidity proxies commonly used in the literature include Cash over Assets and Maturity. The first measure, Cash over Assets, is specific to each bond issuer and is defined as the ratio of the sum of cash and marketable short-term securities such as trading securities to the amount of total assets, indicating the issuers ability to meet its short-term obligations. A higher level of cash over total assets indicates a higher funding liquidity profile of the bond issuer. In general, therefore, this variable is expected to be negatively related to yield spreads assuming that a lower liquidity profile represents higher liquidity

[2] There are several ways to categorize fixed income instruments, and one of them is according to the rating of risk, it corresponds to a note that provide information about the ability of a firm to meet its financial commitments, which is granted by a sorter, such as Standard and Poor's, Fitch, Moody's, etc. In this case, it is called Investment Grade bond to those with the best risk rating, that is, they receive a note from AAA to BBB-.

demand from the bond issuers perspective. However, an excessively high level of cash ratio might represent higher inventory costs, meaning that after a threshold, a higher cash ratio drives up the yield spread. Whereas Maturity is the time left until maturity from the issuance date of a security. As mentioned in Longstaff, Mithal, and Neis (2005), the rationale for using this variable is that there might be maturity-sensitive clientele for corporate bonds. Accordingly, it is expected that the shorter the maturity, the more liquid the bond.

This study considers two credit risk variables as explanatory variables. The first proxy, Rating, is the credit rating assigned to each security that a firm issues. Of course, a positive relationship is expected between yield spreads and credit ratings. The Distance-to-Default (DtD) measure is based on Mertons (1974) bond pricing formula. DtD represents how far a firm is from default; a smaller DtD value means a higher probability of default. This study takes the average of the distance-to-default estimates of the period while a specific issue is outstanding within the sample period.

For estimating the impact of credit and liquidity risk on yield spread pricing, we run a time series regression of bond spreads on the proxies for liquidity and credit risk. The basic model specification is given by

$$\text{spread} = \beta_0 + \beta_1 \text{Cu} + \beta_2 \text{DtD} + \beta_3 \text{Clas} + \beta_4 \text{Mat} + \beta_5 \text{CoA} + \varepsilon$$

The dependent variable Spread represents the average of the difference between the interest rate of CODELCO bonds and the treasury bonds that has a comparable maturity. It is measured using the difference between the interest rates of the bonds at the end of each quarter, and the results are expressed in basis points.

Among the explanatory variables, the price of copper is included using the quarterly variation of this, which is obtained taking the price at the end of each quarter and calculating the variation compared with the close price of the previous quarter. Considering that much of the risk is associated with the fulfilment of obligations and this should be related to the results of its operations, which in turn should be linked to the price of copper. Considering this, we expect that the estimator for the variation in the copper price and the spread of the bonds is expected to be negative.

To measure the credit risk in this study, credit rating and distance to default (DtD) were considered. The credit rating corresponds to the risk rating assigned to each asset (bond in this case) that has been issued by the firm. It corresponds to the risk rating average given by the three major rating agencies , following the coding proposed by Covitz and Downing (2007) for credit ratings: AAA = 1, AA + = 2, ..., BBB- = 10, which in the case of Codelco, the following scale is presented:

Table 1. Risk Classification.

AAA	1
AA +	2
AA	3
AA-	4
A +	5
A	6
A-	7

Source: Own elaboration

Table 2. Codelco Risk Classification.

	Rating	Scale
1997 - 2003	A-	7
2004 - 2012	A-	6
2013 - 2015	AA-	4

Source: Own elaboration

A positive relationship between the spread of corporate debt of CODELCO and risk classification is expected, since increasing the value on the scale also increases the level of risk which is expected to be reflected by a greater spread.

