Evaluating The Impact of FDI and Copper Mining in Chile

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ABSTRACT

This thesis seeks to examine the effects of foreign direct investment (FDI) on Chile's copper industry. Copper production and exports are dominated by Chile on a global scale and demand for copper is increasing due to its critical role in industries such as construction, manufacturing, automotive, and telecommunications. Chile has experienced significant political and economic transformations over the last five decades. Beginning in the 1930s, socialist governments-imposed policies of nationalization and control over key sectors such as copper production and other industries such as banking, finance, and textiles.

Under August Pinochet's dictatorship, the country implemented a series of neoliberal reforms in 1973, including trade liberalization, financial liberalization, and privatization. These changes made it possible for Chile to attract FDI, which was critical to the country's economic development. This research will look at the effects of FDI and copper price on the Chilean economy, using GDP to measure economic growth. The study will employ time-series econometric techniques such as unit root tests, and autoregressive distributed lag model. The study's data will be gathered from 1980 to 2019, spanning a period of significant change in Chile's political and economic policies. The findings of this study will shed light on the relationship between FDI, copper price, and Chilean economic growth. This study also aims to contribute to the broad knowledge of the impact of FDI on the Chilean economy and copper sector.

Keywords: Chile, Neo-liberalism, FDI, Copper, GDP, MNE, NRC, DD.

ÖZ

Bu tez, doğrudan yabancı yatırımın (FDI) Şili'nin bakır endüstrisi üzerindeki etkilerini incelemeyi amaçlamaktadır. Bakır üretimi ve ihracatı küresel ölçekte Şili'de hakimdir ve inşaat, imalat, otomotiv ve telekomünikasyon gibi sektörlerdeki kritik rolü nedeniyle bakır talebi artmaktadır. Şili, son 50 yılda önemli siyasi ve ekonomik dönüşümler yaşadı. 1930'lardan başlayarak, sosyalist hükümetler, bakır fiyatı gibi kilit sektörler ve bankacılık, finans ve tekstil gibi diğer endüstriler üzerinde kamulaştırma ve kontrol politikaları dayattı. Ağustos Pinochet'nin diktatörlüğü altında ülke, 1973'te ticaretin serbestleştirilmesi, finansal serbestleşme ve özelleştirme dahil olmak üzere bir dizi neoliberal reform gerçekleştirdi. Bu değişiklikler, Şili'nin ülkenin ekonomik kalkınması için kritik olan DYY'yi çekmesini mümkün kıldı. Bu araştırma, ekonomik büyümeyi ölçmek için GSYİH'yı kullanarak, DYY ve bakır fiyatının Şili ekonomisi üzerindeki etkilerine bakacaktır. Çalışmada birim kök testleri, eşbütünleşme testleri ve hata düzeltme modelleri gibi zaman serisi ekonometrik teknikler kullanılacaktır. Çalışmanın verileri, Şili'nin siyasi ve ekonomik politikalarında önemli değişimlerin yaşandığı bir dönemi kapsayan 1980'den 2019'a kadar toplanacak. Bu çalışmanın bulguları doğrudan yabancı yatırım, bakır fiyatı ve Şili ekonomik büyümesi arasındaki ilişkiye ışık tutacaktır. Bu çalışma ayrıca DYY'nin Şili ekonomisi ve bakır sektörü üzerindeki etkisine ilişkin geniş bilgiye katkıda bulunmayı amaçlamaktadır.

Anahtar Kelimeler: Şili, Neo-liberalizm, DYY, Bakır, GSYİH

DEDICATION

To My Beloved Parents

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I want to express my gratitude to my supervisor, Assoc. Prof. Dr. Salih Katircioglu, for all his help and direction during the preparation of my research.

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Chapter 1

INTRODUCTION

1.1 Background

The world's top producer and exporter of copper is Chile with a production of 3.243.960.000 kgs in 2019 (World Integrated Trade Solution, 2019). The country has been dependent on copper mining for decades (Meller & Simpasa 2011). Being an export-focused country, Chile has developed an export diversification strategy by investing in other more labor-intensive export sectors such as manufacturing and servicing to depend less on copper. However, Chile's export basket is still highly concentrated in copper products (Salinas, 2021).

In this context, Kondo (2002) identifies some factors to consider when assessing the impact of copper prices on a country's development. The first question is whether capital inflows contribute to long-term development in host countries. Indeed, the flow of capital, technology, and information has increased in recent years as a result of globalization. According to Chowdhury and Mavrotas (2005), Foreign Direct Investment (FDI) plays a dominant role in host countries because it is a source of capital that should not be overlooked and is often correlated with an increase in jobs and technological transfers, and it accelerates the growth of the economy in host countries. In fact, the FDI allocated to Chile rose from an average of $1,2 Billion in the period between 1990-1996 to an average of $5,5 in the period between 1996-2014 Ramirez (2017).

Secondly, the government's role in putting in place strategies that will allow the country to benefit from FDI in the mining sector. It is crucial for the government to put policies in place that will maximize the benefits of natural resources. According to an OECD report, Chile's economic environment has improved since the 1970s as a result of the country's implementation of several economic liberal policies, such as the Codes of Liberalization of Capital Movements (CLCM) and the Current Invisible Operation (CLCIO), both of which have played an important role in attracting foreign investors. According to Miguel, Lufin, and Soto (2021), the Chilean government's legal framework for FDI in mining enabled the country to allocate 29% of FDI to the mining sector between 1974 and 1989. From 1990 to 1995, it increased to 56% of total FDI to the mining sector, owing primarily to the restoration of democracy.

The third area is concerned with the contribution of multinational corporations. Aside from significant economies of scale, the mining sector necessitates a significant amount of capital, appropriate technology, and suitable human resources. (2011) (Meller & Simpasa). As a result, the mining sector is dominated by large enterprises from developed countries, which have the capital resources to invest in such activities. These multinational corporations can help host countries by developing solutions to environmental and social problems that may arise.

