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Public-Private Partnership Program: The Chilean Case

Lessons learned in 30 years of development

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Table of Contents

List of Figures

List of Tables

1. Abstract

This thesis analyzes the Chilean Public-Private Partnerships (PPPs) program, to do so it considers a database of 181 projects built from information of the official website of the Chilean Department of Concessions, which is the special organization of the Ministry of Public Works (MOP by its name in Spanish) dedicated to run the Chilean Concession program. The database considers contracts signed between 1993 and 2023, which correspond to the entire lifecycle of the Chilean PPPs Program.

Chile was an early adapter of this type of public policy, due to the rapid growth of the country and the necessity to develop public infrastructure, therefore, it is one of the biggest PPPs programs in the world and it is supported by a complex structure of regulations and organizations that control and supports the relationship between public and private sectors. Moreover, the 30 years of development make the Chilean Case an important example from where to learn and extract helpful insights for similar programs and initiatives around the world.

The Chilean case has built a regulation where the reconcession of a project once the contract is finished has become the norm and an example of how a same project can be concessioned more than once. In fact, of the 181 projects that are part of this study, there are 29 contracts that finished and 85% of those projects were re-concessioned. The remaining projects are distributed in different phases of development and, therefore, only the active projects (those under construction, under operations, or under construction and operations, that correspond to a total of 74 projects) where considered for a statistical analysis to determine the behavior of the different variables and how they interact through time to characterize the Chilean PPPs Program. The thesis studies the different variables that mold each project and therefore the system. This thesis also analyzes the application of the PPPs program to different types of public infrastructure such as Airports, Urban and Interurban highways, Hospitals, Prisons, and water solutions among others. This is a particularity on the PPPs environments because not many programs have such an extended coverage in the different type of infrastructure sectors.

2. Introduction

Public-Private Partnerships (PPPs) are a contractual arrangement between public authorities and private entities, where both parties collaborate to finance, develop, operate, and maintain public infrastructure projects or provide public services. PPPs leverage the respective strengths of the public and private sectors, sharing risks and responsibilities, to achieve shared objectives, improve service delivery, and promote sustainable development (Hodge, Greve, & Boardman, 2010). In general terms, PPPs are a long-term contract where the public sector benefits from the private sectors experience, efficiency, and resources to develop complex infrastructure project meanwhile liberating fiscal pressure and the demanding responsibilities of maintenance. Simultaneously, the private sector can develop expensive and complex projects with the public sector support, which is a strong partnership when it becomes to financing and accessing creditors due to the risk allocation and leverage advantages that the government provides.

The overall objective of these programs is the construction of infrastructure to satisfy the public demand and be able to respond with the level of public services that the user needs. Therefore, the continuity of this bilateral and mutual benefit relation depends on their value creation, that is, the aggregation of benefits derived from these partnerships for different stakeholders (Kivleniece & Bertrand, 2012). The PPPs model for value creation on development of public infrastructure became a useful tool for governments and gained popularity in the 1990s and for more than 30 years countries have been developing, improving, and innovating to develop public infrastructure through long-term programs. But the design and objective of a PPPs program can change from one country to another, for example the United Kingdom built one of the biggest programs of the world, the Private Finance Initiative (PFI) in the 1990s, with a focus on developing infrastructure projects on Healthcare, Public Transportations, and Education. Another example is The Infrastructure Ontario Program in Canada, that has a focus on delivering hospitals, urban public infrastructure, and with a strong focus on public transportation. Meanwhile, in South America, Colombia and Brazil are other excellent examples of PPP Programs, with the 4G Highway Program to develop more than 8.000 kilometer of highway to improve connectivity in Colombia, and with several projects of public transportation

and public services like the Rio di Janeiro Light Rail Transit system and the Belo Horizonte Water Supply PPP in Brazil.

The complexity, scale, and scope of PPP programs change based on different cultural, geographical, and economic factors, but what is certain and common to all programs, and that aligns with the scope of this thesis, is the necessity to build a strong legal framework, with a clear stated policy, and develop projects aligned with the regional context. To do so, and since many major projects have a 30-year history to analyze and extract lessons and valuable insights, the study of the Chilean PPP program not only seeks to understand the system itself, but to search for improvements based on how the model design has respond to the initial objectives and specific context. Furthermore, the Chilean system can offer important insights for other models and can, at the same time, take lessons learned in other PPPs and apply them to the Chilean development if the situations apply and require such improvements.

3. Public-Private Partnership Programs (PPPs)

PPPs are a useful tool for governments, but the reason they are chosen over public provisions or other methods of infrastructure development is due to the efficiency gains they offer in certain contexts. Since private firms engage in building infrastructure projects both under public provision and PPPs, efficiency gains do not arise from private participation per se, but from different incentives under both organizational forms. These may be due to differences in risk allocation, contract design, financing, and political economy (Engel, Fischer, & Galetovic, 2020). In addition, PPPs are not only a useful instrument for the public and private sector, but there is also a significant role in the figure of the user, who is responsible not only for the use and benefit from the new infrastructure but has the power to assess the social legitimacy of the project. The social Legitimacy can be defined as the level of the social perception required for any PPP to be recognized as appropriate and desirable based on the impacted stakeholders' value objectives and concerns (Levitt, y otros, 2014). Moreover, this thesis adopts the point of view from which social legitimacy is shaped through the interaction of the public sector, private sector, and impacted stakeholder during the PPP lifecycle (Castelblanco, Guevara, Mesa, & Hartmann, 2022). In this context, on a PPP program is possible to recognize three major stakeholders, the first two

are given by the nature of the contractual agreement between public sector and Private sector, but the third one which does not participate directly in the contract but also plays an important role in PPP programs, is the impacted stakeholder which includes users and communities affected by the PPP. These three stakeholders can be related with distinct roles over the PPP lifecycle phases, since each one participates in a unique way on each of them and the roles become active or passive as the projects' life cycle phase changes. Since the role each stakeholder takes according to the project phase, and according to PPP literature, they can be classified as responsible, interested, and impacted (El-Gohary, Osman, & El-Diraby, 2006). Furthermore, the different phases of the life cycle of a PPP can be defined as the shaping phase, the implementation phase, and the operation phase (Castelblanco, Guevara, Mesa, & Hartmann, 2022).

Considering all the information above, this thesis understands and recognize a PPP as a long-term trust-based partnership between public and private parties (Delhi & Mahalingam, 2020) where building a sense of connection among the two parties and developing social skills can facilitate the connection linking stakeholders, enhance the benefit for impacted stakeholders, and lead to a better development of the project and better outcomes of the program itself.

3.1.   The Chilean Model

In 1991 the Chilean public sector started to prepare and develop a legal framework to implement a new concession program, which later in 1993 will materialize with the first concession and the creation of the Chilean Public-Private Partnership Program. This initiative was born from the necessity to develop public infrastructure due to the loss of competitiveness of the national economy because of the lack of connectivity and poor public infrastructure present in the country. At the time the deficit in matter of infrastructure was valued to be more than $11.000 MM USD (Ministerio de Obras Publicas, 2003), near 15% of the GDP at the time which is a very high amount in contrast to 2015-2019 where the private investment reaches approximately the 8.% of the GDP (The Economist Intelligence Unit, 2019), with a loss because of competitiveness that at the time was estimated to be more than $1.710 million USD annually.

Infrastructure Type	Estimated Investment Required ($ million USD)
Interurban road and highways	4.250
Urban roads and highways	2.000
Water treatment	1.480
Clean water solutions	950
Public equipment	810
Ports	450
Railways	470
Irrigation and agriculture	370
Airports	100
Rainwater control	200
Total	11.080

Table 1 Estimation of Infrastructure investment required for 1995-2000 (Ministerio de Obras Publicas, 2003)

The estimation done in 1994-95 by the Ministry of Public Work (MOP by the name in Spanish) started to model a program according to the necessity of infrastructure and the previous experience the country had managing these kinds of projects. In addition, and as shown in Table 1 Estimation of Infrastructure investment required for 1995-2000 , the scope of the program was intensive on interurban and urban roads and highways, infrastructure type with which the MOP did not have great experience, moreover the Ruta 5 interurban highway, which at the time was the main highway connecting the country from north to south, was in poor conditions and experiencing a slow development, generating high cost and low benefits for the Chilean economy. (Ministerio de Obras Publicas, 2003)

Cause	Estimated annual loss ($ million USD)
Road Congestion in Santiago	475
Damage to fruit in transport	120
Time waste in highways and vehicle wear	510
Damage because of Accidents	140
Effects over Health	360
Delays on ports	105
Total	1.710

Furthermore, and as the data in Table 2 Annual loss because of low competitiveness and lack of public infrastructure exposes, the high estimated annual losses led the Chilean Government to seek for alternatives to respond rapidly and efficiently to the public necessity for infrastructure, but the high investment required was an amount not achievable to reach in a short or medium-term with only public funds. In the 1990s the Chilean economy was recovering from the economic global crisis of the 80s and some previous years of political instability. Because of this context and inspired by the models developed in the United States, France, and Mexico, it became clearer that the path to follow was PPP projects, and that the Government needed the private sector to respond and accelerate the Chilean public infrastructure development.

The Chilean proposal was made through BOT type contracts (Build-Operate-Transfer) with a pay-per-use system and in return the public sector benefit from the experience, efficiency, and resources that the private sector could offer. This scenario attracted the national and international investments from private sector, which boosted private investments to levels never seen before in the country, showing that there was big interest for the benefits and conditions the Chilean system offered.

Year	Amount of private investment ($ Million USD)	Variation (%)
1993	1.9	
1994	14.1	716.0
1995	73.1	519.0
1996	142.1	94.3
1997	233.7	64.4
1998	270.3	63.1
1999	590.4	59.4
2000	689.3	8.5
2001	647.3	-9.4
2002	493.4	-31.1

Table 3 Annual Private investment in public infrastructure, 1993-2002 (Ministerio de Obras Publicas, 2003)

The rapid growth of the investment and the high interest from the private sector in the Chilean PPP program was due to three main pillars that characterize the beginning of the Chilean model, according to the MOP these three pillars were:

a) The development of an innovative and efficient organization to respond to the government's public infrastructure necessities and requirements.

b) The implementation of a strategy to consolidate and get the proper political support to unify the public policies related to the matter.

c) Achieving a broad and cross-cutting consensus on the desirability of prompting the PPP program as a long-term development project.

These three pillars converged between 1991-1993 to enable the creation of the Public-Private Partnerships initiative in Chile. Furthermore, they were key elements to build an environment of trust among private investors and the Chilean public institutions, and even though this could be considered a subjective factor, the growth that has reach the program now days reflects the credibility instated by the public sector, and specially by the MOP, to the commitment in developing a long-term program with clear strategies, solid legal framework, and with a public investment in infrastructure that, on the first decade of the program, raised from US$ 240 million in 1990 up to US$ 636 in 2002. (Ministerio de Obras Publicas, 2003)

Like in most long-term programs, changes have been made and inspired by the cases of failures and success the Chilean PPP program has improved and strengthen the framework and the public institutions that promote, control, and regulate the initiative. From the initial proposal of pay-per-use model and BOT type contracts during the first concessions, the program has shifted and evolved to include other initiatives that model, characterize, and differentiate the Chilean Program. In this context some of the Chilean PPP program particularities are:

a) Even though road and highways represent the main scope of the program, Chile has devoted great effort and invested a big number of resources to boost other sectors and infrastructure types in compared to other programs, especially airports, prisons and recently with a new project focus on hospitals and health infrastructure. (The Economist Intelligence Unit, 2019)

b) Santiago, the Chilean capital, is the city in the world with the biggest urban highway network developed completely by PPP and with a model of toll payments. (PPIAF, 2009) This level of development was possible thanks to a long-term design done with more than 15-years anticipation of the beginning of the project's concessions, showing that the public institutions act with long-term planning and is an important factor to reduce cost and boost efficiency reducing the time required for the project implementation.

c) It has become a norm (with few exceptions) to operate the program under contract with variable-term contracts and the introduction of the Present-Value-of-Revenue (PVR) concept, which is a model of risk-sharing, meanwhile other models transfer the risk to the private sector using fixed-term contracts. This particularity complements with the fact that Chile usually mitigates risk through compensations, guarantees, and insurance policies such as currency exchange insurances and minimum income guarantees. (Vasallos, Heras-Molina, Garrido, & Gomez, 2020)

d) Due to the high number of toll urban and interurban highway concessions, it has a complex challenge to manage and control toll rates. This factor provoked in 2019 massive riots and a serious social and political outbreak in sign of unconformity with the high costs of pay-per-use rates of public services in the country.

e) It has a low rate of materialized Unsolicited Proposals, even though the mechanisms for the private sector to propose new projects and PPPs have been present from the beginning of the program, the long process and high requirements set by the system represent a filter and a major entry barrier for the unsolicited proposals to reach the tendering and execution phase.

These particularities have been shaped and developed together with a complex legal system to consolidate the program. The first set of regulations for the program was signed into law in 1991 with the Concession Act Nº19.068 which objective was to modify the existing regulations that applied to the MOP and introduce the new legal framework to regulate PPPs: (MOP, 1991)

a) Concept of Unsolicited proposal

b) Tendering process and methods for evaluation and factor to consider in the decision making

c) Concession transfer and concessionaire obligations

d) Litigation resolution system

e) Preliminary Pronouncement of the Conciliatory Commission for application of Major Sanctions

f) Consolidated text of regulations for PPPs

After this first law the first four projects of the PPP Program were concessioned, these four cases of success for the Chilean initiative where:

1) Túnel El Melón (started operating in September 1995)

2) Acceso norte Concepción tramo Puchuncaví-Los Nogales

3) Ruta 78 Santiago-San Antonio (nowadays under the name of Autopista del Sol)

4) Camino de la Madera

Out of this first set of projects, the legal framework was supported with new regulations that were born from the lessons learned in these first tendering processes and concessions, this is how the Act N° 19.252 of 1993 which had the main objective to increase the certainty and security of investors and financers of PPP projects (Cordinación de Concesiones de Obras Públicas - CCOP, 2016). Other important legislation act, under the which many of the current active concessions where developed and therefore regulated by, is the Act N°19.640 of 1996, which introduced several tax and financing regulations, within which was the concept of Total Income of the Concession (ITC by the terms in Spanish) which is a key factor in the analysis of the PVR in the context of variable-term contracts.

After 1996 and for the following 10 years, the Chilean PPP program had a stable development, in fact the official data shows that until 2004 it had a sustained growth, with a materialized investment of more than $16.000 million USD ($35.805 million UF[1]).

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[1] Unidad de Fomento (UF) in Chile is a non-circulating currency and the exchange rate between UF and the Chilean Peso (CLP) is constantly adjusted accordingly to inflation. It was created with the objective to secure against inflation long-term loans and calculate the principal and interest of international secured loans.
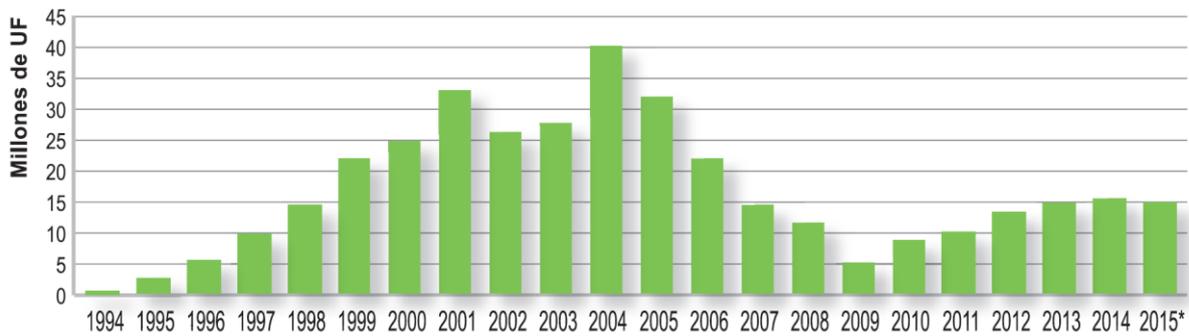
Graph 1 Materialized investments in concession, 1994-2015. According to official data - MOP

After the peak in 2004, the program started to show some weakness, this is how in 2006 three programs were stopped and the ability of the public authority to execute and deliver solid was questioned by the private sector. The concessions in discussion are the following:

1) Embalse El Bato
2) Estación Intermodal Quinta Normal
3) Grupo II de Cárceles

Even though these three concessions were ended because of specific economic problems associated with discrepancies between the original terms stated in the contract and the real situation that the privates found when executing the construction and development of the projects, there was an uncertainty in the private sector that led to a decrease in the levels of confidence in the Chilean PPP Program. Furthermore, and due to the recent problems, the public sector initiated a discussion to change the regulations and the legal framework of concession, which aggravated the situation and led the program, as shown in Graph 1, to its lowest point of investment in 2009. The previous situation concluded in 2010 with a new legislation text for concessions that represents a landmark regarding the legal framework of the Chilean PPP program. The main considerations of the Act Nº20.410 of 2010 was to increase the requirements for the concessions, especially in matter of modifications of term contracts, dispute, and litigations, and to raise the standards of the services provided by concessionaires. All this with the target to protect and safeguard the public and the state interests against the private sector (Cordinación de Concesiones de Obras Públicas - CCOP, 2016).

In this context, the main changes introduced by the Act 20.410 of 2010 to the concession system were the following:

1) Creation of the Concessions Council, chaired by the Minister of Public Works, and with an advisory role, the council is membered by one civil engineer, one administration and economic specialist, a legal science professional, and an architecture. The council is responsible for reporting on the type of infrastructure to be developed, and the concessional schemes and arrangements. The creation of this body is of great importance for the PPP program because it is the first materialized effort that gives greater institutionality to the Chilean initiative (Ibarra-Coronado, 2011).

2) Contract terms modifications is the main subject addressed in this legislation and the changes it introduced are later analyzed in this thesis. Moreover, the new legislation regulates: (MOP, 2010)

   a) Compensation for acts of authority arising, stating the hypothesis under which the concessionaire has the right to be compensated for an act of arising of the public authority.

   b) Any extra expense or investment for the maintenance of the services levels and basic standards stated in the contract will not be subject to compensation nor negotiation of contract terms.

   c) Amounts and deadlines, the public authority is empowered to request new investments that cannot exceed 15% of the project official budget. Furthermore, modifications for mutual agreements are allowed if they do not exceed 25% of the project official budget and they must be of public interest and justified by the concessionaire.

   d) Any unilateral modification proposed by the private sector that exceeds 5% of the project budget must be subject to a tendering process and the concessionaire cannot carry out the modifications or benefit from the new funds.

   e) Declaration of serious non-compliance: in case of serious non-compliance the MOP is entitled to submit a new tendering process, in case this does not apply then the concessionaire must pay a fine set by the public authority, matter that can be submitted to the

discussion of the Technical Panel and if not solved it can be treated by the Arbitral Commission.

f) Unilateral Termination of the Concession by the State, in which the President of the Republic has the authorities, after consulting the Concessions Council, to end the concession for reasons of national and public interest. To do so, the new regulation also states the method to set a proper and just compensation for the private investors. In case of unconformity, the matter can be submitted to the discussion of the Technical Panel and if not solved it can be treated by the Arbitral Commission.

g) Dispute and litigation resolution system: the most discussed modification to the legal framework because it stablishes the elimination of the Conciliation Committee and the establishment of a Technical Panel, body responsible for technical or economic matters that arise between the public and private stakeholders. The Panel is commissioned by two engineers, two lawyers, and one specialist in economic sciences. It also introduces major modifications to the Arbitral Commission and how the members are chosen (one by the public authority, one by the private concessionaire, and the third one by mutual agreement), adding a political aspect to a body that must always and under any circumstances rule according to the applicable law and give proof of such rule logic.

After 2010, there are no major legislation modification to the Chilean PPP program, and it is possible to sustain that the developed legal framework has empower the public authorities while offering opportunities and certainty to the private sector. Furthermore, a legislation that was originally created with a focus on road infrastructure has shifted and evolved to an integral body of law that regulates a wider spectrum of types of infrastructure, a more competitive market, offers certainty and tools to address possible issues that may arise in the concession process, and protects not only the public sector, but also the private sector and other passive stakeholders. With this environment the Chilean program improve on the second 10 years of development, it not only increased the investment but the quality of services and the quantity of project by year, improvements boosted by the new legal

framework and the national economy, and that are possible to perceive after 2012 (see Graph 2 and Table 4).

Graph 2 Total concessions and investment per year, 1993–2015. Source MOP.

Inversión Materializada en Concesiones como % del PIB, 1996-2015 (*)

Año	Inversión Materializada sobre PIB construcción en UF	Inversión materializada sobre PIB total en UF
1996	2,4%	0,2%
1997	4,0%	0,4%
1998	6,4%	0,5%
1999	11,9%	0,8%
2000	15,1%	0,9%
2001	19,3%	1,2%
2002	14,6%	0,9%
2003	13,7%	0,9%
2004	19,7%	1,1%
2005	14,4%	0,8%
2006	8,6%	0,5%
2007	5,1%	0,3%
2008	3,4%	0,2%
2009	1,4%	0,1%
2010	2,4%	0,2%
2011	2,6%	0,2%
2012	3,1%	0,2%
2013	3,2%	0,2%
2014	3,3%	0,3%
2015	5,1%	0,4%

(*) Se utiliza empalme publicado por el Banco Central, basado en año de referencia 2008.
Elaboración propia en base a cifras del MOP y Banco Central.