The companys default risk is measured using the probability of default calculated by Bloomberg, which is based on the distance to default (DtD) of Merton (1974), which assumes that the equity of a firm is a purchase option on total assets whose strike price is the value of its liabilities, so it follows that if the value of the assets is greater than or equal to the strike then the company does not enter into default. However, this method has the weakness that assumes that the company can only enter into default when there is a maturity of its debt. Because of this fact, Bloomberg methodology is applied, which assumes that the option is a one-year term, which places greater demands on measuring the risk of default. To estimate our model, we used the value of the average probability of default of the bonds at the end of each quarter. We expect the relationship between the distance to default and the spreads of CODELCO's bonds to be positive, since increasing the risk of deafult should increase the spread of the bonds.

With respect to liquidity risk, the variables are Cash over Total Assets and Maturity. Cash over Assets is defined as the ratio of the sum of cash and short - term liquidating assets regarding total assets, and indicates the issuer's ability to meet its short - term financial obligations. A high level of cash available on total assets indicates a profile with high liquidity in the funds available by the issuer. In general, it is expected that this variable is negatively related to the interest rate spread, assuming that low liquidity of the issuer implies that when paying their obligations they could also face high levels of financial stress. However, a level of cash on excessively high asset may represent high inventory costs, which in some cases could lead that above some level, a high level of cash implies an increase in the spread. For model we used the result of the ratio between cash and short -term liquidating assets to total assets, for each quarter.

Maturity corresponds to the average term a corporate bonds is due for a given quarter. The idea behind this variable is that bonds with shorter time to maturity are more attractive (higher demand) so they could put pressure on the financial structure, requiring funds to be paid. The sign for this variable is expected to be negative, because as the duration of debt issued increases, the spread of the bonds should be reduced as the pressure on the financial structure decreases as debt payments would be spread over a longer period.

5. Results of the Econometric Model.

As we stated in the previous section, the econometric model has the following form:

$$\text{spread} = \beta_0 + \beta_1 \text{Cu} + \beta_2 \text{DtD} + \beta_3 \text{Clas} + \beta_4 \text{Mat} + \beta_5 \text{CoA} + \varepsilon$$

The analysis is performed using the variables mentioned in the previous section with a sample of 51 data that are quarterly arranged and range from the second quarter of 2003 to the fourth quarter of 2015, and the goal is to measure the debt spread determinants from a credit risk and a liquidity risk perspective.

Analyzing the data seeking for serial multicollinearity problems, we only find an important level of correlation between Mat and Clas, while there are not high levels of correlation between the other variables.

Table 3. Correlation Matrix

	Spread	CoA	Mat	Clas	DtD	Cu
Spread	1.00000					
CoA	-0.04120	1.00000				
Mat	-0.37110	-0.02060	1.00000			
Clas	-0.27910	0.11790	0.83250	1.00000		
DtD	0.63850	-0.28740	-0.12530	-0.09980	1.00000	
Cu	-0.52800	-0.05810	0.27390	0.22510	-0.01710	1

After performing a first set of regression models, we perform a Breusch - Pagan test for heteroskedasticity, finding evidence for this problem, therefore the estimate is made using robust errors by the method of White (1980). Finally, the following results are obtained:

Table 4. Results for the Different Models.

	Spread			
Variables	Model 1	Model 2	Model 3	Model 4
CoA	246.71	258.95	-	-
Std. Err.	198.45	189.78	-	-
t	1.24	1.36	-	-
P-value	0.22	0.18	-	-
Mat	-5108.43	-4302.06	-4433.61	-
Std. Err.	4049.28	2226.60	2244.81	-
t	-1.26	-1.93	-1.98	-
P-value	0.21	0.06	0.05	-
Clas	2.49	-	-	-
Std. Err.	10.38	-	-	-
t	0.24	-	-	-
P-value	0.81	-	-	-
DtD	5692.15	5707.57	5412.57	5589.68
Std. Err.	751.37	740.90	715.12	730.60
t	7.58	7.70	7.57	7.65
P-value	0.00	0.00	0.00	0.00
Cu	-164.53	-164.48	-166.52	-182.37
Std. Err.	29.38	29.07	29.30	29.02
t	-5.60	-5.66	-5.68	-6.29
P-value	0.00	0.00	0.00	0.00
Cons	18.67	42.13	52.78	108.09
Std. Err.	102.37	29.47	28.68	6.37
t	0.18	1.43	1.84	16.97
P-value	0.86	0.16	0.07	0.00
Statistics for each model				
R-squared	0.71	0.71	0.70	0.68
F	22.25	28.38	36.55	49.86
p-value F	0.00	0.00	0.00	0.00
Breusch-Pagan (BP)	1.13	1.05	0.24	0.03
p-value BP	0.29	0.31	0.62	0.87