There is an anecdote that arises from natural resource-rich countries, the Natural Resources Curse (Kumral & Maranon, 2021). Van der Ploeg and Arezko (2007) cite the phenomenon known as the "natural resource curse," in which the economy of resource-rich countries underperformed those of resource-poor countries. The Dutch Disease is an important factor to consider in the natural resource curse theory (Kumral & Maranon, 2021). When a new sector, frequently a natural resource sector, develops

and overtakes formerly dominant industries like manufacturing or agriculture, DD occurs Davis (1995). The discovery and growth of oil and gas production in the North Sea, which led to a decline in industrial output, is thought to be the cause of the Dutch Disease phenomena, which was first seen in the Netherlands in the 1970s. This notion has since been confirmed in other nations. Some nations, nevertheless, have avoided contracting the Dutch disease.

Chile amongst other countries have been heavily dependent on natural resources, most importantly the export of mining which represent an average of 50.8% of the total export from 2003 to 2016 and contributed on average of 12,7% of the Gross Domestic Product (GDP) from 2003- 2015 Fernandez (2021). In terms of fiscal revenue, the taxes on mining contributed 17,5% on average of the total fiscal revenue from the period 2003 to 2015 Fernandez (2021).

1.2 Statement of the Problem

The "Chicago Boys," a prominent group of economists led by Milton Friedman, helped Chilean dictator Augusto Pinochet implement a free-market economic strategy that is now known as the "free-market miracle" or "The Miracle of Chile" (Lebdioui, 2021). General Pinochet, with the help of the Chicago Boys, repealed the minimum wage, trade union negotiating power, wealth, and income taxes on businesses, and proceeded through the privatization of 212 state-owned businesses and 66 state-owned banks, which were auctioned off at a 40% discount from book value (Leither, 2006). The nation experienced social and financial difficulties as a result of these profound transformations. According to Finn (1998), it is illogical to consider a laissez-faire economy successful if copper, the economy's fundamental driver, is still regulated by the government.

According to Lebdioui (2019), rather than the miracle of the free market, Chile's export diversification success was really the consequence of four decades of carefully thought-out government intervention. Despite this, those who support the free market still do so since it is one of the myths that has persisted the longest in the history of contemporary economic growth.

The GDP has been one of the conventional stand-ins for economic growth. Results from theoretical and applied studies suggest that export and GDP may be related. The ideas of export-led development and growth-led growth have long been studied in the literature. It has been established that there is a causal relationship between the two even if the direction of the connection has been disputed (Hsiao & Hsiao, 2006; Cuadros et al., 2004; Liu et al., 2002). For Chile, Siliverstovs and Herzer (2006) in particular, offered support for the export-led development hypothesis. In recent years, Chile's GDP has benefited significantly from copper mining and exports. In general, mining accounts for 15% of Chile's GDP. Over the previous 20 years, copper mining has averaged 10% of Chile's GDP.

On the other hand, the website Tradingeconomics reports that in 2021, Chile's exports of goods and services accounted for 31.89% of its total GDP, with copper exports accounting for 25% of all exports. Therefore, copper exports account for 8% of Chile's GDP. Considering the correlation between export and GDP, the contribution of copper to Chile's GDP may indicate a link between copper and GDP. More thorough studies have also confirmed the connection between copper and economic growth (Namahoro et al., 2022; Sachs & Warner, 1995).

The link between copper and GDP might also be studied from a different perspective because the economic cycle has been found to respond to changes in copper prices (Medina & Soto, 2007). Additionally, Stock and Watson (2003) assert that the business cycle is driven by variations in total production. The authors emphasize the tight relationship between real GDP and the business cycle by using real GDP as a useful proxy for the full business cycle. Given that the association between copper price and business cycle has been documented in the literature, as was indicated previously, the business cycle might thus serve as an intermediary in another potential link between copper and GDP.

Additionally, from a theoretical standpoint, the relationship between these two variables seems self-evident because FDI is a dynamic component of GDP. However, some researchers have claimed a unidirectional or trivial connection between the variables, despite the fact that both conventional economic growth theories and a number of empirical investigations support a bidirectional relationship (Ferrer and Zermeno, 2015; Chowdhury and Mavrotas, 2006; Hansen and Rand, 2006; Li and Liu, 2005). As a result, considering the link between FDI and GDP might provide us significant insight into the dynamic nature of FDI and GDP in the instance of Chile, given the inconsistent results in the literature.

1.3 Aim of the Thesis

The dynamic link between many macroeconomic factors and the dependent variable, economic growth, is the main emphasis of this study. With FDI, exchange rate, copper price, and GDP serving as proxies for economic growth and independent variables, respectively, we achieve this goal. This dissertation attempts to advance knowledge of the roles that foreign direct investment and copper prices play in the economic growth

of Chile's economy. More particularly, the following research topics are addressed in this paper:

1. How does FDI impact the economic development of Chile?
2. How production of copper products contributes to the GDP of Chile?
3. In what way do the exchange rate policies of Chile benefit the economy?

This paper's conceptual contribution is to deepen our comprehension of the roles that FDI, the growth of copper mining, and the exchange rate played in Chile's economic development.

1.4 Research Methodology

This study uses empirical data to examine how the price of copper and other macroeconomic factors affected Chile's economy from 1980 to 2019. To reveal the stochastic dynamics of each variable, their potential long-run, and the causal link between them, the inquiry will be undertaken utilizing a variety of time-series analytic approaches. The World Bank, the World Integrated Trade Solution, the International Monetary Funds, as well as historical data from the Chilean Copper Commission (COHILCO), and books, will all provide the data for this study.

1.5 Thesis Structure

There are five chapters in the thesis. The introduction will be covered in the first chapter. The literature study and earlier research on the topic will be covered in the second chapter. The third chapter will discuss the methods used, the fourth chapter will showcase the results of the statistical analysis, and the conclusion and recommendations are covered in the fifth chapter.