Table 4 Materialized investment in Concessions as % of the GDP, 1996-2015

To conclude this chapter, it is important to mention that no general data analysis of the whole program was found on an academic level, there are periodical reports published by the MOP and there are some specific studies (most of them included in the references of this study) but with a limited

scope of the Chilean PPP program, therefore they do not provide a detailed general perspective of the actual state of the program. Furthermore, the periodical reports provided by the MOP and the information published on the official website of the General Direction of Concessions (DGC, because of the name in Spanish) was the main source of information due to the veracity and formal characteristic of the source.

4. Methodology

This study seeks to understand the Chilean PPP program, from its origins to the current operation and development of the program. To do so, it is necessary to build a full map of the program, understand how it works, how it's been developed over time, and how it continues to operate now days. To achieve these goals the methodology followed in this study considers three main sections, where each one of them points to understand a different aspect of this initiative. These sections are the Literature review, the Data collection, and the Statistical analysis.

4.1. Literature Review

The objectives of the first part of the methodology were to understand the concept of Public-Private Partnerships, how the concept has been developed over time, and identify the stakeholders that participate in this environment. For such objectives, it was required to conduct an initial investigation of academic and public sources to identify what has been studied in the matter of PPP Programs and to what result and conclusions other academics have been able discuss. This section considered academic papers, reports, publications from official authorities, and news report, the las two only regarding the Chilean program whereas the first two cover general PPP information, other programs around the world, and the Chilean model. The results from this section have deep impacts over the study: the first one is the references present along this document, that provide context and support to what is being discuss, and the second one was inserted in the database built on the section of Data Collection since it provided information that was not fund in the official information provided by the public body.

4.2. Data Collection

The objective of this section of the methodology was to build a database of every project that is part of the program in subject, and even though the Chilean system is committed with transparency, especially regarding the PPP program, and provides a large quantity of information through official websites, there is not a uniform format in which the information is provided. Some attempts to build standard reports and establish structured methods to share and publish information have been made, but there is still a long way ahead to arrive at a standardized and uniform system to communicate information. Regarding this issue, the main problem is older projects which are already finished concessions, or they been operating for a long-term, this problem arises from the fact that the older information is difficult to find and not always it can be available in a digital format. As a result, the data collection section covered the following sources:

I.   MOP official website: https://www.mop.gob.cl/
       Where two main sections where relevant for the study:
       - The Documentation Center
       - Projects
II.   DGC official Website: https://concesiones.mop.gob.cl/
       Where the following sections where relevant for the study:
       - Who we are
       - Concessions (divided into 5 sections: portfolio 2023-2027, Concessions under construction, Concessions in operation, Concessions in operation and under construction, and Finished concessions)
       - Private Initiatives
       - Tolls and Toll portals
       - Publications (divided into 3 sections: Trimestral reports, Public account, and Publications)
       - News

Both sources of information had a great quantity of resources available, and the greater challenge was to extract the information and build a database with a standardized format. Greater part of the information was contained in the sections Concessions, Private initiatives, and Publications, of the DGC website since it is the central institution in the Chilean PPP program.

The output of this Section was a complex database of the complete program, including information from 181 projects and that will later be explained with more details on the section Research Output.

Project ID	Included in the study	Macro Project (No name = not reconcessed)	Project Name	Initiative Type	ID_Private Iniciatives under study	# of Concessions	Concession Number	Reconcession Y/N	Project Status	Phase of Development
1	Yes	Ruta de la Madera	Camino de la Madera	Solicited Proposal	0	1	1	No	Concession Finished	100.00%
2	Yes	Ruta 78	Primera Concesion Autopista Santiago - San A	Solicited Proposal	0	1	1	No	Concession Finished	100.00%
3	Yes	Nogales Puchuncavi	Primera Concesion Camino Nogales - Puchun	Solicited Proposal	0	1	1	No	Concession Finished	100.00%
4	Yes	R5 Chillan Collipulli	Primera Concesion Ruta 5 Tramo Chillan - Col	Solicited Proposal	0	1	1	No	Concession Finished	100.00%
5	Yes	R5 Los Vilos La Serena	Primera Concesion Ruta 5 Tramo Los Vilos - L	Solicited Proposal	0	1	1	No	Concession Finished	100.00%
6	Yes	R5 Talca Chillan	Primera Concesion Ruta 5 Tramo Talca - Chill	Solicited Proposal	0	1	1	No	Concession Finished	100.00%
7	Yes	Rutas del Loa	Primera Concesion Rutas del Loa	Unsolicited Proposal	0	1	1	No	Concession Finished	No info
8	Yes	Tunel El Melon	Primera Concesion Tunel El Melon	Solicited Proposal	0	1	1	No	Concession Finished	100.00%
9	Yes	Acceso Vial SCL	Primera Concesion Acceso Vial Aeropuerto A	Unsolicited Proposal	0	1	1	No	Concession Finished	100.00%
11	Yes	Carlos Ibañez	Primera Concesion Aeropuerto Carlos Ibañez	Solicited Proposal	0	1	1	No	Concession Finished	100.00%
12	Yes	Carriel Sur	Primera Concesion Aeropuerto Carriel Sur de	Unsolicited Proposal	0	1	1	No	Concession Finished	100.00%
13	Yes	Andres Sabella	Primera Concesion Aeropuerto Cerro Moren	Unsolicited Proposal	0	1	1	No	Concession Finished	100.00%
14	Yes	Diego Aracena	Primera Concesion Aeropuerto Diego Aracen	Unsolicited Proposal	0	1	1	No	Concession Finished	100.00%
15	Yes	El Loa	Primera Concesion Aeropuerto El Loa de Cala	Unsolicited Proposal	0	1	1	No	Concession Finished	100.00%
16	Yes	El Tepual	Primera Concesion Aeropuerto El Tepual de F	Unsolicited Proposal	0	1	1	No	Concession Finished	100.00%
17	Yes	SCL	Primera Concesion Aeropuerto Internacional	No Info	0	1	1	No	Concession Finished	100.00%
18	Yes	La Florida	Primera Concesion Aerodromo La Florida de	No Info	0	1	1	No	Concession Finished	100.00%
19	Yes	Chacalluta	Primera Concesion Aeropuerto Chacalluta de	No Info	0	1	1	No	Concession Finished	100.00%
20	Yes	La Florida	Segunda Concesion Aerodromo La florida de	Solicited Proposal	0	2	2	Yes	Concession Finished	100.00%
21	Yes	Carlos Ibañez	Segunda Concesion Aeropuerto Carlos Ibañe	Solicited Proposal	0	2	2	Yes	Concession Finished	100.00%
22	Yes	Diego Aracena	Segunda Concesion Aeropuerto Diego Aracer	Solicited Proposal	0	2	2	Yes	Concession Finished	100.00%
23	Yes	El Tepual	Segunda Concesion Aeropuerto El Tepual de	Unsolicited Proposal	0	2	2	Yes	Concession Finished	100.00%
24	Yes	Diego Aracena	Tercera Concesion Aeropuerto Diego Aracen	Solicited Proposal	0	3	3	Yes	Concession Finished	100.00%
25	Yes	El Tepual	Tercera Concesion Aeropuerto El Tepual de P	Solicited Proposal	0	3	3	Yes	Concession Finished	100.00%
26	Yes		Concesion Conexión Vial Suiza - Las Rejas	Solicited Proposal	0	0	1	No	Concession Finished	
27	Yes		Concesion Corredor de Transporte Publico A	Solicited Proposal	0	0	1	No	Concession Finished	100.00%
28	Yes		Concesion Estaciones de Transbordo para Tr	Solicited Proposal	0	0	1	No	Concession Finished	100.00%
29	Yes		Estación Intermodal Quinta Normal	Solicited Proposal	0	0	1	No	Concession Finished	No info
35	Yes	Acceso Vial SCL	Segunda Concesion Acceso Vial Aeropuerto A	Solicited Proposal	0	2	2	Yes	In Construction and Op	88.97%
38	Yes	SCL	Segunda Concesion Aeropuerto Internaciona	Solicited Proposal	0	2	2	Yes	In Construction and Op	97.52%
47	Yes		Concesion Vial Puente Industrial	Solicited Proposal	0	0.1	1	No	In Construction	30.59%
50	Yes		Concesion Hospital del Salvador - Geriatrico	Solicited Proposal	0	0.1	1	No	In Construction	69.51%
58	Yes	Acceso Norte Concepció	Concesión Acceso Norte a Concepción	Solicited Proposal	0	1	1	No	In Operations	100.00%

DB_PPP CHILE | Reconcessions | Initiative Type | DB_DATA ANALYSIS | Renegotiations-Year | Re +

Figure 1 Data Collection Output: Database PPP Program Chile

4.3. Statistical analysis

Statistical analysis is a systematic process of data collection, organized, summarized, and interpreted to draw conclusions using different statistical techniques. It is an appropriate and useful tool to analyze the data collected due to the possibility to express the information contained in the database as variables of different nature (scales, ordinal or cardinal). Furthermore, te data collected represents a significant sample to submit for this type of data analysis. Moreover, this methodology has the capacity to test different hypotheses and

provide meaningful information about how the attributes of a sample interact, relate, and behave. An important consideration with applying methods of statistical analysis is that it does not provide causes, explanations, or discussion about the results, it is a number-based method that require additional interpretation and analysis of the outputs of the statistical results, therefore results can be misinterpreted, manipulated, or unverified. But due to the sources from where the data was collected, and considering, the amount of data contained in the database, it is a useful methodology to recognize patterns and correlations, it can be imitated to other similar models, it is straight forward, it can be used multiple time with different variables and on the large sample of PPPs the possibility of generalization is high. In this context, the selected methods of statistical analysis were:

a) Linear Regression

This is a method that allows to study the relation between one dependent variable and one or more independent variables. It is simple to implement and provides a simple output based on coefficients that represent the different elements of the linear equation that best represents the relationship between the variables. Based on the coefficients it is possible to determine the nature of the relationship linking the variables and how the dependent variable changes in direction and magnitude according to a change in the independent variables. It is important to consider that it is a good method for prediction and forecasting the behavior of a variable, reason for which it was selected for the study.

The database constructed for the study provides a large group of variables, from which the relationship between each other is not clearly identified, which are to reason because linear regression is a good method to study the data: large number of variables and unclear relationship among them. Moreover, there are some hypotheses to test to be able to understand how the Chilean PPP Program works at an internal level. In the previous sections, the

Chilean program was characterized, and some lessons were extracted based on the system reaction to change. These situations provide valid hypothesis to be tested, verified, or refuted through the linear regression method.

Within the benefits of the linear regression for this specific study are mainly the simplicity of the model and the interpretability of the result, valuable reasons from which to start understanding the complex Chilean PPP program.

b) One-Way ANOVA Test

This test is an important method of analysis that studies the variance, which is basically a statistical comparison of the means of two or more groups. Among the benefits and the reasons why this method was chosen for the study, is the possibility to analyze the means of two or more populations with a low Type 1 error, making it a powerful method among the statistical analysis tools. Furthermore, it was selected to be the second test applied to the variables due to its limitations with variables that do not follow a normal distribution and the necessity to check the independence of the variables.

Overall, it is a useful test to study how the means of two or more variables change, in which magnitude and direction, considering that not all the variables present conclusive results in the linear regression test, the One-Way ANOVA can give the evidence to support a different kind of relation between variables.

c) Kruskal-Wallis H Test

This third test, that also represents a third level on the data analysis, is a variation of the One-Way ANOVA test due to the possibility to apply it when one or more variables does not follow a normal distribution or when a group has an unequal variance. In other words, it is a non-parametric test that determines whether there is a significant statistical difference between medians. In this study, it has the benefit that it can be applied to ordinal variables and

interpret whether one or more groups of the sample differs significantly from the others.

As a third and last level of statistical analysis it has the importance to close a multilevel group of tests assuring that the hypotheses tested do not remain uncertain and a primary approach to understanding the Chilean initiative can be completed.

Finally, for further analysis and to show the results in a graphic format, Boxplots and Bar graphs were used in the final part of the Analysis and Results section of the thesis.

5. Research Output

The research targets the whole Chilean PPP Program, from the first concessions in 1993 until the ongoing projects and concessions in 2023, including those under-study projects for the upcoming years.

Considering this scope, to March 2023, the program has currently 181 projects, which had been divided into the following categories depending on the status of development:

a) Concession Finished
b) In Construction
c) In Construction and Operations
d) In Operations
e) In Project
f) In Study
g) Public Tender in Progress
h) Public Tender Pending

Regarding the "In Project" status, these projects correspond to the current portfolio of upcoming projects developed by the Dirección General de Concesiones (DGC) del Ministerio de Obras Publicas (MOP), which is composed of Solicited Proposals (17), Unsolicited Proposals (2), and other 10 projects of which there is no info about the initiative type.

Meanwhile, regarding the "In Study" status, these projects correspond to Private Initiatives (Unsolicited Proposals) been studied by the Chilean authorities.

According to the project status, the numbers are shown in the following table:

Status	Total Projects	% Total Projects	Official Budget (MM USD)	% Total MM USD
Concession Finished	29	16%	$ 2,453.35	6%
In Construction	17	9%	$ 4,715.10	11%
In Construction and Operations	11	6%	$ 4,131.81	10%
In Operations	48	27%	$ 9,876.36	23%
In Project	29	16%	$ 3,699.00	9%
In Study	35	19%	$ 14,932.61	35%
Public Tender in Progress	9	5%	$ 1,914.80	5%
Public Tender Pending	3	2%	$ 664.00	2%
Total	181	100%	$ 42,387.02	100%

Table 5 Chilean PPP Summary by Concession Status

It is important to underline the great number of active projects, this means those that can be classified under B) In Construction, C) In Construction and Operations, and D) In Operations. Furthermore, if those within G) Public Tender in Progress are considered it is possible to state that **the Chilean PPPs Program has a total of 85 active PPPs.**

The Chilean Program is also characterized by a wide spectrum of project types that address different industries and social-economic necessities. Therefore, the projects have also been divided and defined in the following industries:

- I. Airport Infrastructure
- II. Health Infrastructure
- III. Interurban Road Infrastructure
- IV. Prison Infrastructure
- V. Public Building and Urban Equipment
- VI. Urban Road Infrastructure
- VII. Water solutions

Project Type	Total Projects	% Total Projects	Official Budget (MM USD)	% Total MM USD
Airport Infrastructure	31	17%	$ 2,497.38	6%
Health Infrastructure	15	8%	$ 3,262.98	8%

Interurban road infrastructure	57	31%	$ 16,673.05	39%
Prison Infrastructure	8	4%	$ 263.49	1%
Public Building and Urban Equipment	39	22%	$ 5,134.52	12%
Urban road infrastructure	21	12%	$ 6,722.11	16%
Water Solutions	10	6%	$ 7,833.50	18%
Total	181	100%	$ 42,387.02	100%

Table 6 Chilean PPP Summary by Project Type

According to this classification, III. Interurban Road Infrastructure is the leading industry of the program with a total of 57 projects, followed by V. Public Building and Urban Infrastructure (39), and I. Airport Infrastructure (31). This classification will be later analyzed under the scope of the Amount Invested and the active projects in each category, to show the relative importance of each industry.

Also, an upcoming category, for now, included under Public Building and Urban Equipment, could be Energy Infrastructure, because several projects address this industry, especially from the green, sustainable, and renewable initiative's scope.

The most important and peculiar characteristic of the Chilean PPPs Program is the amount of "Reconcessions" that some projects have achieved, *understanding reconcession has the process of concessioning a project that has finished the period of concession.* Meanwhile in other PPPs Programs once a concession is finished the administration, operation, and maintenance are transferred to the Government and public agents, Chile has chosen the path of reconcessions aiming to take advantage of the comparative advantages that the public sector has in terms of management due to the high maintenance costs that many of the infrastructure works require.

According to these characteristics, the projects can be divided into the following depending on their concession number and the fact or possibility of being reconcessed:

"0" – First Concession Finished and NOT reconcessed.

"0.1" – First Concession currently in progress or new project which could be reconcessed in the future but with no second concession yet defined.

"1" – First Concession, finished and reconcessed or in progress with already a second concession project being studied or in the tender phase.
"2" – Second Concession
"3" – Third Concession
"4" – Fourth Concession
"5" – Fifth Concession

According to the Number of Concession, the projects can be analyzed and weighted according to the total amount invested.

Concession Number	Total Projects	% Total Projects	Suma de Official Budget (MM USD)	% Total MM USD
0	5	3%	$ 612.59	1%
0.1	91	50%	$ 25,651.02	61%
1	37	20%	$ 5,480.07	13%
2	37	20%	$ 9,942.77	23%
3	8	4%	$ 336.33	1%
4	2	1%	$ 91.25	0%
5	1	1%	$ 273.00	1%
Total	181	100%	$ 42,387.02	100%

Table 7 Chilean PPP Summary by Concession Number

The Number of Concession can be also analyzed under the scope of Solicited/Unsolicited Proposal. The initiative type is an important indicator of the Private Sector's interest and participation in the PPPs Program.

In the early years of the program, Chile permitted a great amount of Unsolicited Proposal, a phenomenon which during the years, and as the program was regulated with better and stronger mechanisms of control, decreased in proportion to the Solicited Proposals. Furthermore, the Chilean Government has initiated a strong program to develop concessions so the country's infrastructure can meet the needs of the demand.

Concession Number	Total Projects	% Total Projects	Official Budget (MM USD)	% Total MM USD
0	5	2.8%	$ 612.59	1.4%
Solicited Proposal	5	2.8%	$ 612.59	1.4%
0.1	91	50.3%	$ 25,651.02	60.5%

No Info	9	5.0%		0.0%
Solicited Proposal	34	18.8%	$ 9,131.88	21.5%
Unsolicited Proposal	46	25.4%	$ 16,156.14	38.1%
(No Data)*	2	1.1%	$ 363.00	0.9%
1	37	20.4%	$ 5,480.07	12.9%
No Info	6	3.3%	$ 501.80	1.2%
Solicited Proposal	20	11.0%	$ 4,179.10	9.9%
Unsolicited Proposal	11	6.1%	$ 799.18	1.9%
2	37	20.4%	$ 9,942.77	23.5%
No Info	1	0.6%		0.0%
Solicited Proposal	32	17.7%	$ 7,490.52	17.7%
Unsolicited Proposal	3	1.7%	$ 2,452.25	5.8%
(No Data)*	1	0.6%		0.0%
3	8	4.4%	$ 336.33	0.8%
Solicited Proposal	7	3.9%	$ 336.33	0.8%
(No Data)*	1	0.6%		0.0%
4	2	1.1%	$ 91.25	0.2%
Solicited Proposal	2	1.1%	$ 91.25	0.2%
5	1	0.6%	$ 273.00	0.6%
Solicited Proposal	1	0.6%	$ 273.00	0.6%
Total general	181	100.0%	$ 42,387.02	100.0%

Table 8 Chilean PPP Summary by Concession Status and Initiative Type

*(No Data) refers to projects for which it has not been able to get precise information on the source and nature of the initiative.

Applying the same parameters but only to the 85 Active PPPs:

Concession Number	Total Projects	% Total Projects	Official Budget (MM USD)	% Total MM USD
0.1	44	51.8%	$ 11,675.35	56.6%
Solicited Proposal	30	35.3%	$ 8,438.73	40.9%
Unsolicited Proposal	13	15.3%	$ 2,991.62	14.5%

(en blanco)	1	1.2%	$ 245.00	1.2%
1	19	22.4%	$ 3,710.17	18.0%
Solicited Proposal	15	17.6%	$ 3,264.24	15.8%
Unsolicited Proposal	4	4.7%	$ 445.93	2.2%
2	17	20.0%	$ 5,102.30	24.7%
Solicited Proposal	15	17.6%	$ 4,802.30	23.3%
Unsolicited Proposal	1	1.2%	$ 300.00	1.5%
(en blanco)	1	1.2%		0.0%
3	3	3.5%	$ 59.00	0.3%
Solicited Proposal	2	2.4%	$ 59.00	0.3%
(en blanco)	1	1.2%		0.0%
4	2	2.4%	$ 91.25	0.4%
Solicited Proposal	2	2.4%	$ 91.25	0.4%
Total	85	100%	$ 20,638.06	100%

Table 9 Chilean PPP Summary of Active Projects by Concession Status and Initiative Type

These results show a clear predominance of the Solicited Proposals with 75% of the projects, this can be explained by the high regulations and extensive development program led by the Chilean government. Furthermore, currently is being projected another ambitious project of national infrastructure towards 2050, which shows that the program has just started.