When we are moving from the model 1 to the 4, we are eliminating systematically the variables that are not statically significant. Beginning with risk classification in Model 1, even the result has the positive relationship expected, as intuition suggests that as the risk rating worsens (increases the number of coding) then the firm should have a greater spread, however, given the lack of statistical significance, there are no problems if this variable is removed to estimate the model (Appendix). The ratio cash to total assets relates positively, this is contrary to what is expected, since a high level of these liquid assets are associated with a good ability to repay debt therefore it should relate inversely with the spread, however, the increase in short - term assets could be also related to an increase in inventories, which could be perceived negatively by the market and explain the positive relationship observed, but again the variable is not statically significant, the we can remove it. In Model 3, the relationship between the average maturity of the bonds and the spread is inverse, as expected, as the shorter is the maturity the more liquid are the bonds, since they are closer to be asked, which could put pressure on the payment ability of the firm, increasing the risk perception and therefore increasing the spread, but the variable can be discarded due to a lack of statistical significance with a level of confidence under 5%. Finally we have the Model 4 with DtD, C_u and the constant of the regression being statically significant, resulting with a positive relation between the probability of "default" and the bond spread, as expected, and the price of copper is related negatively with the bond spread, which is in line with expectations, because if the price of copper rises, one would expect an improvement in the sales of the company which reduces the risk of default, so the spreads should be reduced.

In addition to the statistical significance of the variables, we have a second reason for not taking into account variables as Maturity and Risk Clasification, due to that these time series variables possess unit root problems. It can be seen in the following table, where we show the results for Phillips-Perron and Dickey Fuller tests.

Table 5. Phillips Perron Test for Unit Root.

	Phillips-Perron test				
	Z(t)	1% Critical Value	5% Critical Value	10% Critical Value	p-value
CoA	-4.056	-3.58	-2.93	-2.6	0.0011
Mat	4.744	-3.58	-2.93	-2.6	1
Clas	1.07	-3.58	-2.93	-2.6	0.7268
DtD	-3.18	-3.58	-2.93	-2.6	0.0212
Cu	-5.983	-3.58	-2.93	-2.6	0

Table 6. Dickey - Fuller Test for Unit Root.

	Dickey-Fuller test				
	Z(t)	1% Critical Value	5% Critical Value	10% Critical Value	p-value
CoA	-4.141	-3.58	-2.93	-2.6	0.0008
Mat	1.482	-3.58	-2.93	-2.6	0.9975
Clas	-1.084	-3.58	-2.93	-2.6	0.7215
DtD	-3.039	-3.58	-2.93	-2.6	0.0314
Cu	-6.056	-3.58	-2.93	-2.6	0

It is possible see that in both tests, Maturity and Risk Classification has a $Z(t)$ statistic over the critical values at 1%, 5% and 10%, that is, there are not rejecting the null hypothesis of unit root presence, then both variables can be dropped.

Finally we can conclude that is possible to eliminate of the model Cash to Total Assets due to a lack of statistical significance and Maturity and Risk Classification due to both problems, the presence of a unit root in the data and because there are not statiscally significant. Then, we can choose Model 4, although it determination coefficient is around 68%, it is the strongest model from a methodological point of view, because it is estimated through the White method, which applies robust errors to the presence of heteroskedasticity, does not consider variables that have multicollinearity problems and does not include variables with unit root problems.