Chapter 2

LITERATURE REVIEW

In their analysis, Ahn and Park (2022) defined three primary types of foreign direct investment (FDI). The first kind of foreign direct investment (FDI) is market seeking, which is also often referred to as horizontal FDI investment. The primary goal of this type of investment is to grab a market in a different country. The second kind of foreign direct investment (FDI) is known as efficiency-seeking FDI. In this type of FDI, foreign investments are made primarily because of advantageous geographic circumstances, productive human resources, and solid governance. The third kind of foreign direct investment is called resource searching. The home country may be lacking in particular resources, such as cheap labor costs, raw materials, or natural resources; as a result, investors may prefer to invest their capital in other countries.

One of the reasons that Chile has been able to reap the benefits of foreign direct investment (FDI) is because of the Decree Law 600, which was put into effect in 1974 and was meant to manage the admission, investment, and remittance of foreign money (Finckenstein, 2013). This decree was very appealing to foreign investors because it allowed them to return all their capital gains to their home countries and gave them access to the banking system, which enabled them to buy foreign currency at market exchange rates or use US Dollar accounts and pay fixed income taxes. Foreign investors found this decree to be very appealing.

In his study, Ffrench-Davis (2015) looked at the several waves of foreign direct investment (FDI) that hit Chile between 1973 and 2013, and he separated them into three distinct time periods. A military revolution that took place in September 1973 and was engineered by Augusto Pinochet marked the beginning of the first phase that lasted from 1973 to 1981. During this time period, there was a significant increase in the privatization of various production methods as well as the liberalization of several markets and industries, such as imports and the financial market. The primary objective of the administration of Pinochet was to bring under control macroeconomic problems such as hyperinflation and the large fiscal imbalance that they had inherited from the government that came before them. The primary exporter of copper, CODELCO, had a rise in its earnings from the sale of copper in 1974 as a result of a boom in the copper market. This gain in revenue was completely used for government spending.

In 1975, the financial market in Chile was completely liberalized, the government was in the process of adopting free trade policies, and the country's taxes on revenues had significantly lowered. Chile became very attractive and started to receive a considerable amount of FDI (Samuel, 2016). This was primarily due to passive public policies which allowed inflows on capital and appreciated the exchange rate and increased domestic demand. By 1977, there was an excess of capital in the international market and investors were looking for new destinations. At the same time, Chile was going through a significant period of underutilization of production methods, which led to business owners not being able to produce at their full potential and, consequently, not earning sufficient profits to enable them to grow their operations.

The recent financial changes in Chile caused a rise in the average real interest rate on loans taken out inside the country, which was around 38 percent. The Chilean populace noticed this increase. At that time, the vast majority of loans were considered to be of the short-term kind and were typically kept for a duration of one month. The lowering of import prices for consumer products and the local crowded-out were both made possible because of the introduction of trade liberalization and appreciation of the Chilian pesos, which had a significant impact on the attraction of foreign direct investment (FDI). Chile was hailed as an economic miracle by international financial institutions and major corporations due to the country's success in eradicating inflation, displaying a significant fiscal surplus, and achieving a high GDP Growth rate by the year 1981. Despite this, Chile fell out of balance because of the government's mistaken belief that the market would adapt and self-regulate itself. Due to the fact that they were receiving substantial help from the IMF, the Chilean authorities began to ignore the potentially detrimental effects that an unsustainable deficit may have on the private sector. The fact that private creditors and lenders were in charge of the government's external borrowing led to this predicament, which was made possible by the fact that the country had had a budget surplus in the past.

The second phase, which lasted from 1990 through 1995, was distinguished by the application of a rule that was designed to counteract cyclical trends. Following the restoration of democratic rule in 1990, the primary objective of the new government was to undo some of the damage done by the previous authoritarian regime. To this end, the government set out to restore equilibrium to the real economy by reworking the capital market, the currency exchange rate, and the monetary policies. Due to the availability of foreign capital, the government did implement policies that moderate

short-term capital inflows while simultaneously encouraging long-term capital inflows. This was accomplished by increasing the cost of short-term investment through the implementation of a requirement known as encaje. Long-term capital inflows were also encouraged (Agosin & Ffrench Davis 2001).

The goal of the finance minister and the central bank was to keep the currency exchange rate at a level that was relatively low to satisfy the demand from outside. In addition to this, they used monetary sterilization in their efforts to keep domestic demand in line with potential GDP. The administration instituted three more critical procedures in order to maintain control over the incoming financial resources. They adopted a new fiscal policy, which included the imposition of extra taxes and the maintenance of stable copper income; this resulted in a rise in public expenditure and prevented the value of the currency from gaining. The Chilean government made the decision to increase banking regulation in 1982 in an effort to avoid the financial crisis that year. The adopted measures included the right to halt banking operations and restrictions on dividend payments by institutions that finance banks. Asset monitoring, limits on bank lending to affiliated companies, the implementation of automatic mechanisms of bank equity adjustment when the market value of equity falls below the limits required by regulators, and the implementation of automatic mechanisms of bank equity adjustment were also included in the measures. The authorities were keeping a close check on overall demand to ensure that it was in line with the capabilities of production so that they could avoid an imbalance.

After the financial crisis that hit the world in 2008, economic activity in Chile dropped significantly during the third phase, which lasted from 2008 through 2013. To

compensate for the adverse effects of the external shocks, the government enacted robust counter-cyclical fiscal measures. The government raised its spending by 17%, some taxes were dropped, and the interest rate was lowered by the central bank. However, these policies had to be implemented concurrently with a procyclical outflow of capital from Chile to other nations, notably the private social security corporations; this outflow of capital was equal to ten percent of the country's gross domestic product in 2009 (Wray, 2019).

When we begin our examination of nations that are abundant in natural resources, we find that the most current research supports two distinct schools of thinking. According to Elheddad (2016), natural resources may be a curse or a blessing depending on the structures that a nation has in place to profit from these resources. Natural resources can be a curse if the country does not have the structures in place to benefit from these resources. According to the findings of Asiedu's (2013) research, inflows of foreign capital play a significant role in the economic growth of the host country. These inflows contribute not only to the creation of new jobs but also to the transfer of new knowledge and technology, as well as to the enhancement of the country's ability to compete.