Initiative Type	Total Projects	% Total Projects	Official Budget (MM USD)	% Total MM USD
Solicited Proposal	64	75.3%	$ 16,655.51	80.7%
Unsolicited Proposal	18	21.2%	$ 3,737.55	18.1%
(en blanco)	3	3.5%	$ 245.00	1.2%
Total general	85	100.0%	$ 20,638.06	100.0%

Table 10 Chilean PPP Summary of Active Projects by Initiative Type

6. Analysis and results

At the beginning of the present document in chapter 3, the Chilean PPP program was studied and characterized according to the historic

development and the information contained in reports and papers addressing and discussing the model. From this first section, the hypothesis from the behaviors shown by the system was developed and studied to propose a line of investigation. Later, the through the development of the present research was possible to model the Chilean program from the perspective of numbers, investments, periods, and phases, among other variables, which permitted to understand the initiative from another scope. In this context, this section develops 7 different analyses:

- Reconcession Y/N
- # of Renegotiations or Modifications
- #Renegotiations/year
- # of Shareholders
- Case Study: Airport El Tepual of Puerto Montt
- Data Analysis of Concessions after 2010
- Finished Concessions

The objective is to apply lessons extracted from chapter 3 and integrate them into the statistical analysis to extract better information and insight about the program. Therefore, the present se chapter studies through data analysis how variables behave and interact, with the purpose of understanding the complex system behind the Chilean PPP program. Considering the above, for the Data Analysis of the Chilean PPPs Program the interest variables selected to be for the statistical analysis are defined as shown in Table 11.

ID	Criteria	Variable Type (SPSS)	Definition
A	Project ID	Scale – Case Label	Each project has been assigned an ID number just to be recognized in the test results, but this number does not work as a variable in the study.
B	Infrastructure Type	Nominal	1. Airport Infrastructure 2. Health Infrastructure 3. Interurban road Infrastructure 4. Prison Infrastructure 5. Public Building and Urban Infrastructure

			6. Urban Road Infrastructure
			7. Water Solutions
C	Initiative Type	Nominal	1. Solicited Proposal
			2. Unsolicited Proposal
D	Concession Number	Ordinal	1. First Concession
			2. Second Concession
			3. Third Concession
			4. Fourth Concession
			5. Fifth Concession
E	Reconcession Y/N	Nominal	0. No
			1. Yes
F	Macro Region	Nominal	1. North
			2. Center
			3. South
G	# of renegotiation or modifications	Ordinal	Number of modifications and renegotiations of the project's contract
H	# of Shareholders	Ordinal	Number of shareholders of the SPV
I	Repeated Shareholder	Nominal	0. No
			1. Yes
J	Procurement Period	Scale	Number of days that took the procurement period
K	Construction Period	Scale	Number of days that took or is expected to finish the construction of the project
L	Type of Contract	Nominal	1. Fixed
			2. Variable
M	Operational Period of Contract (Years)	Scale	Number of years for which the concession contract was granted
N	Official Budget (MM USD)	Scale	The official budget of the project agreed upon in the contract
O	Year of beginning of concession	Scale	The year in which the concession started.

P	Renegotiation/ year	Scale	Number of renegotiations per operational year

Table 11 Variables description and definition for the SPSS model

Projects that did not meet any of these variables because of a lack of information or due to their current state of development did not permit them to have such detailed information were left out of this section of the study. Consequently, **out of the 181 projects under study, 76 projects were left out of the data analysis** due to their current phase of early development. All projects currently in phases of "In Project" (29), "In Study" (35), "Public Tender in Progress" (9), and "Public Tender Pending" (3), were excluded from the data analysis. Furthermore, other two projects did not meet the criteria because of a lack of information, these projects were:

- 051. Concesión instituto nacional del Cáncer
- 036. Tercera concesión aeropuerto La florida de La Serena

According to the remaining data, a **total of 103 projects** will be analyzed from the perspective of **15 variables** (variable ID-A of Table 11 is not under study due it serves as an identification code for each project) and under the statistical methods described previously in the section Statistical analysis of the present document. In addition, some of the results and findings are also supported and explained through bar and boxplot graphs.

6.1. Reconcession Y/N

The first variable to be analyzed is Reconcessions Y/N, which is of high interest for this thesis due to the high number of reconcessions in Chile compared to other programs in the world. Moreover, in other PPP programs, reconcession has caused less competitiveness for new bidders and less benefits for users due to low quality services. In addition, reconcessions in the Chilean program tend to be born from a public initiative therefore, the link between reconcessions and the Initiative Type (solicited or unsolicited proposal) is also a focus of this section.

The statistical results for Reconcession Y/N were conclusive to extract conclusions about repeated bidders, official budgets, and contract types, and are shown below.

- Linear Regression

  The null hypothesis is that there is no significant change in reconcessions due to the independent variables, and the results in Table 12 show that there is a correlation between the variables (R=0.905) and that the

variation of Reconcessions could be explained by the independent variables (R^2=0.819).

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.905[a]	.819	.791	.194

a. Predictors: (Constant), Official Budget (MM USD), Macro Region, Concession Number, # of shareholders, Procurement period, Initiative Type, Type of contract, Renegotiations/year, Infrastructure Type, Repeated Shareholder, Construction period, Year of Begining of concesssion, Operational period of contract (yrs), # of Renegotiation or Modifications

b. Dependent Variable: Reconcession Y/N

Table 12 Linear regression model summary for Reconcession Y/N

Furthermore, the ANOVA test in Table 13 shows Sig=0.000 which means the results of the model are significant for the chosen variables and the F-ratio shows the group means have significant difference, but it is an expected value due to the nature and differences between the independent variables.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.085	14	1.077	28.533	.000[b]
	Residual	3.323	88	.038		
	Total	18.408	102			

a. Dependent Variable: Reconcession Y/N

b. Predictors: (Constant), Official Budget (MM USD), Macro Region, Concession Number, # of shareholders, Procurement period, Initiative Type, Type of contract, Renegotiations/year, Infrastructure Type, Repeated Shareholder, Construction period, Year of Begining of concesssion, Operational period of contract (yrs), # of Renegotiation or Modifications

Table 13 Linear Regression ANOVA for Reconcession Y/N

Finally, in the linear regression, the coefficient table shows that the independent variables that have a strong relation with reconcessions are Concession Number (Sig=0.000), and the Type of Contract (Sig=0.014), with a positive relation between them showed on the B coefficient column. Similarly, the variables Repeated Shareholders (Sig=0.081) and Official

Budget (Sig=0.059) have a weaker relationship and with positive correlation.

These results show that reconcessed projects are related to a higher concession number which from a logical point of view is obvious, but it also adds that reconcessions have a strong relation with Variable Term Contracts. In addition, the results show that in reconcessions it is less likely that the shareholders from any of the previous contract repeats, which shows a strength in competition and change of the private sectors actor among the different lifecycle of a project.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-6.018	6.605		-.911	.365
	Infrastructure Type	-.006	.015	-.027	-.428	.670
	Initiative Type	-.016	.050	-.016	-.316	.753
	Concession Number	.586	.051	.861	11.425	.000
	Macro Region	-.031	.032	-.045	-.957	.341
	# of Renegotiation or Modifications	-.005	.006	-.081	-.800	.426
	Renegotiations/year	-.010	.083	-.011	-.121	.904
	Year of Begining of concesssion	.003	.003	.050	.767	.445
	# of shareholders	.010	.026	.021	.380	.705
	Repeated Shareholder	.196	.111	.100	1.763	.081
	Procurement period	.000	.000	-.065	-1.212	.229
	Construction period	-3.873E-6	.000	-.013	-.214	.831
	Type of contract	.121	.048	.142	2.500	.014
	Operational period of contract (yrs)	-.002	.003	-.039	-.534	.595
	Official Budget (MM USD)	.000	.000	.120	1.914	.059

a. Dependent Variable: Reconcession Y/N

Table 14 Linear Regression Coefficients for Reconcession Y/N

- One-Way ANOVA

The test for the Contract type variable shows a significant difference of means between Fixed contracts (0.09) and Variable Contracts (0.41) which confirms the linear regression results that Variable Contract get more reconcessions than Fixed Term Contract.

Descriptives

Reconcession Y/N

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Fixed Contract	57	.09	.285	.038	.01	.16	0	1
Variable Contract	46	.41	.498	.073	.27	.56	0	1
Total	103	.23	.425	.042	.15	.32	0	1

Table 15 One-Way ANOVA descriptives for Reconcessions Y/N and Contract Type

These results are consequence of the program policy of preferring variable-term deals, but the data also shows there are some exceptions because fixed contract mean is higher than zero has shown in Table 15 and Graph 3. Nonetheless, the data shows whether a contract is fixed or variable-term conditions the possibility of a reconcession.
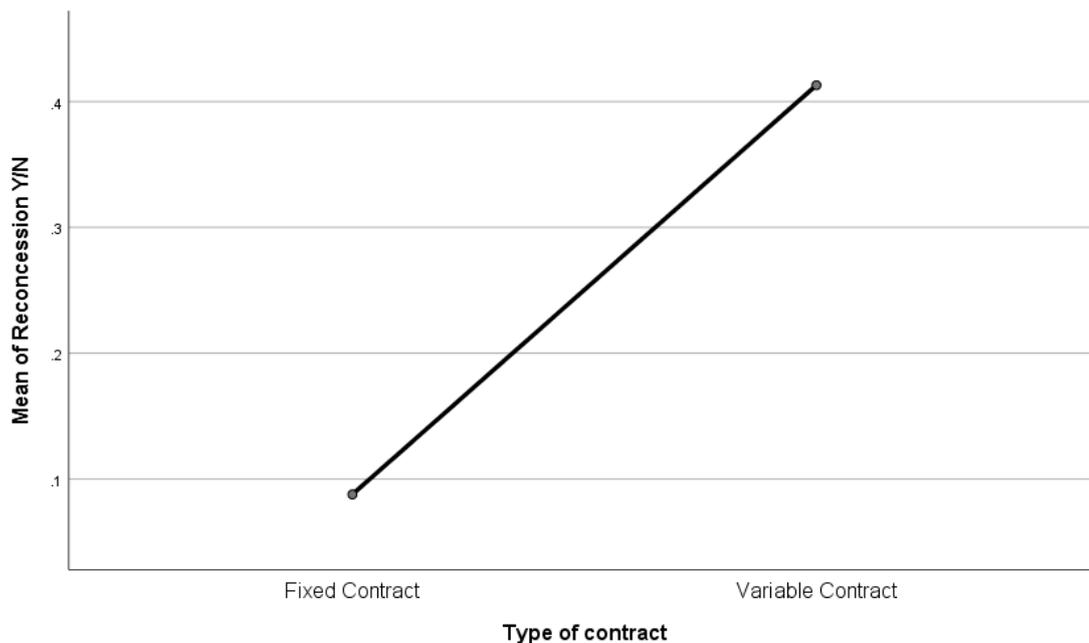
Graph 3 One-Way ANOVA for Reconcession Y/N and Contract Type

For the variable of Repeated Shareholders, the One-Way ANOVA was a biased test due to the nature of the groups. As shown below in Table 16, the test considers that all projects with Repeated Shareholders are Reconcessions ("Yes" group mean=1) which is certain, therefore it does not require further analysis.

Descriptives

Reconcession Y/N

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Yes	5	1.00	.000	.000	1.00	1.00	1	1
No	98	.19	.397	.040	.11	.27	0	1
Total	103	.23	.425	.042	.15	.32	0	1

Table 16 One-Way ANOVA for Reconcession Y/N and Repeated Shareholders

Finally, the other two variables that presented significance in the linear regression where not submitted for One-Way ANOVA test because for Concession number is redundant and Official Budget is a Scale variable type, so it does not match the requirements for the test.

- Kruskal Wallis H Test

The test was executed simultaneously for Reconcession Y/N and the variable Initiative Type, due to the inexistence of a direct link between them the scope is to compare their relationship with other variables to study possible indirect links.

Before running the test, it is necessary to analyze if the sample includes an equal number of subjects for each category of the number of shareholders. Therefore, using the descriptive analysis of data, we can observe the following frequency for the Reconcession Y/N variable:

Reconcession Y/N

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	24	23.3	23.3	23.3
	2	79	76.7	76.7	100.0
	Total	103	100.0	100.0	

Table 17 Descriptive Analysis results for the Kruskal-Wallis H Test for variable Reconcession Y/N

Applying the descriptive analysis of data to the other dependent variable, we can observe the following frequency for Initiative Type:

Initiative Type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	78	75.7	75.7	75.7
	2	25	24.3	24.3	100.0
	Total	103	100.0	100.0	

Table 18 Descriptive Analysis results for the Kruskal-Wallis H Test for variable Initiative Type

Both variables show a significant number of samples for each group, with these results it is possible to proceed with the Kruskal-Wallis H Test, also mentioning that even though Reconcession Y/N and Initiative Type are variables measured in a nominal level, and not ordinal or continuous, the literature shows that in some cases, for which these variables apply for the amount of samples, they can be considered as a continuous variable.

The comparative Kruskal-Wallis H Test for both dependent variables were only conclusive for Reconcession Y/N and showed a link with infrastructure type (sig=0.001), macro region (sig=0.026), # of shareholders (0.029), and type of contract (sig=0.000) (see Table 19 below). Meanwhile, for the dependent variable Initiative Type there were no significant result, which shows the relevance of Reconcessions to understand the program in contrast with other variables that do not show conclusive insights about how the interact and affect the system.

The results obtained in the Kruskal-Wallis H test indicate that, as it was expected by the information provided in section 5. Research Output, reconcessions have a great impact in the program due to the strong relationships it has with other variables. The link between Infrastructure Type, Macro Region and # of shareholders is relative to the median of the variable data, but due to limitations of the test it is not possible to stablish the direction and magnitude of the relationship, and neither with which groups of the variables.

Test Statistics[a,b]

	Reconcession Y/N	InitiativeType
Kruskal-Wallis H	24.096	10.180
df	6	6
Asymp. Sig.	.001	.117

a. Kruskal Wallis Test

b. Grouping Variable: InfrastructureType

Test Statistics[a,b]

	Reconcession Y/N	InitiativeType
Kruskal-Wallis H	7.316	.057
df	2	2
Asymp. Sig.	.026	.972

a. Kruskal Wallis Test

b. Grouping Variable: MacroRegion

Test Statistics[a,b]

	Reconcession Y/N	InitiativeType
Kruskal-Wallis H	9.034	6.151
df	3	3
Asymp. Sig.	.029	.104

a. Kruskal Wallis Test

b. Grouping Variable: # of shareholders

Test Statistics[a,b]

	Reconcession Y/N	InitiativeType
Kruskal-Wallis H	14.929	.006
df	1	1
Asymp. Sig.	.000	.939

a. Kruskal Wallis Test

b. Grouping Variable: Type of contract

Table 19 Kruskal-Wallis H Test result for dependent variables Reconcession Y/N and Initiative Type for independent variables with significant statistical impact

- Boxplot Graphs and One-Way ANOVA test

This section studies the relationship Reconcession Y/N has with scale variables, these are Procurement Period, Construction Period, Operational period of Contract (Yrs.), and Official Budget.

➢ Procurement Period: the first observation is that the graph shows a considerable number of outliers, which is a sign of dispersion and not positive for the purpose of this study. However, the information provided by each boxplot suggests that reconcessions have longer procurement period and lower data dispersion, meanwhile the procurement period of first concessions and not reconcession projects tend to be shorter. This indicates that the longer the procurement period the better quality of project and therefore the higher probability of reconcession. This is an important insight not only for the public authority capacity of improving the procurements, but also for the bidders that according to the extension of the procurement should expect a certain level of outcome from the tendering process and from the project.
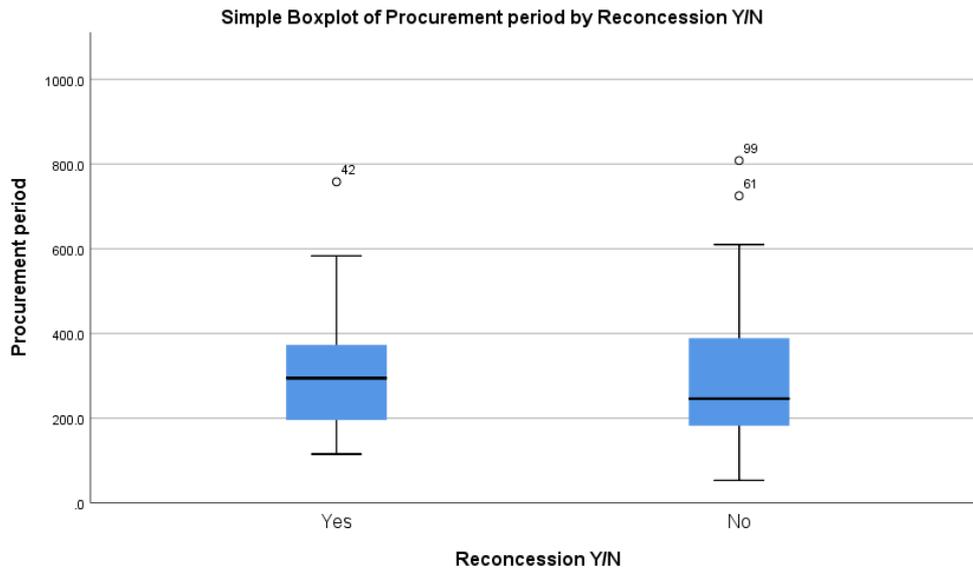
Graph 4 Boxplot Reconcession Y/N vs Procurement Period

Due to the high significance value (sig=0.504) on the ANOVA test, it is not possible to rule out that there is no relationship between this variables, therefore these variables will be further analyzed in section Data Analysis of Concessions after 2010.

ANOVA

Reconcession Y/N

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17.241	95	.181	1.089	.504
Within Groups	1.167	7	.167		
Total	18.408	102			

Graph 5 One-Way ANOVA Test summary for Reconcession Y/N and Procurement Period

➢ Construction Period: the extension of the construction period tends to be 2000 days for reconcessions, meanwhile not reconcessed projects tend to be faster constructors and more efficient from a time perspective. Furthermore, the grate presence outliers in Graph 6 rises doubts whether the results are significant and therefore require a One-Way ANOVA Test.
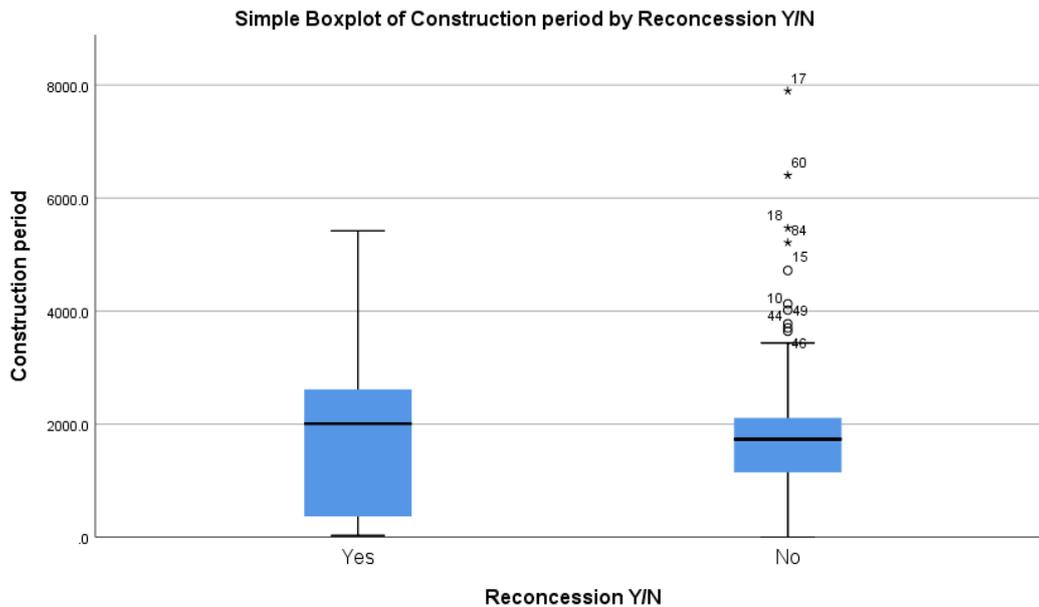
Graph 6 Boxplot Reconcession Y/N vs Construction Period

As expected, due to the presence of numerous outliers, the ANOVA test below confirms that results are not significant among these variables. Later in the study, these variables will be reviewed with a reduced and more specific scope to a certain group of concessions to evaluate if results change.

ANOVA

Reconcession Y/N

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17.074	93	.184	1.239	.389
Within Groups	1.333	9	.148		
Total	18.408	102			

Table 20 One-Way ANOVA for Reconcession Y/N and Construction Period

➢ Operational Period of Contract (Yrs.): The operation period in the Chilean PPP Program, shows data that supports the idea that having shorter periods of contract increases the reconcessions. Even though the ANOVA Test shows no significance and therefore, the model is not appropriate to assure that reconcessions are impacted by the operational period of contracts.