6. Conclusions

CODELCO represents a significant percentage of exports and tax revenues in Chile, which has been a company with a strategic importance in the economic development of this country. This is why it is expected that the financial management of the company may not be a trivial matter for the state, since its deterioration would have a significant systemic impact for the Chilean economy. However, evidence shows that not having a policy of capitalization of profits (reinvesting of earnings) affects the normal development and planning of new structural projects.

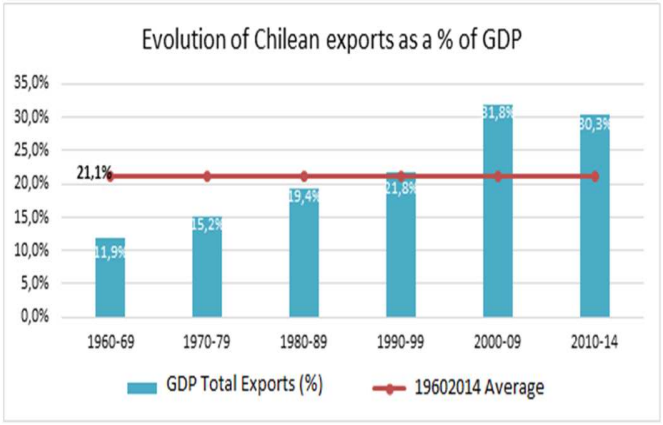
Since the contributions provided by the State to CODELCO are not systematic and there is also no clear rule regarding the reinvestment of profits, then sporadic capitalizations have been the result of cyclical political pressure, rather than a clear guideline of long term investments, which should be based on reinvesting the companys revenues. As noted in Section II, only 10% of CODELCO's profits have been reinvested in the last decade. This has exacerbated the pressure for corporate debt issuance in international markets. While copper prices rose sharply between 2009 and 2013, levels of financial

leverage (debt / equity) rose during that period to more than two times (Source: Codelco Financial Statements). Clearly the increase in copper prices served as collateral to support an emission level of more aggressive debt (Appendix 2, graph 5)

Then, being CODELCO one of the most important players in the copper mining world and given its relevance for the Chilean economy it is important to measure the impact on the financial spreads of CODELCOs debt, as a result of changes in factors such as the fall in copper prices and changes in credit risk. From the results of the implemented quantitative model, the debt spreads proved to be sensitive to variations in the price of copper, and also have an inverse relationship, indicating that a fall in copper prices will lead to an increase in the spread of debt, which is a sign that financial markets are able to see that these falls have adverse effects on the company liquidity, affecting the normal operating cycle and therefore it is manifested by a punishment to the value of debt issued by CODELCO (through an increase in the interest rate on its bonds). In relation with the effects of changes in credit risk of the company, these are measured through the distance to default, and the results in general terms indicate that the perception of excessive pressure on cash flows due to payments, may increase the risk perception of investors, leading to an increase in spreads on corporate debt of CODELCO. Finally, it is striking that the risk rating of the company has no relation to debt spreads, which probably shows that investors perceive the company as a significantly important element for the treasury and the Chilean economy, if this experiences financial difficulties, they believe that the Chilean state will provide the necessary financial support (the existence of a "Lender of Last Resort")

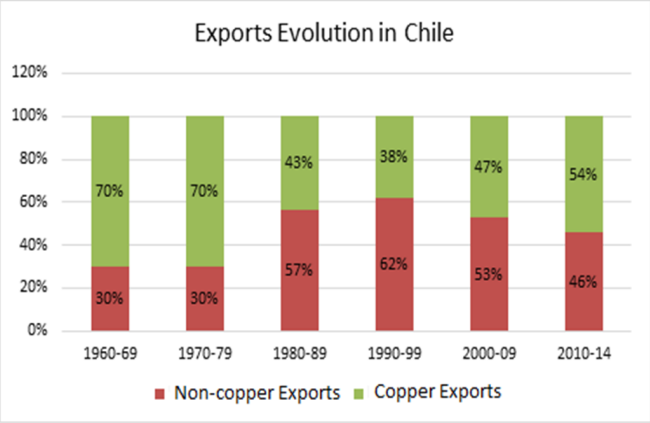
Appendix.