On the other hand, several studies have come to the opposite conclusion, and they have shown that nations that are very reliant on natural resources have a tendency to produce an imbalance in development and do not result in a positive spillover of foreign direct investment (FDI) (Asiedu, 2013; Poelhekke & Van der Ploeg, 2010, 2013). When compared to industries that do not include resources, this indicates that the resource sectors attract the majority of the investment. In addition, Poelhekke and

Van der Ploeg (2010) state that natural resources have very little spillover effects on the non-resource sector on the side of the host country. This is because the process relies less on local subcontractors and suppliers, which is the reason for the lack of spillover effects. The extraction of natural resources is often carried out by multinational corporations based in a foreign country, which bring both their human and financial capital with them.

Academics have been debating on the benefits of natural resources in terms of economic development for a considerable amount of time now. According to Sachs and Waren's (1997) research, having an abundance of natural resources is more of a burden than a boom. This is due to the fact that resource-rich nations usually do worse than those that do not have access to such resources and that natural resources have the potential to stimulate rent-seeking activities by diverting resources such as human, physical, and financial capital away from efforts that promote economic development. An oversupply of natural resources leads to an experience identified as "Dutch Disease," in which the resource sectors see tremendous growth while the balance of the activities involving marketable commodities suffers from a decline in their level of competitiveness (De Gregorio, 2009).

According to Arezki and der Ploeg (2007), there is a negative association between the abundance of natural resources in a country and the degree to which its economy is open to the participation of international business. They came to the conclusion that the more open the economy was, the less probable it was that natural resources would have a negative influence on economic development. According to Mehlum, Moene, and Torvik (2005), there is a link between the availability of natural resources and the

quality of institutions in terms of economic development. They also found that this association was significant. It was discovered that natural resources are not to blame for the natural resource curse; rather, dysfunctional institutions are to blame for the curse. As a consequence of this, countries that have good institutions have a tendency to grow more rapidly.

The currency exchange rate is yet another crucial factor that has a substantial impact on the total amount of FDI that comes into a country. Academics are split on the best approach to take with currency exchange rates to increase foreign direct investment (FDI). According to De Vita and Lawler (2004), for a country to attract foreign direct investment (FDI), the government should implement exchange rate policies that favor the undervaluation of the country's currency. After doing their research, they concluded that nations with lower exchange rates attract foreign direct investment (FDI) because it lowers the unit cost of the production elements and enables investors to generate sizeable profits, particularly in industries that are oriented toward export. This is particularly true in industries that are focused on producing goods that are then sold on international markets. On the other hand, Cypher (2014) suggests that for nations to attract foreign direct investment (FDI), they should implement policies that promote an appreciation of the local currency. This is because an appreciation of the local currency increases the value of earnings that are brought back to the country of origin in a currency other than the local currency.

Between the years 1930 and 1960, the only kind of foreign direct investment (FDI) that Chile received was in the mining industry, particularly the export of copper, which was responsible for 80% of the country's Gross Domestic Product at the time (GDP).

During this period, Chile did not have any other industries that were successful in attracting foreign direct investment (FDI) (Roble, 2010). Copper production was managed and supervised by the American mining firms Kennecott Guggenheim Exploration Co. and Anaconda, both of which have their headquarters in the United States (Roble 2010). In the late 1960s, in order for the government to have a larger degree of control over the mining sector, it made the decision to buy 51% of the mining operations that were held by Kennecott as well as 25% of those that were controlled by Anaconda. As a consequence of this advancement, the government was in a position to exercise a greater degree of control over the mining sector. The completion of both purchases went off without a hitch and with flying colors. (Louis, 2013).

According to Bravo-Ortega and De Gregorio (2005), the amount of human capital that is readily accessible is another factor that determines whether the natural resource is a gift or a burden. The results of their investigation led them to the conclusion that industries connected to natural resources tend to take most of the human capital from other industries that have the potential to contribute to development. This conclusion was reached as a direct result of the findings of their investigation. This was the verdict that they arrived at as a direct consequence of the facts that were uncovered over the course of their inquiry. However, nations that have developed their human capital are in a better position to deal with the adverse impact that having an abundance of natural resources has on economic development. This is because human capital allows nations to adapt and thrive in the face of adversity. This is because countries with a better level of living are more likely to possess competent people capital. Recent research has shown that nations that are too reliant on their natural resources have a larger chance of being negatively affected by a phenomenon known as the "natural resource curse."

According to this, the nations that are the most dependent on natural resources would be the ones to suffer the most as a direct consequence of Cerny and Filer's work (2006).

Chapter 3

DATA AND METHODOLOGY

3.1 Data Description

Our study covers the years 1980 through 2019, and the data used to support it comes from the official website of the World Bank, the Chilean Copper Commission (COHILCO), and the International Monetary Fund (IMF). These are yearly statistics, and they were retrieved from the site for use in our work. The Gross Domestic Product (GDP), the Foreign Direct Investment net inflows (FDI), the Copper Price in USD, and the Real Exchange Rate are the variables that we used in the development of our thesis. However, owing to a lack of data, we were only able to locate information dating back to 1980 and after. As another proxy for financial development, we looked at the domestic credit extended by banks to the private sector as a percentage of GDP.

Gross Domestic Product, sometimes known as GDP, is a metric that is used to assess the expansion of the economy. This number reflects the aggregate value of all completed products and services produced within an economy. These particulars were obtained from the World Bank.

FDI stands for "Foreign Direct Investment" inflows expressed as a proportion of the gross domestic product. This variable is intended to indicate the total amount of inbound investments made by foreign investors in a certain country. These particulars were obtained from the World Bank.

Copper price: the annual copper price expressed in USD, using data taken from the Chilean Copper Commission (COHILCO).

Real Exchange Rate: The real effective exchange rate is the weighted average of a country's currency against an index or basket of other major currencies. This rate is also known as the real exchange rate. To get an accurate reading, we take the nominal effective exchange rate and divide it by either a price deflator or an index of expenses. The statistics were obtained from the database maintained by the IMF.