41

Simple Boxplot of Operational period of contract (yrs) by Reconcession Y/N
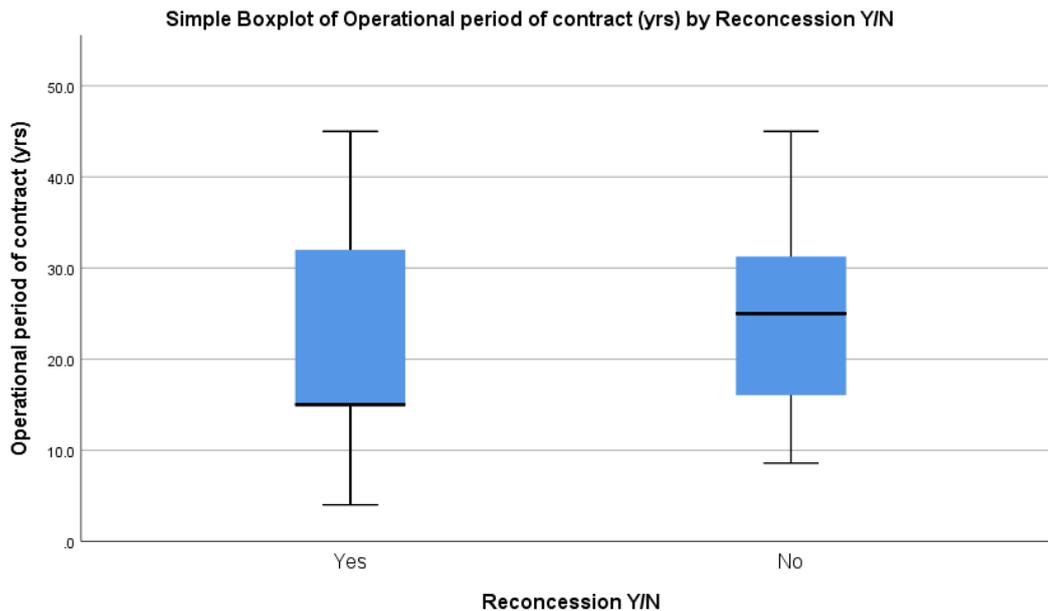
Graph 7 Boxplot Reconcession and Operational period of contract (yrs)

ANOVA

Reconcession Y/N

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.992	33	.182	1.009	.474
Within Groups	12.415	69	.180		
Total	18.408	102			

Table 21 One-Way ANOVA for Reconcession Y/N and Operational period of contract (yrs.)

➢ Official Budget: it is possible to sustain that the lower is the Official Budget, higher are the reconcessions therefore, the link between money invested and Reconcessions is from an inverse nature, in other word, Higher the budget less probability of reconcession. Moreover, and due to the large amount of data and groups on the independent variable, the ANOVA test shows that the data does not have an accurate insight whether the variables as linked in between them.

42
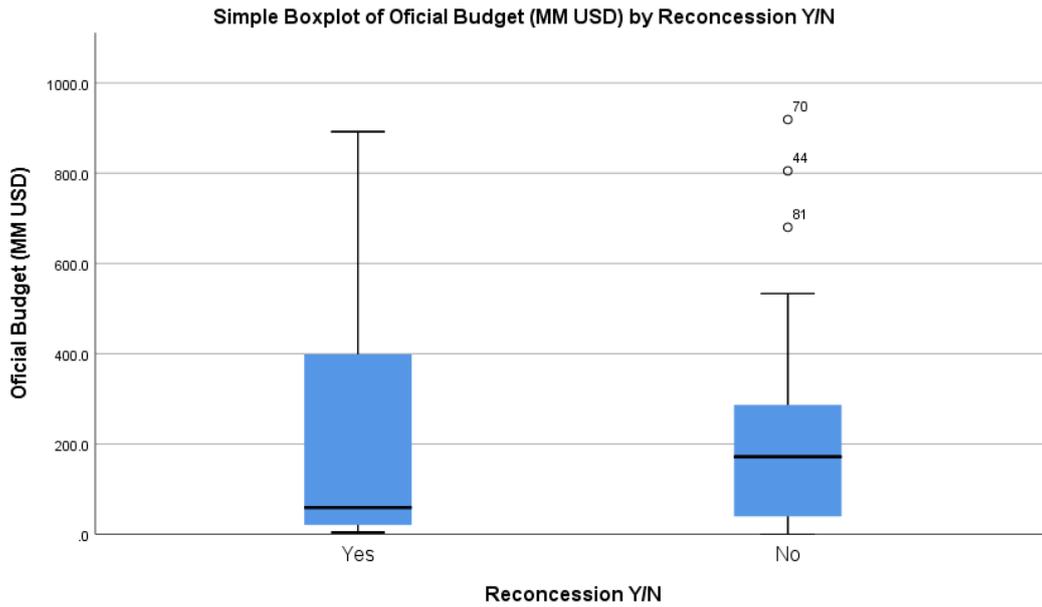
Graph 8 Boxplot Reconcession Y/N vs Official Budget (MM USD)

ANOVA

Reconcession Y/N

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	18.408	100	.184	.	.
Within Groups	.000	2	.000		
Total	18.408	102			

● Graph Analysis

➢ The first independent variable to analyze is the infrastructure type, where airport infrastructure is the most reconcession type, followed by prison infrastructure, and then road infrastructure. This, in contrast to other programs, shows the ability of the Chilean program to extend to multiple types of infrastructure the concession program.
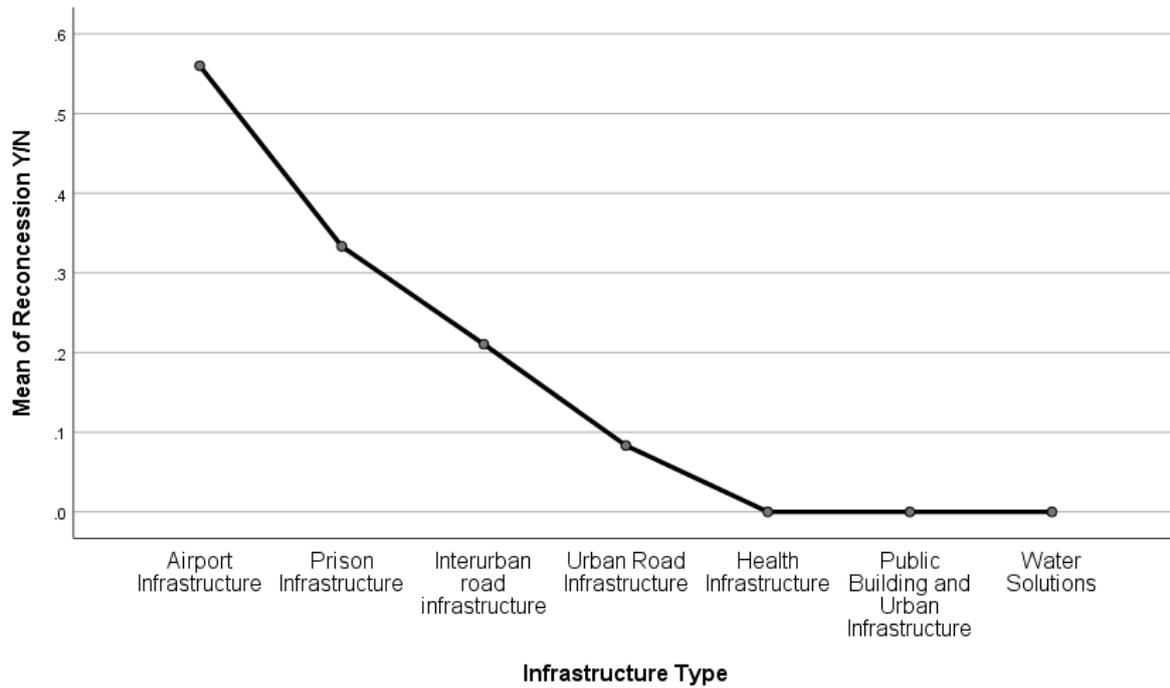
Graph 9 One-Way ANOVA Test results mean plot for dependent variable Reconcession Y/N and independent variable Infrastructure Type
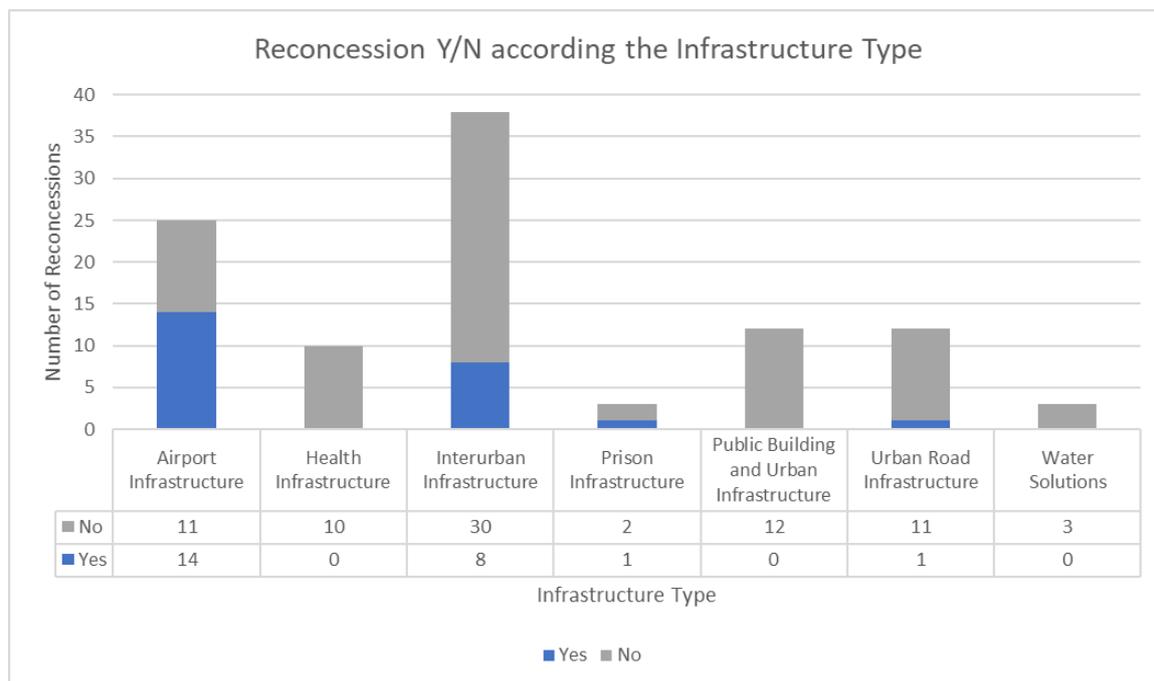
Graph 10 Bar plot of the Number of Reconcessions according to Infrastructure type

➢ The second independent variable to analyze is Macro Region, where a great number of projects and reconcessions are concentrated in the center region of the country. This is not odd since the capital and the major concentrations of populations are in this region.
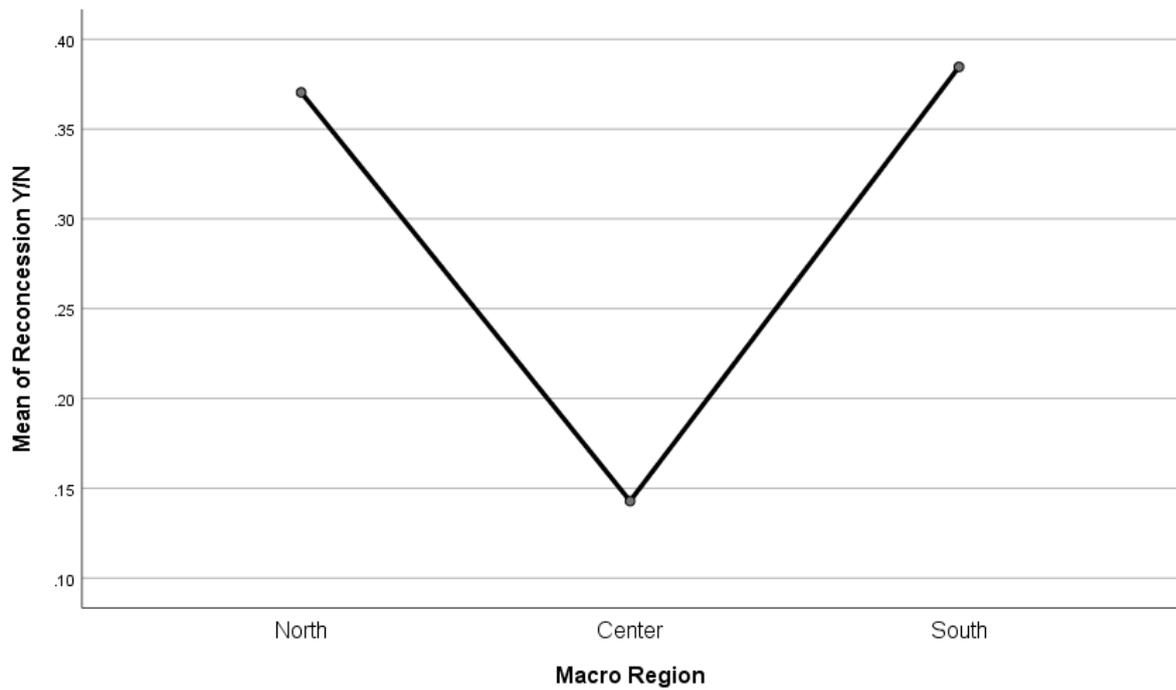
Graph 11 One-Way ANOVA Test results mean plot for dependent variable Reconcession Y/N and independent variable Macro Region
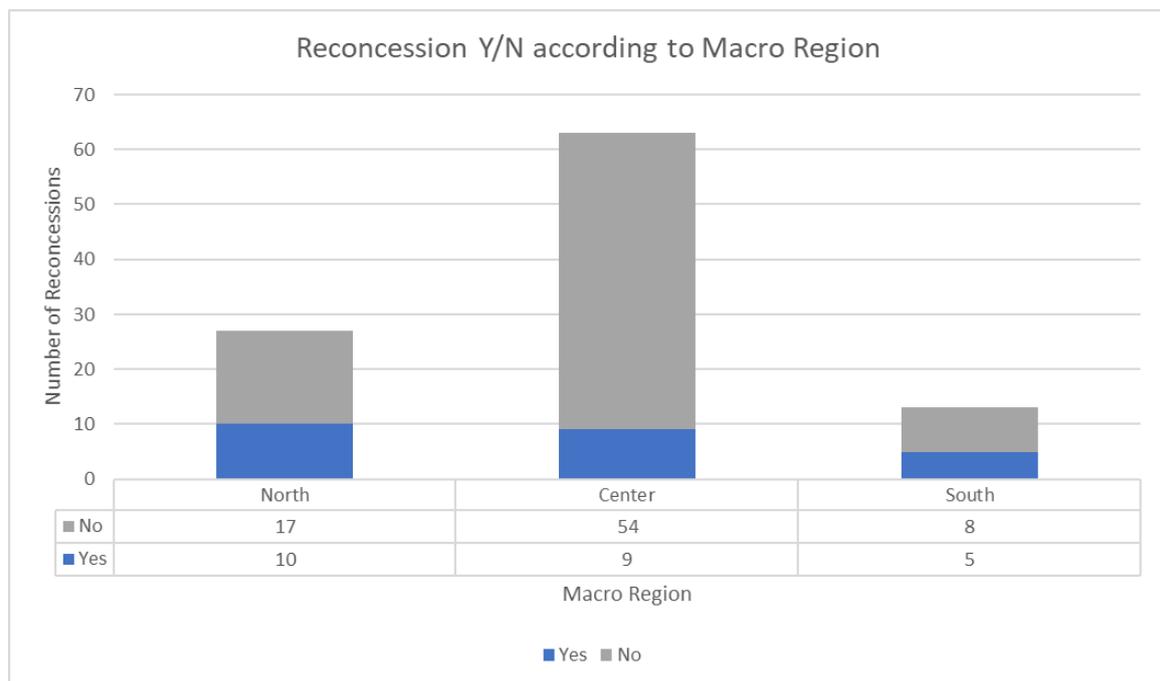
Graph 12 Bar plot of the Number of Reconcessions according to Macro Region

➢ The third independent variable to analyze is # of Shareholders, showing a tendency to two shareholders.
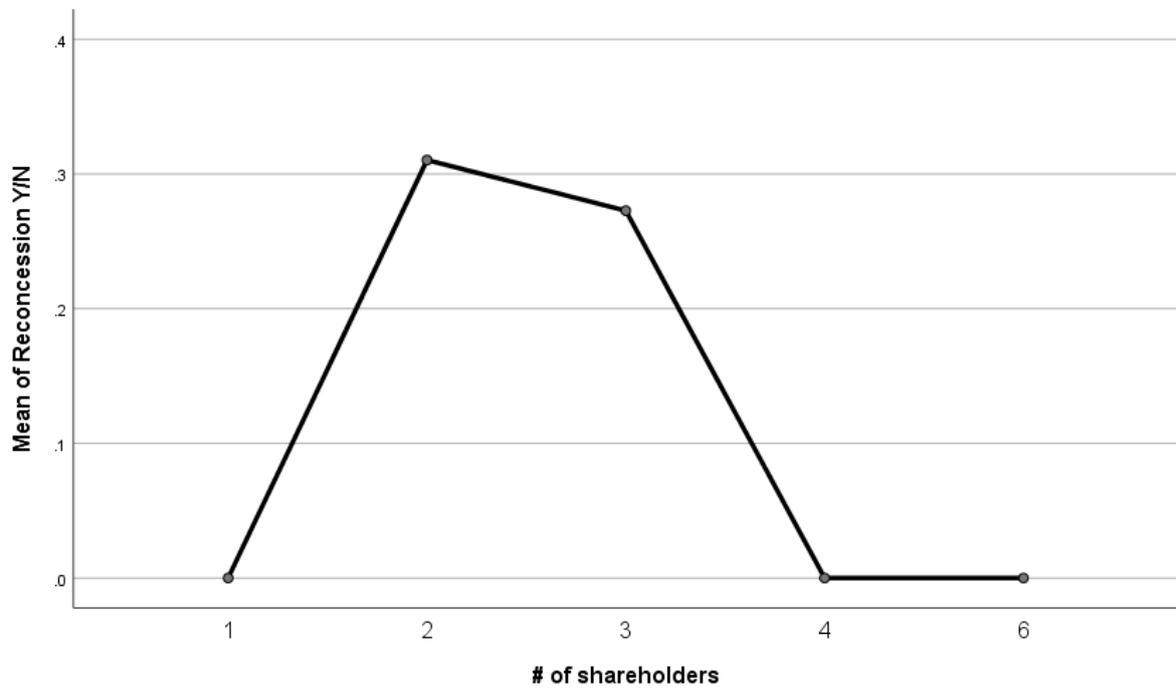
Graph 13 One-Way ANOVA Test results mean plot for dependent variable Reconcession Y/N and independent variable # of Shareholders.
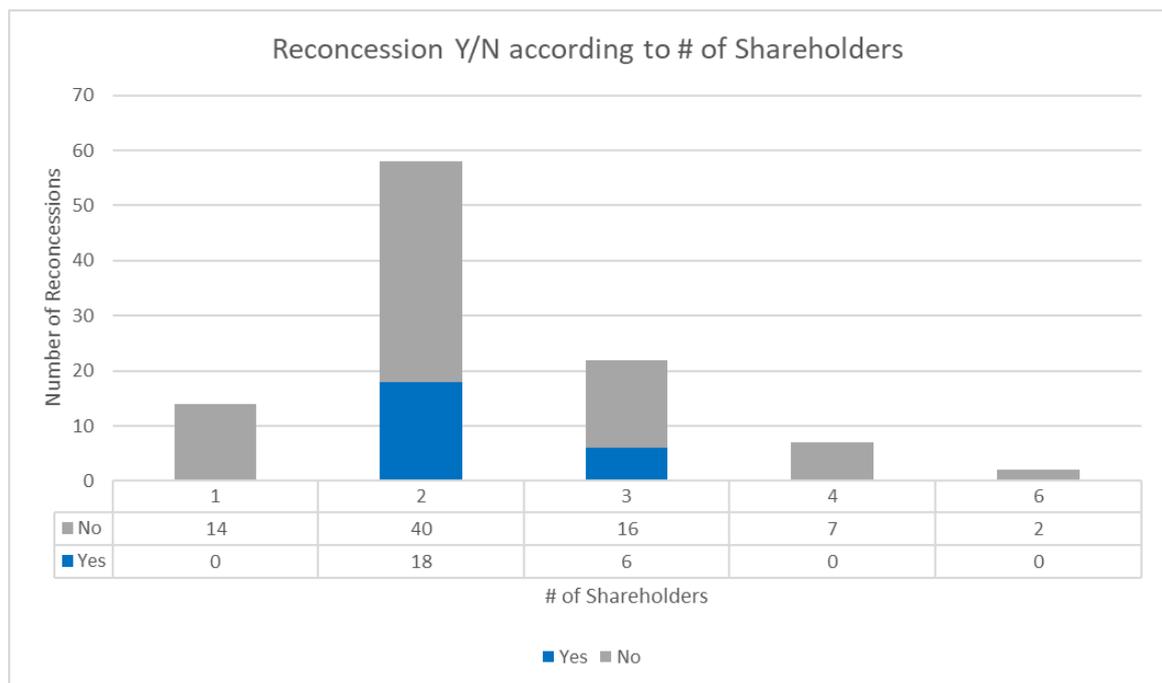
Graph 14 Bar plot of the Number of Reconcessions according to # of Shareholders