Graph 1: Evolution of Chilean Exports as a Percentage of GDP



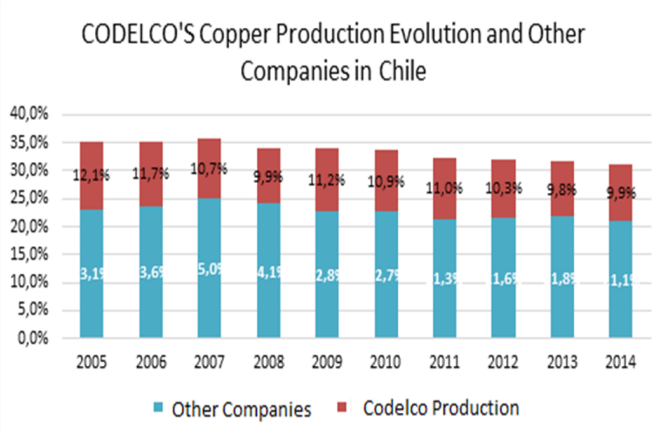
Source: Rodríguez et al. (2015).

Graph 2. Exports Evolution in Chile



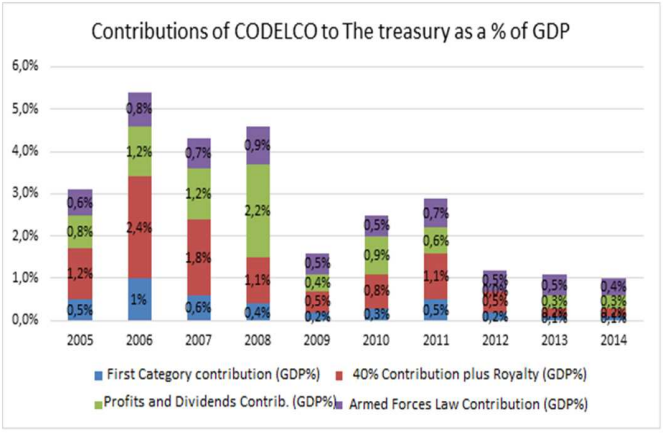
Source: Rodríguez et al. (2015).

Graph 3. Production of CODELCO as part of the total Chilean copper production.



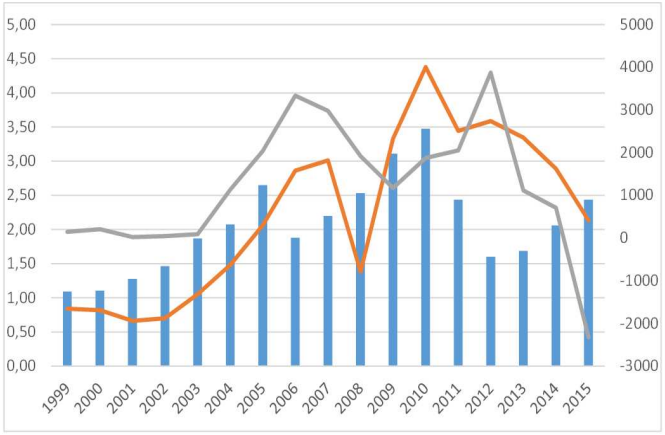
Source: COCHILCO (2014).

Graph 4. Contributions of CODELCO to the Treasury as a Percentage of GDP



Source: DIPRES (2014)

Graph 5: Financial Leverage and Profits



Source: DIPRES (2014)

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