3.2 Descriptive Statistics

Table 1: Descriptive Statistics

	lnGDP	lnFDI	lnCOPP	lnEXC
Mean	25.51	1.34	5.3	4.64
Standard Deviation	0.56	0.85	0.41	0.19
Minimum	24.60	-0.92	4.71	4.45
Maximum	26.29	2.46	5.31	5.27
Jarque-Bera	3.23	5.30	2.63	36.27
Probability	0.2	0.07	0.27	0.00

Note: GDP Stands for Gross Domestic Product constant (2015 US$); FDI foreign direct investment net inflows (%of GDP); COPP stands for copper price; EXC stands for real exchange rate index (2010 = 100)

The descriptive statistics table, shown above, demonstrates that the logarithmic form of the variables in this research has a mean of 25.51 for GDP, 1.34 for FDI, 5.3 for COPP, and 4.64 for EXC. Similarly, the standard deviation for GDP is 0.56, 0.85 for FDI, 0.41 for COPP, and 0.19 for EXC. The standard deviation quantifies how spread out the data is around the mean. The standard deviation of the variables in the research is quite distant from the mean, hence the data are spread out.

The Jarque-Bera test, which considers both skewness and kurtosis, determines if the data are normally distributed. The null hypothesis presupposes a normal distribution, whereas the alternative hypothesis does not. In this model, the p-values for the Jarque-Bera test are 0.20 for GDP, 0.07 for FDI, 0.27 for COPP, and 0.00 for EXC. As a result, we fail to reject the null hypothesis and conclude that the variables in this research are normally distributed, with the exception of the exchange rate, for which we discovered enough evidence to reject the null hypothesis and establish that it is not normally distributed.

3.3 Methodology

In this investigation, we investigated the long-term and short-term relationships between the variables by using a framework known as the autoregressive distributed lag model, or ARDL for short. In order to achieve this goal, we began by using a number of different unit root approaches in order to determine the level of integration for each variable. After that, we applied the ARDL technique since the outcomes of our unit root test suggested that we should.

GDP refers to Gross Domestic Product and is expressed in constant 2015 US dollars. FDI is for foreign direct investment net inflows and is expressed as a percentage of GDP. COPP is an abbreviation for copper price. The abbreviation EXC refers to the actual exchange rate index. 2010 was set at 100. Logarithmic forms are used to express each and every one of these variables.

3.4 Unit Root Test

The unit root test is essential to choose the most appropriate methodology for the investigation. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests, in addition to the Kwiatkowski et al. Unit root test, are now among the most

often used unit root tests (KPSS). We use a test called a unit root test to verify whether the variables are stationary. This is important since false regressions are the consequence of using variables that aren't stable. As a direct result of the research conducted by Dickey and Fuller, the ADF test was established (1979). The models are defined in three different ways: first, without drift or trend; second, with drift but without trend; and third, with both drift and trend. The ADF hypothesis test is shown by the following two hypotheses: H_0: the series has a unit root and H_1: the series is stationary.

The PP test, which is comparable to the ADF test, was created by Phillips and Perron in the year 1988. On the other hand, it may be used to rectify autocorrelation as well as heteroscedasticity in mistakes. The testing of the PP hypothesis is shown by the following two hypotheses: H_0: the series has a unit root and H_1: the series is stationary. On the other hand, Kwiatkowski and colleagues created what is known as the KPSS (1992). In contrast to the ADF and PP tests, this test serves the purpose of establishing whether the subject is stationary. In order to demonstrate how the KPSS tests hypotheses, we will use the following two examples: H_0: the series is stationary and H_1: the series is non-stationary.

3.5 Autoregressive Distributed Lag (ARDL)

In regression models that incorporate non-stationary I(1) variables, it is a technique that is used to estimate short-run and long-run elasticities. Because it was discovered in the early cointegration literature that conventional statistical inference cannot be relied upon in the context of these kinds of models, this approach was created as a response to those discoveries. The ARDL technique is quite similar to the VAR model in general since it also makes use of a vector-autoregressive framework. The ARDL

model's most notable characteristic is that it enables the parameters to be represented as coefficients on mean-zero stationary regressors. This produces parameters that have jointly normal asymptotic distributions and enable them to be estimated via the use of conventional hypothesis tests. As a consequence of this, rewriting the model in such a way that all parameters show on stationary regressors at the same time is not conceivable.

This suggests that linear combinations of the parameter estimates converge at a higher pace and have non-normal distributions as a result of the information presented here. When it comes to justifying the use of the ARDL model in our research, one of the most important considerations will be whether or not our variables are cointegrated with a certain cointegrating connection. This will make it possible to apply conventional hypothesis testing throughout the process of estimate, which will, in turn, make it possible for us to arrive at reliable conclusions about the connection between the variables that are being investigated.

The following is the equation that will be used for the ARDL model that we have developed:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \beta_1 X_{1t-1} + \beta_2 X_{2t-1} + ... + \beta_p X_{pt-1} + \gamma_1 D_{1t-1} + \gamma_2 D_{2t-1} + ... + \gamma_q D_{qt-1} + \epsilon_t$$

In this equation, Yt is the dependent variable, X_{1t-1}, X_{2t-1}, ..., Xpt-1 are the independent variables, D_{1t-1}, D_{2t-1}, ..., D_{qt-1} are the distributed lags of the independent variables, α_0 is the intercept, α_1, β_1, β_2, ..., β_p, γ_1, γ_2, ..., γq are the parameters to be estimated, and ϵt is the error term.

The letter 'p' in the equation reflects the number of lags for the independent variables (AR part) and the letter 'q' represents the number of lags for the dependent variables (DL part).