> ➢ The fourth independent variable to analyze is the Type of Contract, where the data shows a clear predominance of variable contracts over fixed contract in relation to reconcessions.
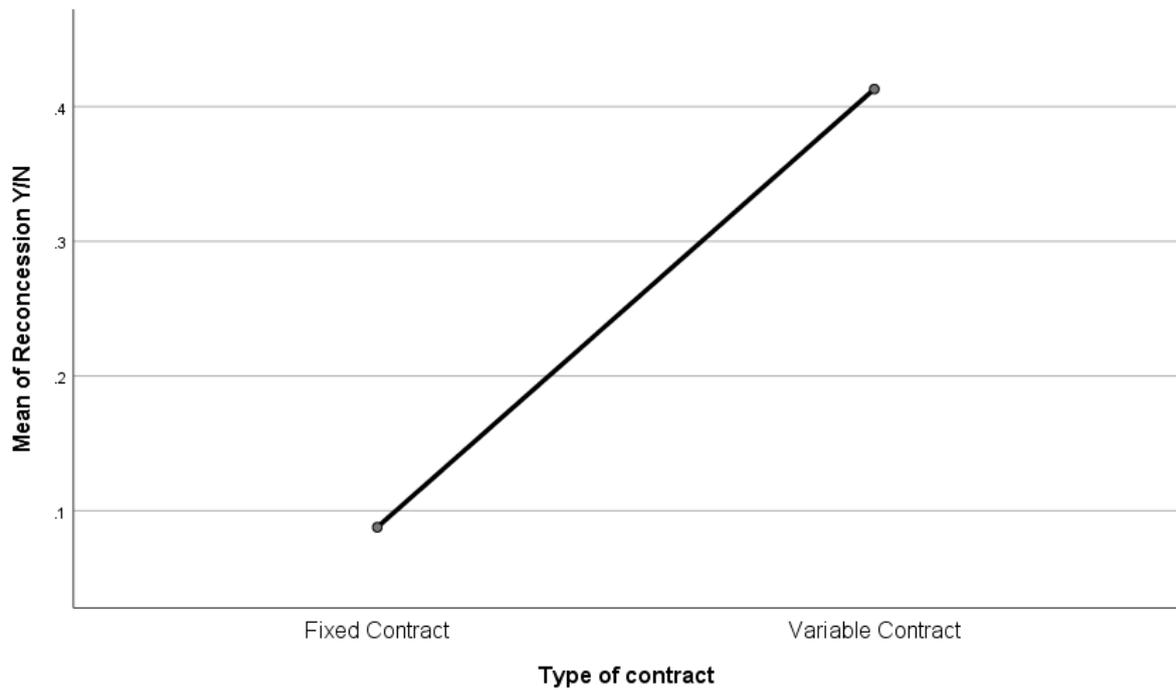
Graph 15 One-Way ANOVA Test results mean plot for dependent variable Reconcession Y/N and independent variable Type of Contract
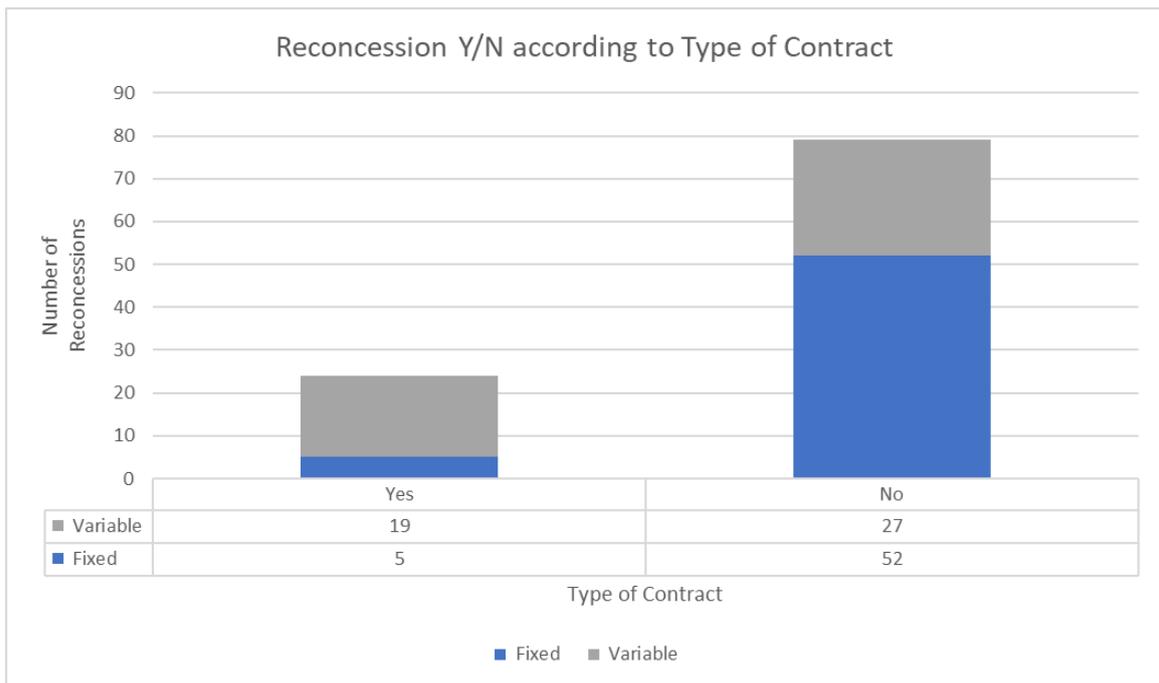
Graph 16 Bar plot of the Number of Reconcessions according to the Type of Contract

6.2. # of Renegotiations or Modifications

Since the 2010 Act Nº20.410, the number of renegotiations and modifications to contract terms is an important variable to measure and understand the impact it has in the system. Furthermore, from the previous section it was noticed that the more a project was reconcession the more renegotiations occurred on the new contracts. Renegotiations tend to have a negative impact on the benefits for users and the public sector because it is a sign of delays, economic problems, or change in the real conditions of the project.

- Linear Regression

The test results show that there is a correlation between renegotiations and other variables (R=0.895) and that the model if effective to explain the variation of the # of renegotiations or modifications variable (R^2=0.800).

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.895[a]	.800	.769	3.663

a. Predictors: (Constant), Official Budget (MM USD), Reconcession Y/N, Macro Region, # of shareholders, Procurement period, Initiative Type, Repeated Shareholder, Type of contract, Renegotiations/year, Infrastructure Type, Construction period, Year of Begining of concesssion, Operational period of contract (yrs), Concession Number

b. Dependent Variable: # of Renegotiation or Modifications

Table 22 Linear Regression Model Summary for # of Renegotiations or Modifications

Furthermore, according to the ANOVA test the model if significant to explain the variable relations (0.000=Sig<0.05) and same as Reconcessions Y/N the means of the independent variables present grate differences, which is expected due to the different nature they have.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4733.296	14	338.093	25.199	.000[b]
	Residual	1180.685	88	13.417		
	Total	5913.981	102			

a. Dependent Variable: # of Renegotiation or Modifications

b. Predictors: (Constant), Official Budget (MM USD), Reconcession Y/N, Macro Region, # of shareholders, Procurement period, Initiative Type, Repeated Shareholder, Type of contract, Renegotiations/year, Infrastructure Type, Construction period, Year of Begining of concesssion, Operational period of contract (yrs), Concession Number

Table 23 Linear Regression ANOVA for # of Renegotiations or Modifications

Finally, the last table of the linear regression shows that the variables Year of beginning of concessions (sig=0), Type of Contract, and Operational Years of Contract have strong relation with renegotiations and modifications of contract terms. Furthermore, the nature of the relationship between these variables shown by the B coefficient in Table 24, stablishes that the higher the year of beginning of the concession the smaller number of renegotiations which is unclear if it is because of the legal framework changes of 2010 or to the fact that newer concessions have less years of operations and therefore, they have had less time for renegotiations. This will be studied in more detail further ahead in the variable Renegotiations/year section. In addition, the B coefficient shows that there is a positive relation between renegotiations and type of contract, the nature of this relationship will be studied below in the One-Way ANOVA test.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	557.435	110.067		5.065	.000
	Infrastructure Type	-.026	.284	-.006	-.091	.927
	Initiative Type	-.979	.933	-.055	-1.049	.297
	Concession Number	-2.031	1.509	-.166	-1.346	.182
	Reconcession Y/N	-1.602	2.002	-.089	-.800	.426
	Macro Region	.085	.614	.007	.138	.891
	Renegotiations/year	11.875	.920	.745	12.911	.000
	Year of Begining of concesssion	-.275	.055	-.305	-4.983	.000
	# of shareholders	-.570	.482	-.069	-1.182	.240
	Repeated Shareholder	-1.436	2.131	-.041	-.674	.502
	Procurement period	-.003	.003	-.064	-1.134	.260
	Construction period	.000	.000	.083	1.334	.186
	Type of contract	2.582	.902	.169	2.861	.005
	Operational period of contract (yrs)	-.107	.056	-.143	-1.912	.059
	Official Budget (MM USD)	.010	.002	.265	4.345	.000

a. Dependent Variable: # of Renegotiation or Modifications

Table 24 Linear Regression Coefficients for # of Renegotiations or Modifications

- One-Way ANOVA

The test was only executed with the variables Year of Beginning of Concession and Type of Contract since the other variables are redundant or do not meet the test requirements.

The results for Year of beginning of Concession are not conclusive due to the dispersion of the data and the high number of groups as shown on Table 24.

Descriptives

# of Renegotiation or Modifications

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1993	1	2.00	.	.	.	.	2	2
1994	1	2.00	.	.	.	.	2	2
1995	4	5.00	4.967	2.483	-2.90	12.90	1	12
1996	3	4.00	4.359	2.517	-6.83	14.83	1	9
1997	3	12.33	16.166	9.333	-27.82	52.49	3	31
1998	6	6.83	4.875	1.990	1.72	11.95	0	14
1999	4	23.00	27.869	13.934	-21.35	67.35	5	64
2000	2	4.00	1.414	1.000	-8.71	16.71	3	5
2001	2	8.00	9.899	7.000	-80.94	96.94	1	15
2002	5	3.00	2.345	1.049	.09	5.91	1	7
2003	3	4.00	2.646	1.528	-2.57	10.57	1	6
2004	8	4.50	4.106	1.452	1.07	7.93	1	13
2005	4	2.25	2.630	1.315	-1.93	6.43	0	6
2006	2	1.00	.000	.000	1.00	1.00	1	1
2007	1	1.00	.	.	.	.	1	1
2008	3	3.33	2.517	1.453	-2.92	9.58	1	6
2009	2	3.00	4.243	3.000	-35.12	41.12	0	6
2010	6	3.50	3.271	1.335	.07	6.93	0	8
2011	4	3.50	4.359	2.179	-3.44	10.44	0	9
2012	3	3.33	4.933	2.848	-8.92	15.59	0	9
2013	3	3.67	3.055	1.764	-3.92	11.26	1	7
2014	5	5.00	3.674	1.643	.44	9.56	1	10
2015	2	9.50	13.435	9.500	-111.21	130.21	0	19
2016	4	5.00	2.944	1.472	.32	9.68	2	9
2017	1	6.00	.	.	.	.	6	6
2018	7	2.86	3.185	1.204	-.09	5.80	0	9
2019	4	2.25	2.630	1.315	-1.93	6.43	0	6
2021	5	.20	.447	.200	-.36	.76	0	1
2022	4	.00	.000	.000	.00	.00	0	0
2023	1	.00	.	.	.	.	0	0
Total	103	4.63	7.614	.750	3.14	6.12	0	64

Table 25 One-Way ANOVA descriptives for # of Renegotiations or Modifications

Another way to present the data on the table above, is through Graph 17, where it is possible to observe a general tendency to decrease Renegotiations during the last few years. This is a positive sign of strength from the Chilean PPP program.
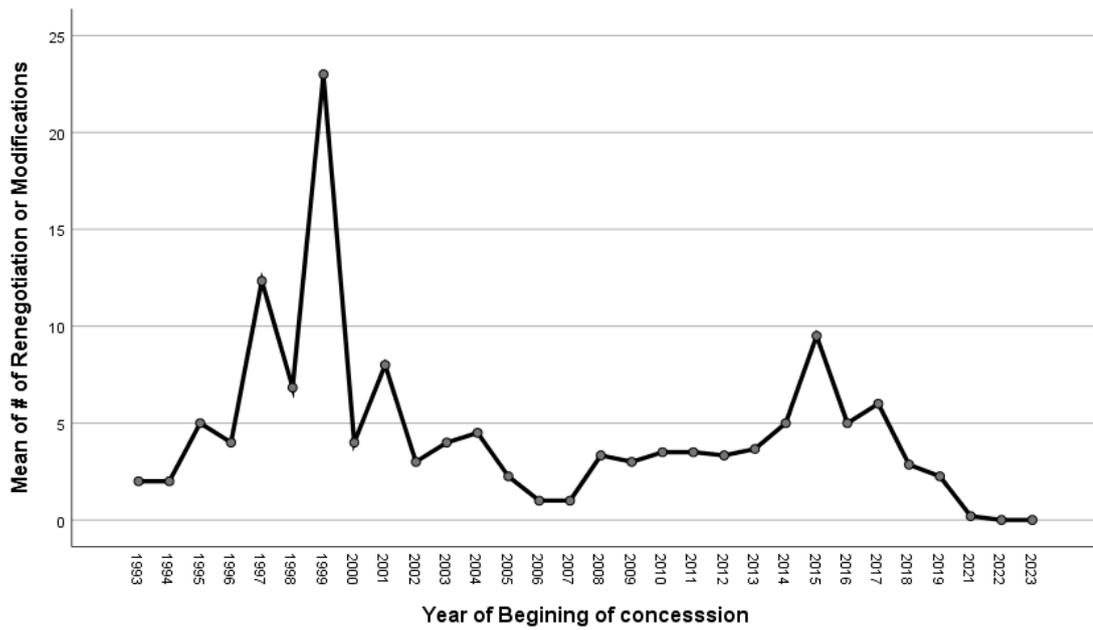
Graph 17 ANOVA test plot for # of renegotiations or Modifications according to Year of Beginning of Concession

- Kruskal Wallis H Test

The first step for the test is to analyze if the sample includes an equal number of subjects for each category of the number of shareholders. Therefore, using the descriptive analysis of data, we can observe the following frequency for # of Renegotiations variable:

# of Renegotiation or Modifications

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	20	19.4	19.4	19.4
	1	18	17.5	17.5	36.9
	2	15	14.6	14.6	51.5
	3	9	8.7	8.7	60.2
	4	3	2.9	2.9	63.1
	5	8	7.8	7.8	70.9
	6	7	6.8	6.8	77.7
	7	5	4.9	4.9	82.5
	8	3	2.9	2.9	85.4
	9	6	5.8	5.8	91.3
	10	1	1.0	1.0	92.2
	12	1	1.0	1.0	93.2
	13	1	1.0	1.0	94.2
	14	1	1.0	1.0	95.1
	15	1	1.0	1.0	96.1
	17	1	1.0	1.0	97.1
	19	1	1.0	1.0	98.1
	31	1	1.0	1.0	99.0
	64	1	1.0	1.0	100.0
	Total	103	100.0	100.0	

Table 26 Descriptive Analysis results for the Kruskal-Wallis H Test for variable # of Renegotiations or Modifications

From the sample containing 103 projects, 9 of them have 10 or more renegotiations; therefore, these cases were merged into one category for projects with "10+ renegotiations". The standardized frequency data is then shown in the table below.

# of Renegotiation or Modifications

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	20	19.4	19.4	19.4
	1	18	17.5	17.5	36.9
	2	15	14.6	14.6	51.5
	3	9	8.7	8.7	60.2
	4	3	2.9	2.9	63.1
	5	8	7.8	7.8	70.9
	6	7	6.8	6.8	77.7
	7	5	4.9	4.9	82.5
	8	3	2.9	2.9	85.4
	9	6	5.8	5.8	91.3
	10	9	8.7	8.7	100.0
	Total	103	100.0	100.0	

Table 27 Descriptive Analysis corrected results for the Kruskal-Wallis H Test for variable # of Renegotiations or Modifications

Comparative Kruskal-Wallis H Test for both dependent variables: **# of Shareholders** and **# of Renegotiations**

In this first case, the null hypothesis (H_1) would be that the median of each group is the same therefore the infrastructure type does not have an impact on the # of shareholders or renegotiations.

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum	25th	Percentiles 50th (Median)	75th
# of Renegotiation or Modifications	103	3.61	3.341	0	10	1.00	2.00	6.00
# of shareholders	103	2.25	.801	1	4	2.00	2.00	3.00
InfrastructureType	103	3.15	1.757	1	7	2.00	3.00	5.00

Test Statistics[a,b]

	# of Renegotiation or Modifications	# of shareholders
Kruskal-Wallis H	11.210	9.316
df	6	6
Asymp. Sig.	.082	.157

a. Kruskal Wallis Test

b. Grouping Variable: InfrastructureType

Table 28 Kruskal-Wallis H Test result for dependent variables # of Shareholders and #of Renegotiations or Modifications for independent variable Infrastructure Type

According to the test, and considering the independent variable the infrastructure type, the only variable that could have an impact would be the Infrastructure Type, even though it is not completely sure that we can reject the null hypothesis due to the not fulfillment of the P-value<0.05. But it is a result to be considered and studied further in the analysis because this independent variable could have a statistically significant impact over the dependent variable due to the P-value = 0.082.

Regarding the result for the other independent variables, no conclusive results were obtained due to the non-conformity with the parameters of significance (P-Value<0.05). The result obtained for other independent variables were the followings:

6.3.   #Renegotiations/year

Number of renegotiations per year, is a parametrized variable that considers all projects and calculate a rate of renegotiation, in this way, the previous problems that arise when evaluating Renegotiations is solved.

The biggest contribution of this variable is the possibility to compare projects no matter in which phase of development they are in. Furthermore, it is a useful tool to evaluate the impact of the new legal framework after 2010.

- Linear Regression: the linear regression shows conclusive data, and it is possible to affirm that there is correlation between the variables under study, and mainly that the variation in Reconcessions can be explained by the model (R^2=0.765).

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.875[a]	.765	.727	.249546

a. Predictors: (Constant), Official Budget (MM USD), Reconcession Y/N, Macro Region, # of shareholders, Procurement period, Initiative Type, Repeated Shareholder, Type of contract, Infrastructure Type, # of Renegotiation or Modifications, Construction period, Year of Begining of concesssion, Operational period of contract (yrs), Concession Number

Table 29 Linear Regression Model Summary for Renegotiations/Year

The ANOVA test shows that the model is significant to explain the variation in Renegotiations/Year among the other variables.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.824	14	1.273	20.444	.000[b]
	Residual	5.480	88	.062		
	Total	23.304	102			

a. Dependent Variable: Renegotiations/year

b. Predictors: (Constant), Official Budget (MM USD), Reconcession Y/N, Macro Region, # of shareholders, Procurement period, Initiative Type, Repeated Shareholder, Type of contract, Infrastructure Type, # of Renegotiation or Modifications, Construction period, Year of Begining of concesssion, Operational period of contract (yrs), Concession Number

Table 30 Linear Regression ANOVA for Renegotiations/Year

In addition, and regarding the coefficient table below, the variables that have a significant relationship with renegotiations are Concession Number(sig=0.004), Year of beginning of Concession (Yrs.) (sig= 0.019), and the Type of Contract (sig=0.015). Furthermore, the biggest insight of these results is that Renegotiations/year has a negative and inverse relationship with Contract Type, this indicates that project of fixed-term contract tends to have more renegotiation rates. This is an important insight because, even though it is an implicit public policy concession with variable -term contracts, there are some exceptions. This data indicates that these exceptions do not

have a benefit for the system, nonetheless, over some projects, the public authority still concessions outside the stablished policies.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-28.389	7.966		-3.564	.001
	Infrastructure Type	-.007	.019	-.027	-.378	.706
	Initiative Type	.073	.063	.066	1.151	.253
	Concession Number	.297	.099	.387	2.997	.004
	Reconcession Y/N	-.017	.137	-.015	-.121	.904
	Macro Region	.019	.042	.024	.454	.651
	# of Renegotiation or Modifications	.055	.004	.878	12.911	.000
	Year of Begining of concesssion	.014	.004	.245	3.464	.001
	# of shareholders	.023	.033	.044	.691	.491
	Repeated Shareholder	.172	.144	.078	1.194	.236
	Procurement period	-7.955E-5	.000	-.025	-.410	.683
	Construction period	-5.642E-6	.000	-.016	-.243	.808
	Type of contract	-.154	.062	-.161	-2.472	.015
	Operational period of contract (yrs)	.007	.004	.145	1.790	.077
	Official Budget (MM USD)	.000	.000	-.122	-1.698	.093

a. Dependent Variable: Renegotiations/year

Table 31 Linear Regression Coefficients for Renegotiations/Year

6.4. # of Shareholders

● Kruskal Wallis H Test

Kruskal-Wallis H Test for dependent variable: **# of Shareholders**

Before running the test, it is necessary to analyze if this sample includes an equal number of subjects for each category of the number of shareholders. Therefore, using the descriptive analysis of data, we can observe the following frequency for # of Shareholders variable:

Statistics

# of shareholders

N	Valid	103
	Missing	0

# of shareholders

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	14	13.6	13.6	13.6
	2	58	56.3	56.3	69.9
	3	22	21.4	21.4	91.3
	4	7	6.8	6.8	98.1
	6	2	1.9	1.9	100.0
	Total	103	100.0	100.0	

Table 32 Descriptive Analysis results for the Kruskal-Wallis H Test for variable # of Shareholders

The sample contains 103 projects, from which 7 have 4 shareholders and only 2 have 6 shareholders, to make every category more balanced in di frequency of samples that contain each of them, categories "4 shareholders" and "6 shareholders" were merged into 1 single category that will be "4+ shareholders", obtaining the following results for the frequency analysis:

# of shareholders

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	14	13.6	13.6	13.6
	2	58	56.3	56.3	69.9
	3	22	21.4	21.4	91.3
	4	9	8.7	8.7	100.0
	Total	103	100.0	100.0	

Table 33 Descriptive Analysis corrected results for the Kruskal-Wallis H Test for variable # of Shareholders

This new frequency for each category will help the analysis of the following test, in a way that we have more equilibrium on the frequencies of each category.