The F-bound test is a statistical test that is used to estimate the best amount of time for the lag period in the ARDL model. It evaluates the F-statistics of a number of various lag length models and picks the model with the greatest F-statistic out of the bunch. The F-bound test is predicated on two hypotheses: the first, known as the null hypothesis, states that the optimum lag length equals zero, while the second hypothesis states that the optimal lag length exceeds zero. The F-bound test statistic is determined by the following calculation:

F = (RSS(0) - RSS (p))/(p*RSS (p)/(T-p-1))

$$\frac{\mathrm{RSS}(0) - \mathrm{RSS}(\mathrm{p})}{\frac{(\mathrm{p}(\mathrm{R}(\mathrm{p}))}{(\mathrm{T} - \mathrm{p} - 1)}}$$

Where:

- The residual sum of squares for the model with zero lags is denoted by the symbol RSS (0).
- The residual sum of squares for the model with p lags is denoted by the symbol RSS (p).
- T represents the sample size
- p represents the number of lags.

We will infer that the optimum lag length is larger than zero and reject the null hypothesis if the estimated F-value is higher than the critical value derived from the F-distribution table with k and T-p-1 degrees of freedom.

The F-test is a statistical test that determines whether or not a given combination of model parameters should be considered significant. The F-test is used within the

framework of ARDL to examine the importance of the short-run and long-run parameters in conjunction with one another. The following is how you would compute the test statistic for the F-test:

$$\frac{\frac{\text{SSRR} - \text{SSRU}}{(\text{h} - \text{f})}}{\frac{\text{SSRU}}{(\text{T} - \text{h})}}$$

Where:

- The residual sum of squares for the model with restrictions on the parameters is SSRR
- The residual sum of squares for the model with unrestrictions or unrestricted on the parameters is SSRU
- h represents the number of parameters in the unconstricted model
- f represents the number of constraints placed on the parameters.
- T represents the sample size.

If the calculated F-value is higher than the critical value found in the F-distribution table with (h-f) and (T-h) degrees of freedom, then we reject the null hypothesis and conclude that the restriction that was imposed on the parameters was not valid. This leads us to conclude that the restriction should not have been imposed. This suggests that the characteristics have significance when considered together.

Chapter 4

RESULTS AND ANALYSES

4.1 Unit Root Tests

To determine whether or not the variables in the model are stationary, the unit root should be carried out. For non-stationary data, the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are run, and the Kwiatkowski et al. (KPSS) test is employed for confirmation. The test for the unit root is carried out using the level and the first difference.

Table 2: ADF, PP, KPSS Tests

At level	LnGDP	lag	LnFDI	lag	LnCOPP	lag	LnEXC	lag
τT (ADF)	-1.33	(0)	-2.32	(0)	-2.34	(8)	-5.20***	(8)
τμ (ADF	-0.36	(0)	-2.32	(0)	-1.40	(1)	-4.46***	(2)
τ (ADF)	2.79	(1)	-0.64	(0)	-0.06	(1)	-1.36*	(0)
τT (PP)	-1.87	(3)	-2.02	(6)	-2.50	(1)	-2.10	(3)
τμ (PP)	-0.40	(3)	-2.20	(9)	-1.58	(1)	-2.44	(3)
τ(PP)	4.99	(3)	-0.43	(10)	0.06	(1)	-1.08	(3)
τT (KPSS)	0.15*	(4)	0.19**	(3)	0.10	(0)	0.12*	(4)
τμ(KPSS)	0.75***	(5)	0.55**	(5)	0.42*	(0)	0.38*	(4)
1st diff.	ΔLnGDP	lag	ΔLnFDI	lag	ΔLnCOPP	lag	ΔLnEXC	lag
τT (ADF)	-4.02**	(0)	-5.56***	(0)	-4.94***	(1)	-5.47***	(0)
τμ (ADF)	-4.08**	(0)	-5.63***	(0)	-5.05***	(1)	-4.92***	(0)
τ (ADF)	-1.14***	(2)	-5.67***	(0)	-5.09***	(1)	-4.66***	(0)
τT (PP)	-4.12**	(1)	-8.79***	(23)	-4.88***	(1)	-5.17***	(3)
τμ(PP)	-4.17***	(1)	-6.22***	(13)	-5.20***	(1)	-5.52***	(4)
τ (PP)	-2.68***	(2)	-6.06***	(11)	-5.05***	(1)	-4.97***	(4)
τT (KPSS)	0.135*	(3)	0.50***	(38)	0.13	(1)	0.08	(3)

τμ (KPSS)	0.141	(3)	0.33	(11)	0.09	(1)	0.18	(3)

Note: ADF represents the Augmented Dickey-Fuller unit root test; PP represents the Phillips- Perron unit root test; KPSS represents the Kwiatkowski et al. τT indicates the model with drift and trend; τμ indicates the model with drift but without trend; and τ indicates the model without drift and trend. The figures within the brackets are the lag lengths; *, **,*** in the model represent 1 percent level, 5 percent level, and 10 percent level of significance accordingly.

According to the findings of the ADF and PP tests, we are unable to reject the null hypothesis at level form for the LnGDP, this is the case when the significance level is set at 5%. As a result, the existence of unit roots could not be ruled out. However, in the case of the KPSS test with an intercept and with a deterministic trend and intercept at 1% and 10%, respectively, we find that the null hypothesis of stationarity cannot be accepted. At first difference, we reject the null hypothesis for the ADF and the PP (model with a trend, with a drift, and model with a trend and a drift). Therefore, we conclude that the model is stationary at 5% and 10% significance level. On the other hand, we fail to reject the null hypothesis on the KPSS and conclude that the variable is non-stationary.

For the LnFDI, the results of the ADF and PP at level form show the presence of a unit root in the variable, hence we failed to reject the null hypothesis. This conclusion is valid in all three models. As for the PP tests, our findings show that the variable is stationary on the model with a drift ad a trend and on the model with a constant. On the other hand, the ADF and the PP tests after proceeding with a first difference show that the variables are stationary on all three models. The KPSS test results show that the variable is stationary only on the model with a drift and a trend.

The results of the ADF and the PP tests on LnCOPP show the presence of unit roots at level form on all three models. The KPSS results show that the variable is stationary

on the model with a constant and a trend and non-stationary on the model with a constant. On the first difference, the results of the ADF and PP tests show that the variables are stationary and 10% level of significance in all three models. As for the KPSS, the results show that the variables are non-stationary at first difference.

The findings of the ADF test on LnEXC show that the variables are stationary at level form at 10% level of significance for the model with the constant and a trend and the model with a trend. And significant at 5% on the model without a constant and a trend. The PP test results indicate the presence of unit roots in the variable on all three models. The results of the KPSS tests indicate that the variables are non-stationary in their respective models. After proceeding with the first difference, the results of the ADF and PP tests show that the variables are stationary at 10% level on all three models. And the results of the KPSS results confirm that the variables are stationary on both the model with a constant and a trend and the model with a constant.

Since we cannot draw any conclusions from these findings, we will go to the next stage of the time series analysis, which is the ARDL.

4.2 Autoregressive Distributed Lag Model

We use ARDL in this work to establish the causal nexus between an endogenous variable of real Gross Domestic Product (LnGDP) and a collection of exogenous regressors. The endogenous variable is the real Gross Domestic Product. The Akaike Information Criterion (AIC) is the model selection process that is being used, and the number of models being examined is 2500. The ARDL model has been determined to be the most successful model (2, 4, 4, 4). The endogenous variables that are utilized in the model are the natural logarithms of foreign direct investment (LnFDI), the

natural logarithms of copper price (LnCOPP), and the natural logarithms of the exchange rate (LnEXC). There is a maximum of 4 lags for each of these endogenous variables. In addition, the model has a deterministic regressor denoted by the letter C. The outcomes of which are shown in the table that may be seen below:

Table 3: ADRL

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LnGDP(-1)	1.166311	0.268573	4.342629	0.0004
LnGDP(-2)	-0.229966	0.259998	-0.884493	0.3881
LnFDI	0.011515	0.009086	1.267306	0.2212
LnFDI(-1)	-0.005357	0.011136	-0.481040	0.6363
LnFDI(-2)	-0.004572	0.010236	-0.446724	0.6604
LnFDI(-3)	0.010279	0.010069	1.020843	0.3209
LnFDI(-4)	0.012731	0.010238	1.243543	0.2296
LnCOPP	0.039952	0.024932	1.602438	0.1265
LnCOPP(-1)	0.011540	0.028769	0.401110	0.6931
LnCOPP(-2)	-0.053373	0.024925	-2.141334	0.0462
LnCOPP(-3)	0.015493	0.028141	0.550543	0.5887
LnCOPP(-4)	0.007546	0.018431	0.409387	0.6871
LnEXC	0.259494	0.089435	2.901469	0.0095
LnEXC(-1)	-0.304164	0.132506	-2.295481	0.0339
LnEXC(-2)	0.054575	0.116712	0.467599	0.6457
LnEXC(-3)	-0.007962	0.077860	-0.102258	0.9197
LnEXC(-4)	0.022437	0.056263	0.398795	0.6947
C	1.404709	0.567933	2.473372	0.0235
R-squared	0.999510	Mean dependent var		25.60447
Adjusted R-squared	0.999046	S.D. dependent var		0.415494
S.E. of Regression	0.015919	Akaike info criterion		-5.135728
Sum squared residual	0.004562	Schwarz criterion		-4.343969
Log likelihood	110.4431	Hannah-Quinn criter.		-4.859383
F-statistic	215.7797	Dublin-Watson stat		2.091313
Prob(F-statistic)	0.000000			

Note: GDP Stands for Gross Domestic Product constant (2015 US$); FDI foreign direct investment net inflows (%of GDP); COPP stands for copper price; and EXC stands for real exchange rate index (2010 = 100).

The outcomes of a regression analysis carried out using the ARDL approach are shown in Table 3. In this scenario, the levels equation is a constrained model that contains a constant but no trend information. The natural logarithms of foreign direct investment (LnFDI), the natural logarithms of copper price (LnCOPP), and the natural logarithms

of exchange rate (LnEXC) are the variables that are considered to be independent in this model. On the other hand, the natural logarithms of gross domestic product (LnGDP) are the variables that are considered to be dependent in this model . For each independent variable, the coefficients, standard errors, t-statistics, and p-values are shown below. The model's constant term, C, is represented by the variable C, and the coefficient for C is 22.06764. The F-Bounds Test, which is the last column of the table, is used to test the null hypothesis that there is no level relationships between the dependent variable and the independent variables. This hypothesis states that there is no connection between the two sets of variables. The statistic that is being put to the test is known as the F-statistic, and its value is 3.862146. The threshold of significance is ten percent. When calculating the critical values for the F-statistic, the values for I(0) and I(1) are taken into consideration. The asymptotic values are shown for the case in which n is equal to 1000, whereas the finite sample values are supplied for the cases in which n is equal to 40 and 35. In addition to this, the p-values of the test statistic are shown for each of the various sample sizes. As a result of the fact that the value of the test statistic, 3.862146, is higher than the critical values for the various sample sizes and levels of significance, the null hypothesis has been rejected, and it has been determined that there is a levels relationship between the dependent variable and the independent variables.

We carried out the F-bounds test in order to evaluate whether or not the variables in question exhibited long-term co-movement. According to Table 4, taking into account the asymptotic behavior of the variables, we conclude that the null hypothesis, which states that there is no long-run connection at level, is incorrect.

Table 4: F-Bound Test

Null Hypothesis: No levels relationship				
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	3.862146	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
Actual Sample Size	36		Finite Sample: n=40	
		10%	2.592	3.454
		5%	3.1	4.088
		1%	4.31	5.544
			Finite Sample: n=35	
		10%	2.618	3.532
		5%	3.164	4.194
		1%	4.428	5.816

Note: I(0) stands for upper boundary, I(1) stands for lower boundary

The long-run relationship between the variables is shown in Table 5, and with the exception of LnEXC, all of the variables are significant at the 5% level of significance. According to the findings that are shown in this table, the connection that exists in the long term between the variables may be described as follows:

$$EC = LnGDP - (0.38LnFDI + 0.33LnCOPP + 0.38\,LnEXC + 22.06)$$

Table 5: Restricted Constant And No Trend

Levels Equation				
Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LnFDI	0.386392	0.111526	3.464589	0.0028
LnCOPP	0.332374	0.156748	2.120441	0.0482
LnEXC	0.382999	0.763932	0.501352	0.6222

C	22.06764	3.891561	5.670639	0.0000

Note: GDP Stands for Gross Domestic Product constant (2015 US$); FDI foreign direct investment net inflows (%of GDP); COPP stands for copper price; EXC stands for real exchange rate index (2010 = 100)

The outcomes of an Error Correction Model (ECM) regression that was carried out utilizing the ARDL approach are detailed in Table 6. The following are included in the table for each independent variable: coefficients, standard errors, t-statistics, and p-values. The long-run adjustment toward equilibrium is denoted by the variable CointEq(-1), and the coefficient for this variable is -0.063655. The result of R squared is 0.801339 which indicates that the independent variables explain 80.13% of the variance in the variable that is being measured (the dependent variable).