6.5. Case Study: Airport El Tepual of Puerto Montt

Currently, the airport El Tepual of Puerto Montt is in the 4th concession period, and it is the only project on the Chilean PPP program to arrive to this level of Concession Number, and only three other projects have reached the 3 reconcession. In this context, the project is not only a landmark of the program and the reconcession policy, but also a source of great information of the long-term cycles that a same project can have if the Public Sector decides not to transfer the infrastructure for public administration at the end of the contract.

This case study focuses on the 2nd and 3rd concessions due to the repetition of the winning bidder; this is the ICAFAL inversions S.A. group.

According to the official information contained in the "Acta de apertura economica" of the project:

3rd Concession	BD Payment (UF)	ITC (UF)	Winner bid
Empresa Constructora BELFI S.A.	$ –	$ 63,230	No
Consorcio A Port Chile – IDC	$ –	$ 7,747	No
Agencias Universales S.A.	$ –	$ 2,893	No
ICAFAL Inversiones S.A.	$ 25,401	$ –	Yes

Table 34 Acta de Apertura Economica Project Airport El Tepual of Puerto Montt 3rd Concession

From this information, it is highly insightful that the only bidder who offered payments for Goods and Rights, meanwhile all the other bidders did not offer any kind of payments to the government and set also set very different ITC values. This situation has different possible analysis but due to the results and

insight obtained in previous section of this thesis it is most likely that the information obtained by the winner bidder in previous concession provided a comparative advantage.

6.6. Data Analysis of Concessions after 2010

The 2010 change of regulation in the Chilean Concession Program had a big impact in how projects and contracts where addressed, therefore, and to be able to compare, analyze, and obtain insights from the information available it is necessary to study those projects that have been concession under the same legal framework. In other words, this section of the study focuses on projects after the publication and entry into force of the new regulation of 2010[2]. According to these criteria, out of the 181 projects included in the database of this thesis research, this section studies 43 projects that fit the criteria. The projects filtered by the Infrastructure Type are as it follow:

Infrastructure Type	Number of Projects	% of total Projects	Official Budget (MM USD)	% of total investment
Airport Infrastructure	25	24%	$ 1,813.38	9%
Health Infrastructure	10	10%	$ 2,531.16	12%
Interurban road infrastructure	38	37%	$ 11,301.29	54%
Prison Infrastructure	3	3%	$ 243.49	1%
Public Building and Urban Equipment	12	12%	$ 482.11	2%
Urban road infrastructure	12	12%	$ 3,773.60	18%
Water Solutions	3	3%	$ 715.77	3%
Total	**103**	**100%**	**$ 20,860.80**	**100%**

Table 35 Concessions started after new regulation of 2010 by Infrastructure Type, total number of projects and total investment (official budget)

From the table above we can observe how the concessions started from 2011 and after, are mainly concentrated on Interurban Road Infrastructure (35%), Airport infrastructure (25%), and Health infrastructure (25%), this distribution of the projects is not highly impacted by the new regulation, but it is a normal distribution according to the infrastructure project of the MOP targeting land

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[2] Act N°20.410, Modification to the Concessions Law and other regulations indicated on the legislation. The act was promulgated on December 14th, 2009, and entered into force on the 20th of January 2010.

and air connectivity of the country, and regional health development that was early described in section 3.1. In addition, according to the Official Budget, the most impactful infrastructure types, from an investment point of view, are the Urban and Interurban roads infrastructure summing more than 70% of the total investment and showing that the numerical distribution of the projects is not equal to the materialized investment. Furthermore, the impact of the new regulation on other variables was considerable and the degree of change fluctuates from one variable to another, therefore each one must be analyzed to understand the complete effect of the new legal framework stablished in 2010. Following this, the present section is divided into two subsections:

- General impact and multiple variables: which studies the 4 main variables of interest that have proven to be more relevant to understand the program dynamic (Initiative type, # of renegotiations, Renegotiations/year, and # of Shareholders).

- Specific Impact - Reconcession: which addresses how the new regulation has modeled the life cycle of long-term projects in the different concession levels.

6.6.1.   General impact and multiple variables

➢ Initiative Type

The Chilean program has the characteristic of having a low percentage of Unsolicited Proposals (as shown previously on this document, less than 25% of the 85 active projects in the Chilean PPPs program) but even though this low rate of private initiatives, the projects after 2010 show an even lower rate where only a 19% correspond to Unsolicited Proposals and 81% to Solicited Proposals (see Graph 18 Initiative Type in % after 2010 new regulation). Furthermore, all the Unsolicited proposals are concentrated in first and second concessions, showing that as the concession number increases (or a project is reconcessioned) the rate of Unsolicited Proposal decreases. The negative relation between Concession Number and Initiative Type was reinforced by the new regulations increasing the standards and requirements for private initiatives, showing a clear intention through the policy making by the Chilean program to discourage the Unsolicited Proposals, situation that has high contrast with the other important PPP

program in the region, the Colombian model which has a high number of Unsolicited Proposals due to the legislative encourage for this type of development.

Data shows, that there are only 8 projects (19%) that correspond to Unsolicited Proposals after 2010, out of which only one belong to second concession and all the other private initiatives correspond to first concession projects, signaling a decreasing tendency as the reconcession progresses and for a clear discouragement from the legal framework to Unsolicited proposal in thirds and fourth concessions. The projects in question are:

  I.   First Concession Rutas del Loa
  II.   First Concession Mejoramiento Ruta G-21
  III. First Concession Mejoramiento Ruta Nehuelbuta
  IV.   First Concession Conexión Vial Ruta 78 hasta Ruta 68
  V.   First Concession Teleférico Bicentenario
  VI.   First Concession Alternativas de Acceso a Iquique
  VII. First Concession Autopista Concepción – Cabrero
  VIII. Second Concession Rutas del Loa
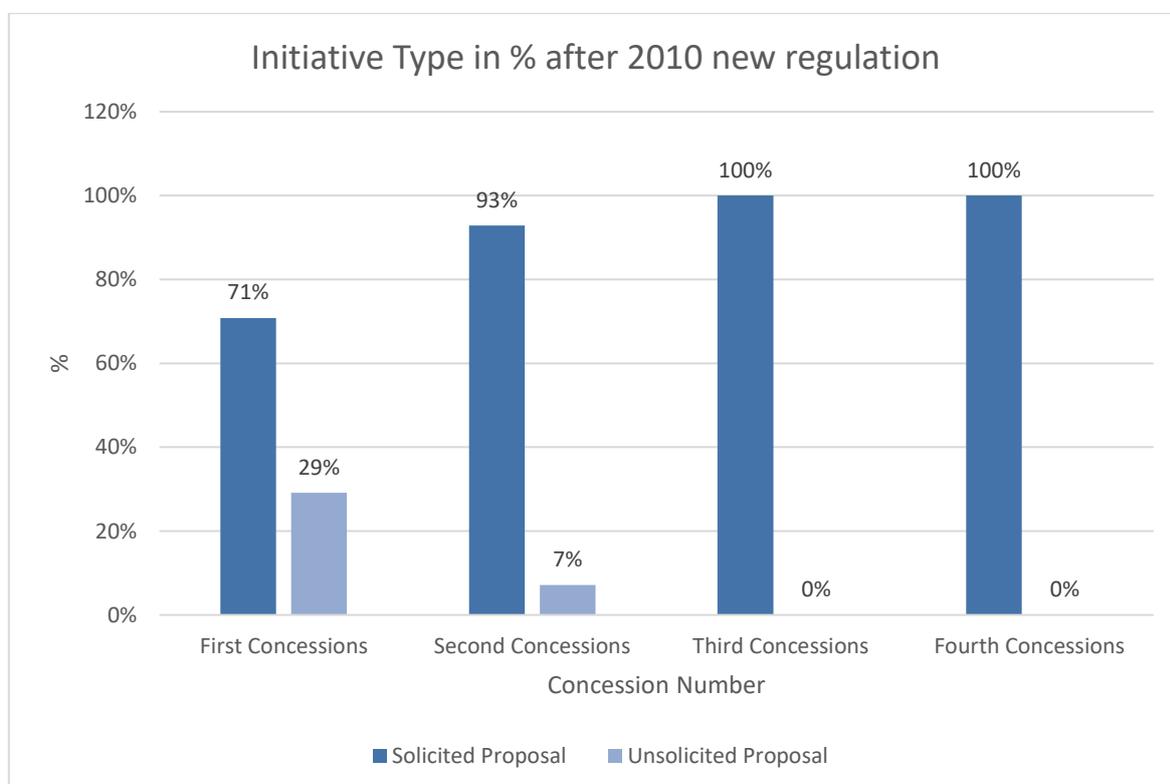
Graph 18 Initiative Type in % after 2010 new regulation

According to the linear regression, the model indicates correlation between the Initiative Type and the Concession Number (R=0.648 and Sig=0.060) with a negative B factor shown in Table 37, which represents that the higher number of the reconcession the more solicited proposal.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.648[a]	.420	.215	.349

a. Predictors: (Constant), Official Budget (MM USD), # of shareholders, Type of contract, Repeated Shareholder, Renegotiations/year, Procurement period, Macro Region, Year of Begining of concesssion, Construction period, Concession Number, Operational period of contract (yrs)

Table 36 Linear regression model summary for Initiative Type after 2010

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	VIF
1	(Constant)	-17.917	39.040		-.459	.649		
	Concession Number	-.241	.123	-.501	-1.950	.060	.283	3.535
	Macro Region	.046	.108	.073	.430	.670	.645	1.551
	Renegotiations/year	.175	.145	.253	1.205	.238	.425	2.353
	Year of Begining of concesssion	.009	.019	.087	.483	.633	.577	1.733
	# of shareholders	-.002	.103	-.003	-.019	.985	.708	1.413
	Repeated Shareholder	-.052	.233	-.039	-.223	.825	.616	1.624
	Procurement period	.000	.000	.084	.531	.600	.747	1.338
	Construction period	-6.305E-5	.000	-.169	-.810	.424	.428	2.334
	Type of contract	.317	.193	.399	1.640	.111	.316	3.161
	Operational period of contract (yrs)	.008	.008	.259	.999	.325	.279	3.587
	Official Budget (MM USD)	.000	.000	-.277	-1.535	.135	.576	1.737

a. Dependent Variable: Initiative Type

Table 37 Linear regression coefficients for Initiative type after 2010

➢ # of Renegotiations

One of the objectives of the Chilean program introducing the change of legislation was to discourage renegotiations and finish with the malpractice of not fulfilling the terms stated in the original contract. According to the data, the effects of the new legislation were positive according to the objective and the expected results. There are 18 projects (41,8%) that do not register renegotiations and there is only one outlier: the second concession of the International Airport Arturo Merino Benitez – SCL which has 19 registered

renegotiations and that it is known to be a conflictive project that also was concessioned under a fixed term contract, an exception to the common practice in the Chilean program after the new regulation of 2010.

Number of Renegotiations after 2010 new regulation

% of total projects

Total Renegotiations and contract modifications

	0	1	2	3	4	5	6	7	9	10	19
First Concessions	42%	17%	8%	4%	4%	4%	0%	8%	8%	4%	0%
Second Concessions	50%	0%	7%	0%	14%	7%	7%	0%	7%	0%	7%
Third Concessions	33%	33%	0%	0%	0%	33%	0%	0%	0%	0%	0%
Fourth Concessions	0%	0%	0%	0%	0%	0%	50%	0%	50%	0%	0%

First Concessions   Second Concessions   Third Concessions   Fourth Concessions
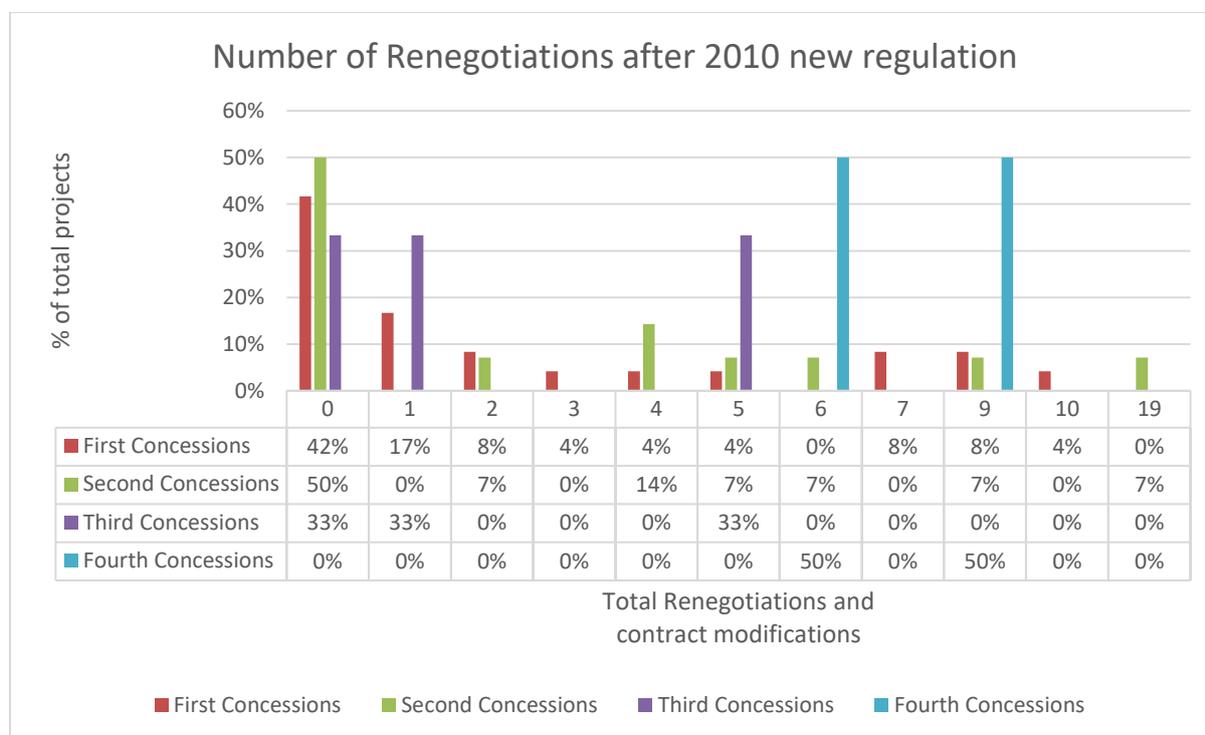
Graph 19 Number of Renegotiations after 2010 new regulation in % of total projects

The tendency showed in the graph above and the correlation between the number of renegotiations and the concession number is confirmed by the linear regression which shows to by a significant model to explain the effects over the renegotiations along the life cycle of a project (R=0.762 and R^2=0.581). With an ANOVA test that shows that the model is significant and therefore we can reject the no effect hypothesis. Furthermore, the coefficients table indicates a significant positive relation (Sig=0.035 and B-Coefficient=3.072) between the variables, confirming the results observed in the previous graph and the link between variables. Moreover, the model shows other significant relationships with the independent variables: year of beginning of concession, # of Shareholders, and type of contract. These links also contribute to provide important information, the newer a project there are fewer renegotiations, but at the same time the higher the number of shareholders the more renegotiations, so these are variables to manage to be able to obtain a balanced and positive result out of the concession.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.762ª	.581	.413	3.093

a. Predictors: (Constant), Official Budget (MM USD), # of shareholders, Reconcession Y/N, Macro Region, Initiative Type, Procurement period, Repeated Shareholder, Year of Begining of concesssion, Construction period, Type of contract, Operational period of contract (yrs), Concession Number

Table 38 Linear regression model summary for # of renegotiations after 2010

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	398.114	12	33.176	3.467	.003[b]
	Residual	287.049	30	9.568		
	Total	685.163	42			

a. Dependent Variable: # of Renegotiation or Modifications

b. Predictors: (Constant), Official Budget (MM USD), # of shareholders, Reconcession Y/N, Macro Region, Initiative Type, Procurement period, Repeated Shareholder, Year of Begining of concesssion, Construction period, Type of contract, Operational period of contract (yrs), Concession Number

Table 39 Linear regression ANOVA test for # of renegotiations after 2010

Coefficients[a]

| Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1215.639	311.297		3.905	.000		
	Initiative Type	1.193	1.592	.116	.750	.459	.580	1.724
	Concession Number	3.072	1.395	.624	2.202	.035	.174	5.748
	Reconcession Y/N	.083	2.193	.010	.038	.970	.188	5.331
	Macro Region	-.217	.963	-.033	-.225	.823	.638	1.568
	Year of Begining of concesssion	-.608	.154	-.549	-3.935	.000	.717	1.394
	# of shareholders	2.274	.833	.349	2.731	.010	.852	1.173
	Repeated Shareholder	2.469	2.103	.180	1.174	.250	.596	1.677
	Procurement period	-.005	.003	-.192	-1.426	.164	.770	1.298
	Construction period	.001	.001	.209	1.192	.242	.454	2.202
	Type of contract	-3.848	1.789	-.471	-2.151	.040	.291	3.439
	Operational period of contract (yrs)	.119	.072	.371	1.654	.109	.277	3.609
	Official Budget (MM USD)	.003	.003	.158	.926	.362	.481	2.077

a. Dependent Variable: # of Renegotiation or Modifications

Table 40 Linear regression Coefficient for # of renegotiations after 2010

> ➢ # of renegotiations/year

The rate of renegotiations per year shows a clear tendency to increase when the concession number increases, this means that first concessions have a low rate and shows that the procurement process builds a good legal framework for the project. Meanwhile, increasing the concession number increases the renegotiation per year rate, showing that the procurement process loses quality while the concessions number increases.

This is an important insight, and it represents an aspect to work on for the Chilean program, specially under the scope of a growing portfolio of projects and the policy to reconcession them. Clearly the 2010 framework has a positive impact over renegotiations, helping the MOP to lower the rate of renegotiation on first concession, but the data shows that as the concession number progresses the positive impact loses its effect, and the rate of renegotiations increase.