Taking into account the total number of independent variables, the adjusted R-squared value is 0.773948, which indicates that the independent factors are responsible for explaining 77.32% of the variance in the variable that is being studied (the dependent variable). The dependent variable has a mean value of 0.046855, and its standard deviation is 0.025613. As additional standards for evaluating the suitability of the model, the Akaike information criteria, the Schwarz criterion, and the Hannan-Quinn criterion are offered here. The value of the Durbin-Watson statistic, which is used as a test to determine whether or not the residuals exhibit autocorrelation, is 2.091313. Because the estimated p-value for CointEq(-1) shows that it is consistent with the t-bounds distribution, this indicates that the cointegration equation should be considered significant.

Table 6: ECM Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LnGDP(-1))	0.229966	0.154753	1.486023	0.1546
D(LnFDI)	0.011515	0.007146	1.611313	0.1245
D(LnFDI(-1))	-0.018437	0.006112	-3.016479	0.0074
D(LnFDI(-2))	-0.023010	0.006312	-3.645181	0.0019
D(LnFDI(-3))	-0.012731	0.007770	-1.638423	0.1187
D(LnCOPP)	0.039952	0.016543	2.415088	0.0266
D(LnCOPP(-1))	0.030335	0.014143	2.144882	0.0459
D(LnCOPP(-2))	-0.023039	0.015348	-1.501052	0.1507
D(LnCOPP(-3))	-0.007546	0.014188	-0.531808	0.6014
D(LnEXC)	0.259494	0.057909	4.481035	0.0003
D(LnEXC(-1))	-0.069050	0.068679	-1.005400	0.3280
D(LnEXC(-2))	-0.014476	0.047931	-0.302010	0.7661
D(LnEXC(-3))	-0.022437	0.043022	-0.521532	0.6084
CointEq(-1)*	-0.063655	0.013103	-4.858189	0.0001
R-squared	0.801339	Mean dependent var		0.046855
Adjusted R-squared	0.773948	S.D. dependent var		0.025613
S.E. of Regression	0.014399	Akaike info criterion		-5.357950
Sum squared residual	0.004562	Schwarz criterion		-4.742137
Log likelihood	119.4431	Hannah-Quinn criter.		-5.143015
Dublin-Watson stat	2.091313			
Prob(F-statistic)	0.000000			

Note: GDP Stands for Gross Domestic Product constant (2015 US$); FDI foreign direct investment net inflows (%of GDP); COPP stands for copper price; EXC stands for real exchange rate index (2010 = 100), and FIND stands for financial development

Chapter 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This section represents the summary and conclusion derived from this research paper which is to probe the impact of foreign direct investment and copper prices on the Chilean economy. Furthermore, the objective of this thesis was to find out the role of the exchange rate in Chile from 1980 to 2019 by employing econometric methods

In fact, this research paper clearly illustrates that FDI and copper prices have played a considerable role in the economic development of Chile. The econometrics results show that FDI and copper prices have a positive relationship with GDP in the short run as well as the long run. This indicates that an increase in foreign direct investment or copper prices increases the Gross Domestic Product. Being an export-led economy, Chile's economy benefits enormously from the demand for copper products on the international market. Hence when the demand for copper is high, the price of copper increases which in turn boosts the mining of copper and increases tax revenue for the Chilian government.

On the other hand, the results show that there is a relationship between the exchange rate and GDP. However, this relationship is not significant in the long run. This means that the fluctuations of in the exchange rate do not influence the GDP of Chile in the long run. Chilean monetary policy is closely tied to that of the U.S Dollar, this

factor contributes to the relationship between GDP and the exchange rate. Consequently, when the U.S. dollar appreciates, the Chilean peso depreciates, making Chilean goods more expensive for foreign buyers and thus reducing demand for Chilean exports and automatically affecting GDP.

5.2 Recommendation

The bottom line for Chilean policymakers is that the country's economy is heavily dependent on global demand for its natural resources and the value of the U.S. dollar. Therefore, to stabilize the economy and the exchange rate, policymakers should consider diversifying the country's economic base and take measures to reduce the economy's dependence on a single sector. In addition, policymakers should consider a monetary policy independent of the U.S. to mitigate the negative impact of fluctuations of the U.S. dollar on the Chilean peso and the country's economy. In addition, Chilean policymakers should keep a close eye on their country's GDP and exchange rate and adjust their policies accordingly, as the relationship between GDP and the exchange rate is not significant in the long run.

The Chilean government should invest more in non natural resource sectors to avoid the natural resource curse phenomenon. As stated previously, natural resources tend to have little spillover in other sectors as it tends to attract most of the human and financial capital. Therefore, Chile should create incentives such as tax reductions, and subsidies that will encourage investors and entrepreneurs to channel their efforts into sectors other than the natural resources sector. This will enable the country to develop these sectors, diversify its export basket and increase its competitiveness in the international market.

The mining sector is dominated by experienced multinational companies, which come in with foreign human capital, foreign subcontractors, and suppliers. The local population in the host countries lacks the necessary expertise to take advantage of copper prices. The government in Chile should implement upskilling programs together with mining companies so that the local communities can increase their knowledge and skills which will empower them to take part in the processing of copper-related products.

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