Number of Renegotiations/Year after 2010 new regulation

# of Renegotiations/Year	0	0.1 - 0.5	0.51 - 0.9	1 - 1.5	more than 1.5
First Concessions	42%	33%	21%	4%	0%
Second Concessions	50%	7%	21%	14%	7%
Third Concessions	33%	33%	0%	33%	0%
Fourth Concessions	0%	0%	0%	50%	50%
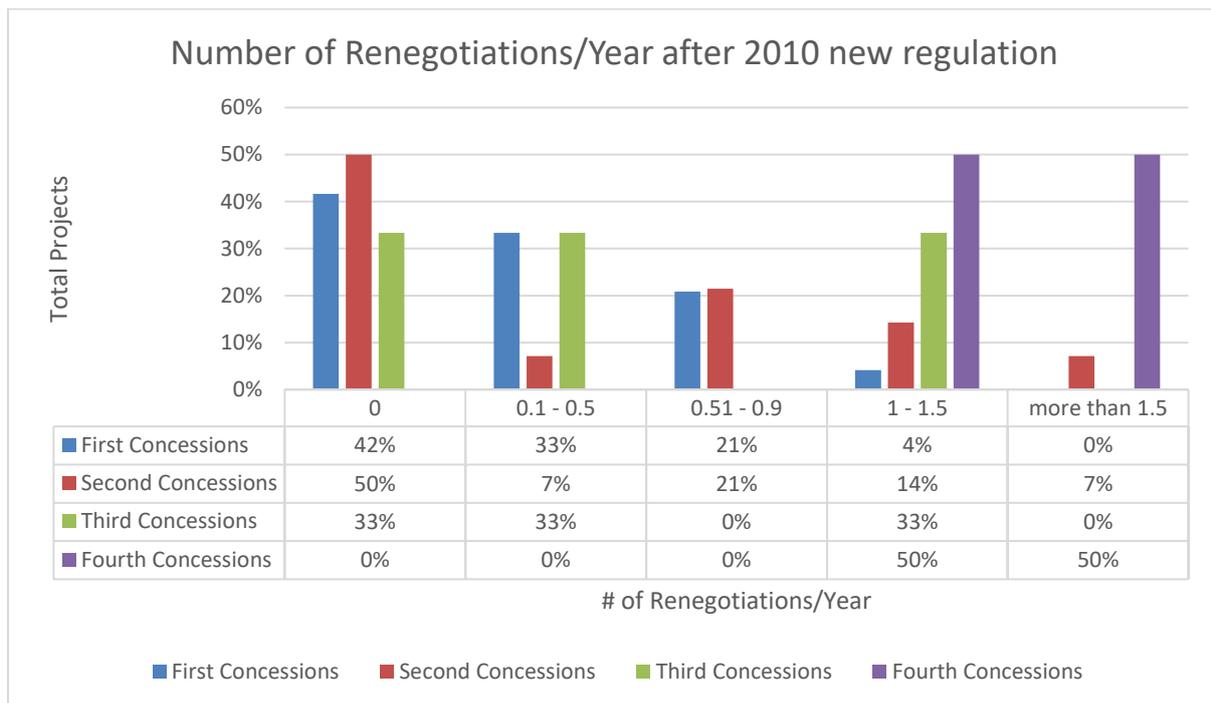
Graph 20 Renegotiations/Year after 2010 new regulation

The linear regression model shows significance and effectiveness to explain the correlation between variables and the variance of the renegotiations/year as shown in Table 41. Furthermore, the ANOVA test shows a significance lower than 5% which indicates the strong significance of the model. Moreover, the link between variables shows a great number of

relationships, being the most relevant for this case: Concession number (sig=0.016), Year of beginning of concession (sig=0.010), # of shareholders (sig=0.019), and Type of Contract (sig=0.035), indicating that renegotiations per year increase with higher number of shareholders, higher concession number, and with variable contracts. Finally, after 2010 the data indicates that renegotiations/year is decreasing as the years go by, meaning that newer projects present less renegotiations/year.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.774[a]	.599	.438	.426400

a. Predictors: (Constant), Official Budget (MM USD), # of shareholders, Reconcession Y/N, Macro Region, Initiative Type, Procurement period, Repeated Shareholder, Year of Begining of concesssion, Construction period, Type of contract, Operational period of contract (yrs), Concession Number

Table 41 Linear regression model summary for Renegotiations/year after 2010

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8.132	12	.678	3.727	.002[b]
	Residual	5.455	30	.182		
	Total	13.586	42			

a. Dependent Variable: Renegotiations/year

b. Predictors: (Constant), Official Budget (MM USD), # of shareholders, Reconcession Y/N, Macro Region, Initiative Type, Procurement period, Repeated Shareholder, Year of Begining of concesssion, Construction period, Type of contract, Operational period of contract (yrs), Concession Number

*Table 42 Linear regression ANOVA test for Renegotiations/year after 2010*

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	117.199	42.912		2.731	.010		
	Initiative Type	.282	.219	.195	1.287	.208	.580	1.724
	Concession Number	.488	.192	.705	2.540	.016	.174	5.748
	Reconcession Y/N	.175	.302	.155	.580	.566	.188	5.331
	Macro Region	.019	.133	.021	.143	.888	.638	1.568
	Year of Begining of concesssion	-.059	.021	-.378	-2.767	.010	.717	1.394
	# of shareholders	.286	.115	.312	2.489	.019	.852	1.173
	Repeated Shareholder	.280	.290	.145	.965	.342	.596	1.677
	Procurement period	-.001	.000	-.153	-1.163	.254	.770	1.298
	Construction period	.000	.000	.272	1.583	.124	.454	2.202
	Type of contract	-.545	.247	-.474	-2.211	.035	.291	3.439
	Operational period of contract (yrs)	.015	.010	.342	1.554	.131	.277	3.609
	Official Budget (MM USD)	2.434E-5	.000	.010	.058	.954	.481	2.077

a. Dependent Variable: Renegotiations/year

Table 43 Linear regression Coefficients for Renegotiation/year after 2010

> ➤ # of shareholders

The Chilean PPPs program has a tendency of SPVs to be formed by two shareholders, this is a tendency that is becoming more visible after 2010 and that also as a logical explanation from a practical point of view: the less shareholders the easiest to manage a project. But the results and the information provided by Graph 21 is that first concessions have more dispersion of the data, meaning that even though the clear tendency to have two shareholders, there are other 7 projects that have more than two shareholders. One of the main reasons that explain these cases is that on first concessions there is a higher risk due to higher costs of construction, therefore investors look to lower the risk by increasing the number of shareholders. If we follow this logic in the analysis of Graph 21, we can see how the number of shareholders decreases and tends to two shareholders, understanding that less shareholders facilitates the management of a contract and that when a project is reconcessed the risk is much lower because there is already an infrastructure in place.
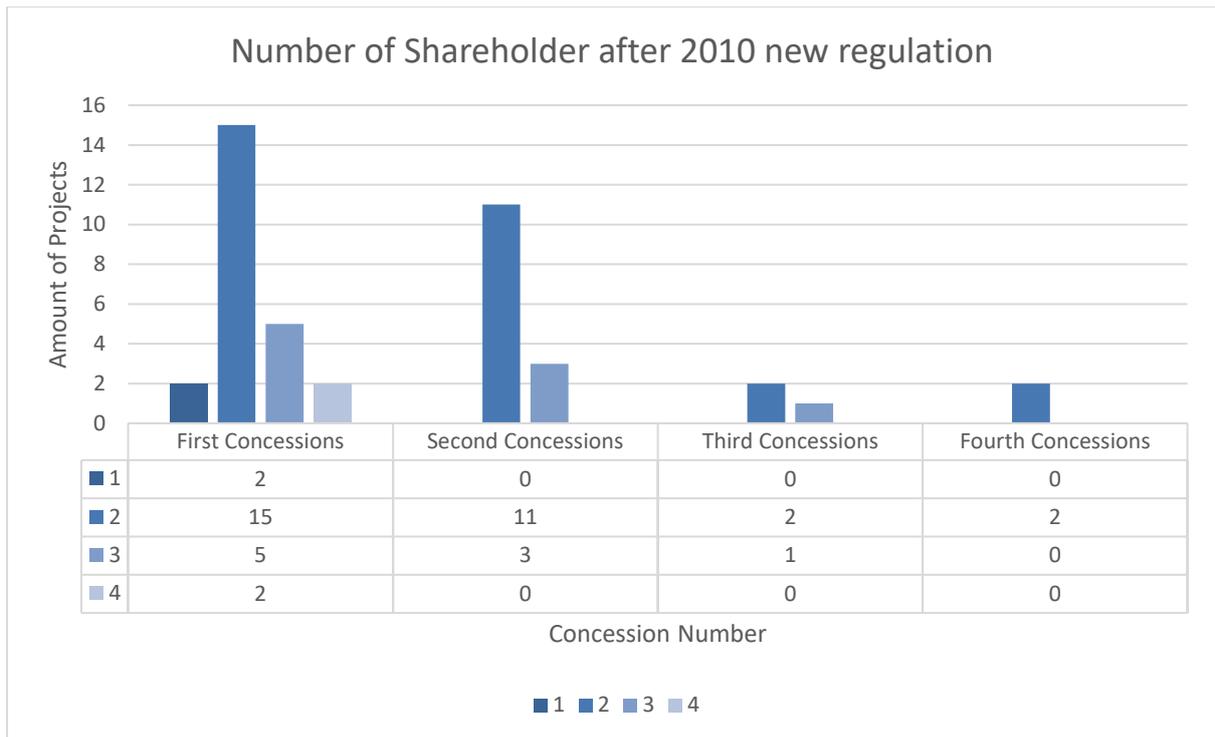
Graph 21 Number of Shareholder after 2010 new regulation

According to the linear regression model, there is a correlation between the variables (R=0.541) but the model is not effective to explain the variation of the number of shareholders (R^2=0.292 < 0.5). Furthermore, the ANOVA test shows a high significance value which implies that the null hypothesis (that the variables do not have an effect over the # of shareholders) cannot be refuted.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.541ᵃ	.292	.041	.608

a. Predictors: (Constant), Official Budget (MM USD), Renegotiations/year, Initiative Type, Repeated Shareholder, Macro Region, Procurement period, Type of contract, Year of Begining of concesssion, Construction period, Concession Number, Operational period of contract (yrs)

Table 44 Linear regression model summary for # of shareholder after 2010

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.732	11	.430	1.164	.350[b]
	Residual	11.454	31	.369		
	Total	16.186	42			

a. Dependent Variable: # of shareholders

b. Predictors: (Constant), Official Budget (MM USD), Renegotiations/year, Initiative Type, Repeated Shareholder, Macro Region, Procurement period, Type of contract, Year of Begining of concesssion, Construction period, Concession Number, Operational period of contract (yrs)

Table 45 Linear regression ANOVA test for # of Shareholders after 2010

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-61.051	67.359		-.906	.372		
	Initiative Type	-.006	.313	-.004	-.019	.985	.580	1.726
	Concession Number	-.550	.205	-.727	-2.682	.012	.310	3.221
	Macro Region	.183	.186	.183	.984	.333	.661	1.513
	Renegotiations/year	.594	.236	.544	2.519	.017	.489	2.045
	Year of Begining of concesssion	.032	.033	.189	.959	.345	.590	1.696
	Repeated Shareholder	-.631	.391	-.299	-1.614	.117	.666	1.501
	Procurement period	.000	.001	-.077	-.442	.661	.745	1.342
	Construction period	.000	.000	-.188	-.812	.423	.428	2.334
	Type of contract	.496	.340	.395	1.459	.155	.311	3.214
	Operational period of contract (yrs)	-.017	.014	-.347	-1.221	.231	.283	3.533
	Official Budget (MM USD)	.000	.001	.099	.483	.633	.539	1.855

a. Dependent Variable: # of shareholders

Table 46 Linear refression coefficients for # of shareholders after 2010

6.6.2. Specific impact - Reconcessions

Reconcessions are an important aspect to study in the Chilean PPP program, since it is one of the models that has most development in this figure worldwide. In this context, the impact of the 2010 new regulations over the capacity, the quality, and the interest for reconcession is of high relevance for this study.

In terms of numbers, after 2010 there are 24 projects that belong to reconcession category, and the scope goes over to airport infrastructure that represents 58% of the total reconcessions after 2010. At the same time, the interurban infrastructure has a bigger economic impact from an

investment perspective which makes this type of infrastructure also relevant for this section.

Infrastructure Type	Number of Projects	% of total Project	Official Budget (MM USD)	% of total investment
Airport Infrastructure	14	58.3%	$ 1,204.92	22.9%
Interurban road infrastructure	8	33.3%	$ 3,983.11	75.7%
Prison Infrastructure	1	4.2%	$ 16.37	0.3%
Urban road infrastructure	1	4.2%	$ 60.00	1.1%
Total	24	100%	$ 5,264.40	100%

Table 47 Reconcessions by Infrastructure type after 2010 new regulations

➢ Reconcession Y/N – Official Budget (MM USD)

After the entry into force of the new regulations, and as shown in the results of Graph 22 the median of the Official Budget is higher than the median before the new regulation and shown on Graph 8 of this study, which shows the increasing of project budgets of the contract that were reconcessed. Furthermore, the interquartile range of the projects reconcessed is bigger which shows that on the reconcessions the spectrum of project budget is much bigger, meaning a positive impact of the new regulation over reconcessions. Moreover, an interesting observation from these results is the smaller interquartile range of the No Reconcessions which points to a problem with projects in the budget range of 180-300 MM USD, and comparatively this interquartile range gets smaller compared to the previous analysis for the case before the Supreme decree N°215 of 2010.

From the analysis of these variables, it is possible to sustain that after the entry into force of the new framework in 2010 the range of budget of the projects reconcessed expand and gets higher, meanwhile for the not reconcessed contracts it gets smaller, more compact and it shows lower budgets than before. Therefore, the overall impact of the new regulations according to budgets is positive for all the quartiles of the private sector, but for the Chilean program it considers higher investments on reconcessions compromising future budgets.

Simple Boxplot of Oficial Budget (MM USD) by Reconcession Y/N
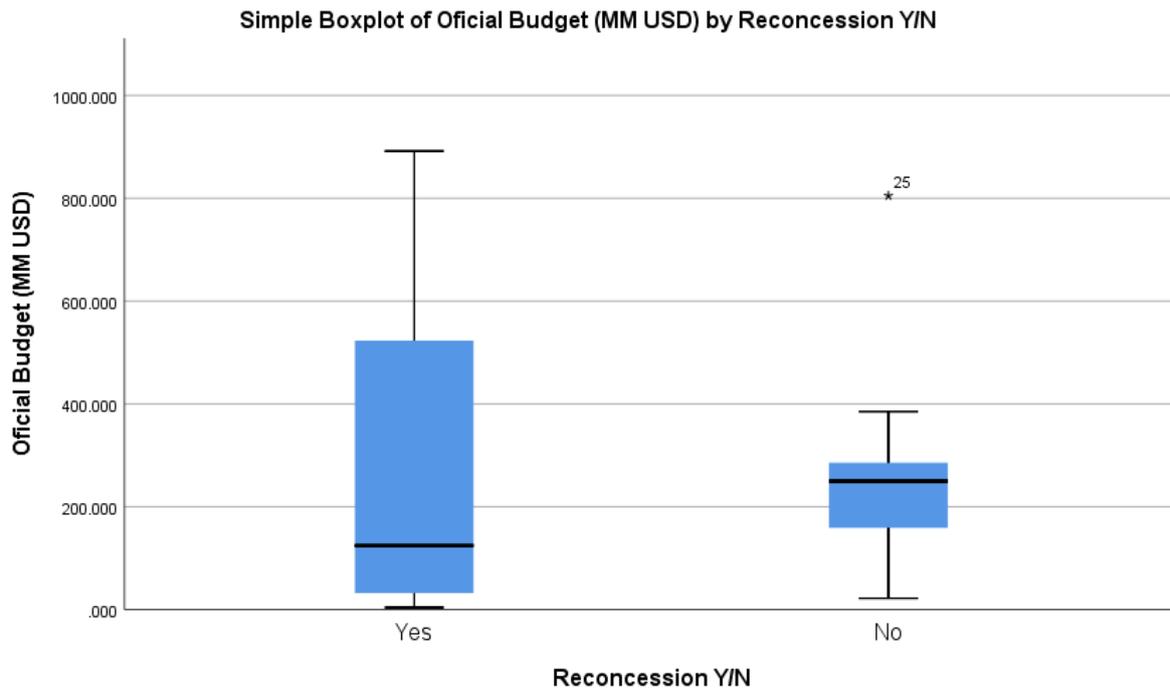
Graph 22 Reconcession Y/N and Official Budget (MM USD) after new regulation of 2010

The statistical test does not confirm the previous findings, as shown in the tables below, the One-Way ANOVA test reports a high significance value which is not inside the target parameters. Nonetheless, the test graph shows a big gap between the mean value of the reconcession and no reconcessions groups, supporting the information extracted from the plot graph above.

ANOVA

Official Budget (MM USD)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5642.278	1	5642.278	.107	.746
Within Groups	2167113.285	41	52856.422		
Total	2172755.563	42			

Table 48 One-Way ANOVA test for Reconcessions Y/N and Official Budget after 2010
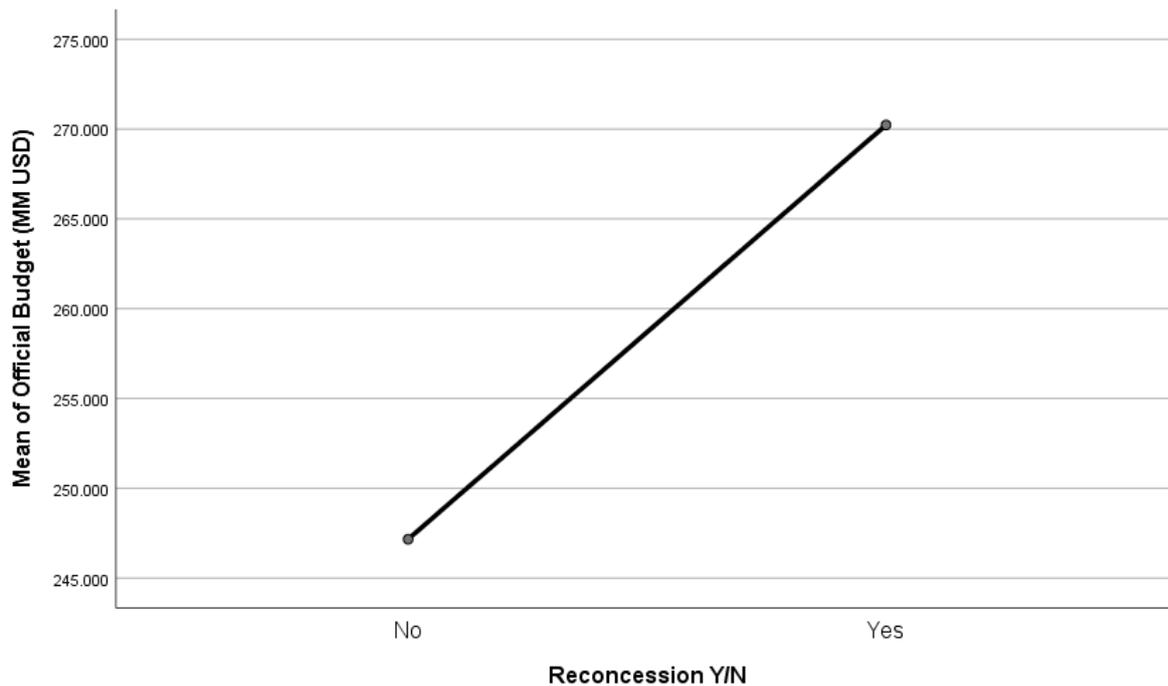
Graph 23 One-Way ANOVA test graph for means of Reconcessions Y/N and Official Budget after 2010

➢ Reconcession Y/N – Construction Period

The impact over the Construction Period is significantly positive since the data dispersion for each case of the variable (Yes and No reconcession) is concentrated in a more logical way, this is:

- For the Yes Reconcession case, the construction period data dispersion is lower, this means that reconcessions are achieving lower periods of construction, making the system more efficient regarding the extension of the construction period. This is a direct impact of the new regulation which objective was to decrease the renegotiations and ensure that the contract terms were fulfilled and not modified. The mechanism stablished by the MOP to avoid the privates abuse in renegotiations produced an efficient development and execution in construction which is a big learning for the program and a big win for the users and the fulfillment of the original contract terms.

- For the No Reconcession case, the data shows that projects with higher periods of construction do not get reconcessed, showing also less outliers and establishing a clear relation between the construction period and reconcession.

These results are logically expected since the theorical objective of PPPs is to benefit from the privates' sector efficiency and value creation, but in the previous section of the study this relation was not clear, and the data did not show significant results. It is possible to affirm that the new framework fixed this problem, and the data indicates that project reconcession is related to the construction period and therefore we can predict outcomes according to this variable.
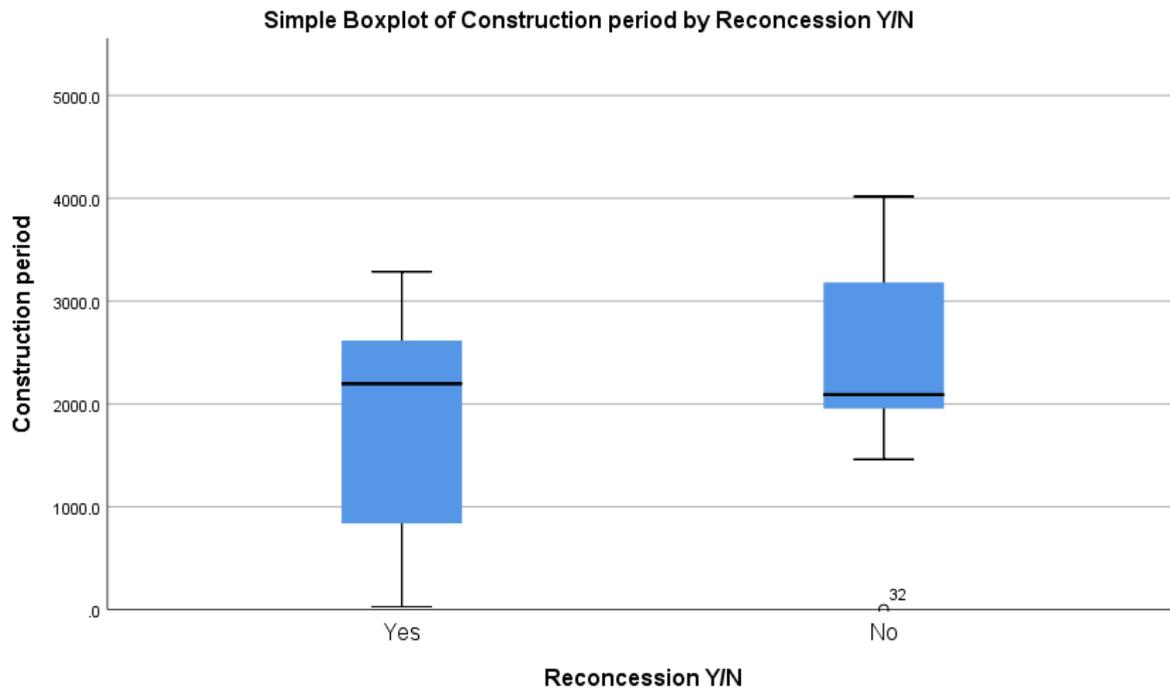

Graph 24 Reconcession Y/N and Construction Period after new regulation of 2010

The statistical test One-Way ANOVA shows a considerable level of significance and provides valid information regarding the longer periods of construction of not reconcessed projects. The data indicates and supports the hypothesis that shorter periods of construction are correlated to higher reconcessions.

ANOVA

Construction period

|	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3530166.525	1	3530166.525	3.337	.075
Within Groups	43372553.75	41	1057867.165		
Total	46902720.28	42			

Table 49 One-Way ANOVA for reconcession Y/N and Construction period after 2010
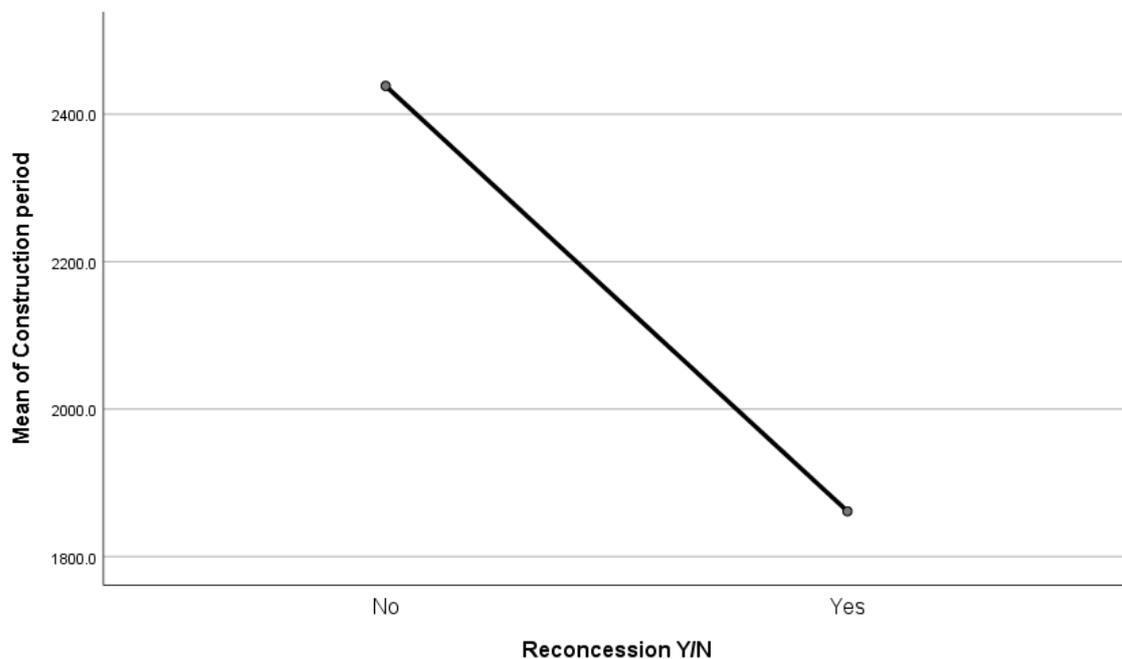
Graph 25 One-Way ANOVA mean graph for reconcession Y/N and Construction period after 2010

➢ Reconcession Y/N – Procurement Period

When addressing the procurement period, the data shows that a longer procurement period is not necessarily a good reference. In fact, the median, the data dispersion, and the interquartile range of the No reconcession case are higher than for the contrary case. These effects can have different possible explanations that require more specific analysis of the data and the cases of study, and that for the scope of this thesis does not qualify. Moreover, it is valid to speculate on the possible causes of this phenomenon, therefore it was observed when studying the data for the database building, that projects that have longer procurement period receive a higher number of questions and observations from the private agents interested in bidding for the concession. In consequence, this indicates that there were unclear or confusing points on the procurement bases of the projects that required to be clarify and therefore extended the procurement periods, showing a sign of a future decrease of the possibility of reconcession and signaling a problematic or directly non-reconcession project.

Simple Boxplot of Procurement period by Reconcession Y/N
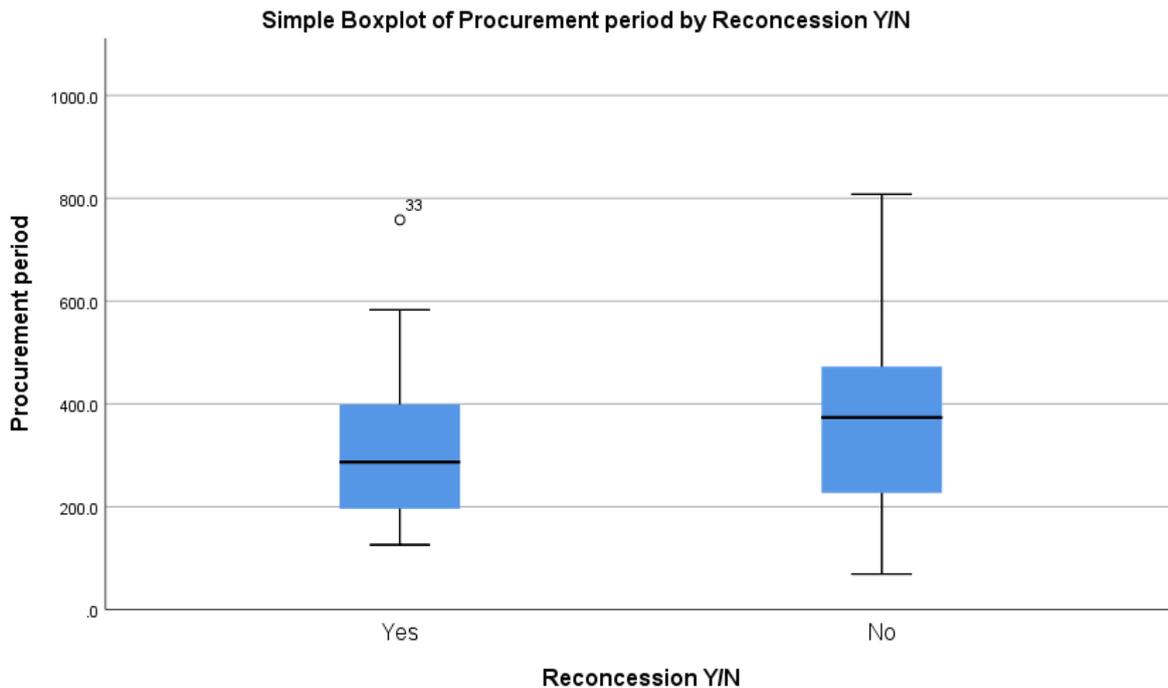
Graph 26 Reconcession Y/N and Procurement Period after new regulation of 2010

Even though the One-Way ANOVA test does not provide significant results, the means graph it provides shows that shorter procurement projects tend to be associated with reconcession, meanwhile longer periods are related to first concessions. This is an important observation due to the high number of renegotiations on higher number of reconcession. Shorter procurement process could be the cause of the increasing negotiations due to poor quality of the procurement.

ANOVA

Procurement period

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17638.128	1	17638.128	.600	.443
Within Groups	1204932.151	41	29388.589		
Total	1222570.279	42			

Table 50 One-Way ANOVA test for reconcession Y/N and procurement period after 2010
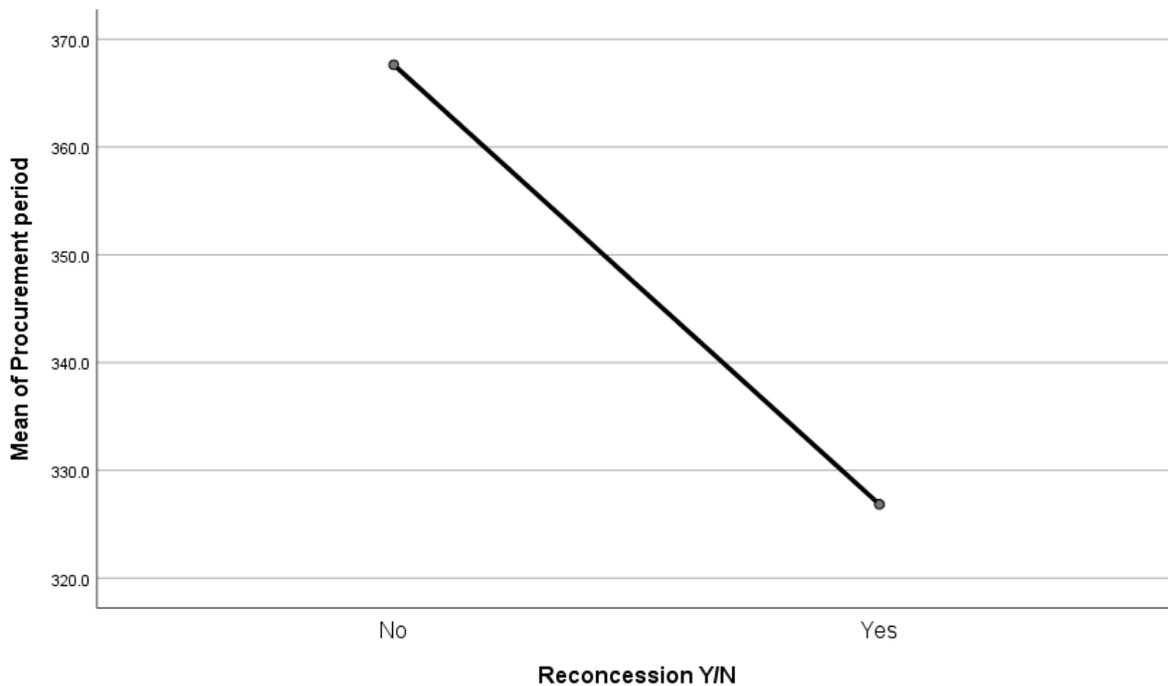
Graph 27 One-Way ANOVA mean graph for reconcession Y/N and Procurement Period after 2010

➤ Reconcession Y/N – Renegotiations/year

The variable Renegotiations/year was included in the study to be able to compare the contracts between each other under the same conditions and legal framework. Furthermore, this variable expressed like a rate makes it possible to analyze contracts that are in different stages of development, and for the non-finished contract to predict in the future will the contract and its renegotiations evolve.

Regarding the data analysis, the results on Graph 28 show that renegotiations/year are higher on reconcessions, higher on the median, on data dispersion, and interquartile range. These results can be explained under the Chilean public policy to reconcession projects. The norm to re-tender a project when the current contract is getting to the end of the concession period is not questioned in the Chilean PPP Program and therefore those projects that do not reach reconcession have special conditions that make them not reach a second period, and in many cases, they do not even reach the construction phase. Furthermore, they enter on the No reconcession case projects that are currently in the first concession, and for these projects the graph shows a positive outcome due to the lower

median of renegotiations/year, which is not the case for 2nd, 3rd or 4th concession projects that are subjects of more renegotiation per year.

Even though these results are not graphically conducive to a conclusion, it was shown on the detailed analysis and study of renegotiations published in 2013 by E. Bitran, S. Nieto-Parra and S. Robledo titled "Opening the black box of contract renegotiations: An analysis of road concessions in Chile, Colombia and Peru" that renegotiations after the new regulations and change of legal framework of 2010 decreased for the Chilean program.

Simple Boxplot of Renegotiations/year by Reconcession Y/N
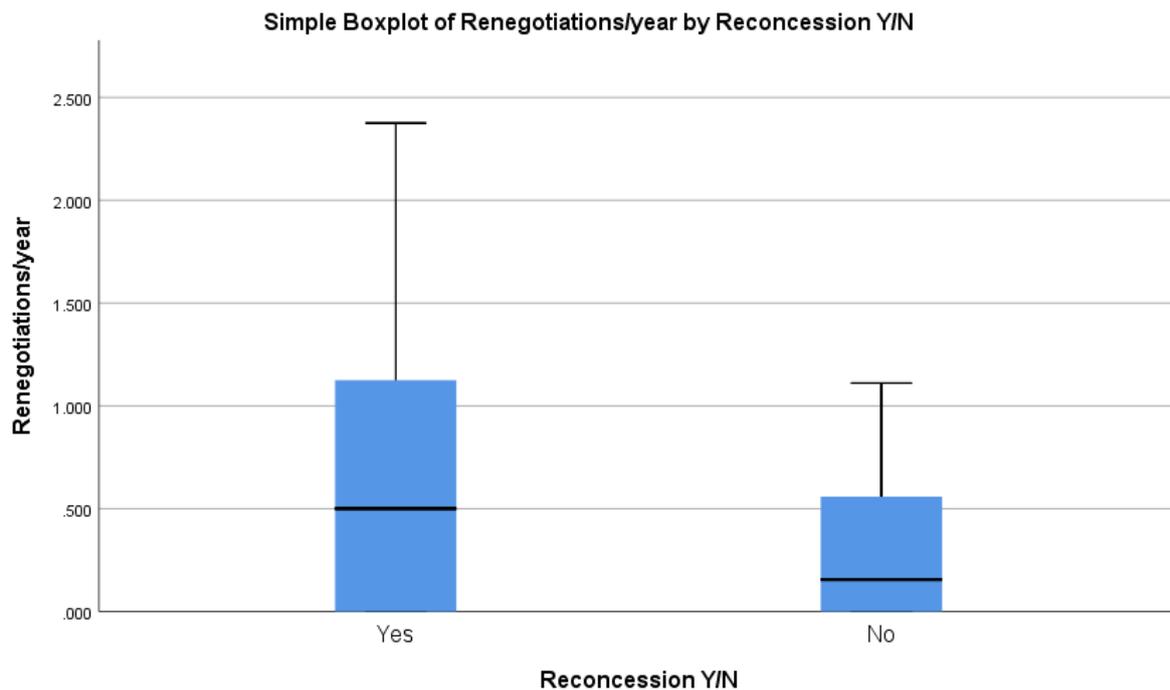
Graph 28 Reconcession Y/N and Renegotiations/Year after new regulation of 2010

With the significance lower than 5% in the One-Way ANOVA, it is possible to stablish that reconcessions have a correlation with renegotiations/year, which is an important insight and aspect for the Chilean PPP program. It is a strong point of improvement for future reconcessions. Some of the reasons that have been proven in this study to impact the increasing of the renegotiation rate are poor procurement process, long periods of construction, and high number of shareholders. The mean gap showed by the ANOVA mean graph below indicates a rate 3 times higher of renegotiations per year for reconcessions, which is a strong statement for the reconcessions performance in the Chilean model.

ANOVA

Renegotiations/year

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.276	1	1.276	4.251	.046
Within Groups	12.310	41	.300		
Total	13.586	42			

Table 51 One-Way ANOVA test for reconcession Y/N and Renegotiations/Year after 2010
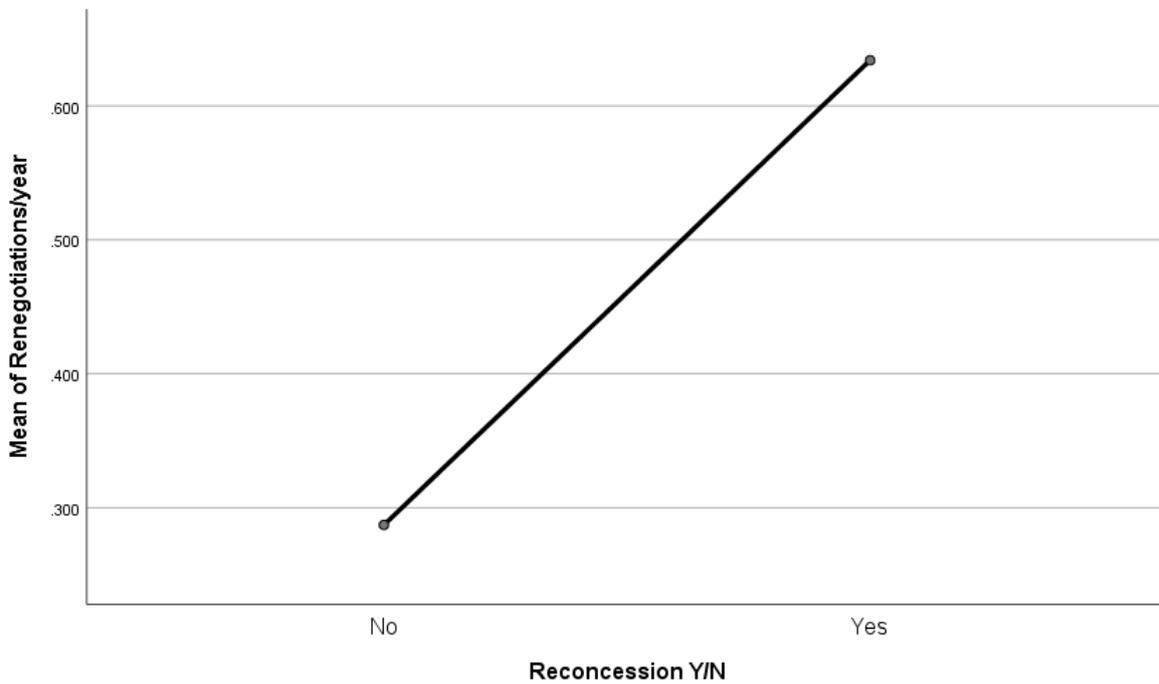

Graph 29 One-Way ANOVA mean graph for Reconcession Y/N and Renegotiations/year after 2010

➢ Reconcession Y/N – Operational Period of Contract (Yrs.)

The main insight that the variable of Operational Period of Contract in years, is that the median for both cases is higher than for contract before 2010. These results can be understood under the logic that many projects after 2011 are not finished concessions and therefore the operational period is considered as the one stated in the contract terms, meanwhile for projects before 2011 there are a larger number of finished concessions that had a shorter operational period than the one stated in the contract and therefore the median on the data is lower. This difference is due to the Present Value of Revenue (PVR or VPI for the definition in Spanish and in the Chilean

Program) that is a term included in Variable Term contracts meaning that a contract is conditioned to the first occurrence of two possible situations: one is the completion of the stated period of the contract and the other is when the net present value of the revenues matches the one stated in the contract. This last case is a financial evaluation method for an anticipated ending of the contract due to a high economic profitability of the project, which present value and the income received by the concessionaire is sufficient to cover the costs of the project and provide a return to the investment. The amount and the method to calculate the PVR is stated on variable term contracts, and it is a useful tool to have shorter operational periods while maintaining the profitability of the infrastructure projects.
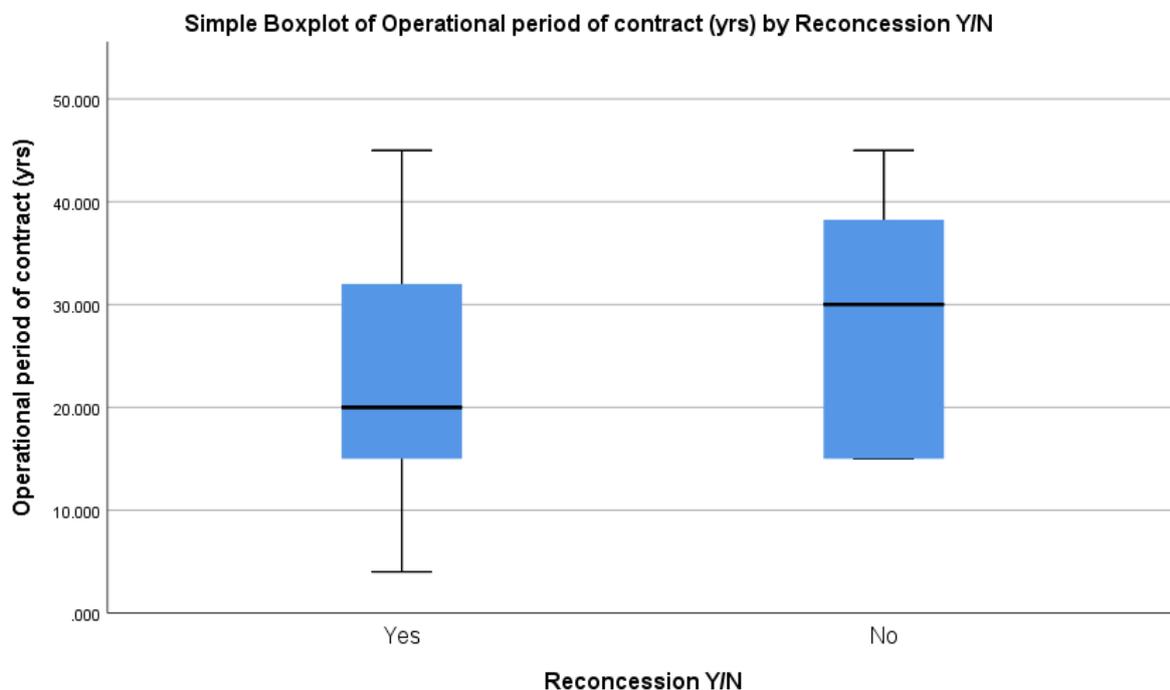

Graph 30 Reconcession Y/N and Operational Period of Contract (Yrs.) after new regulation of 2010

With no conclusive result in the One-Way ANOVA test, it is possible to sustain that the correlation between the two variables is not defined. It is possible though, to state that the reconcessions have shorter operational periods of contract. This can is due to the high numbers of airports reconcessions on the cases selected for this section. In the Chilean PPP program, it is a norm for the airport infrastructure to use short concession periods, with variable contracts and high rotation of concessionaires.

ANOVA

Operational period of contract (yrs)

|	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	349.013	1	349.013	2.250	.141
Within Groups	6359.184	41	155.102		
Total	6708.198	42			

Table 52 One-Way ANOVA test for Reconcession Y/N and Operational period of Contract (yrs.) After 2010
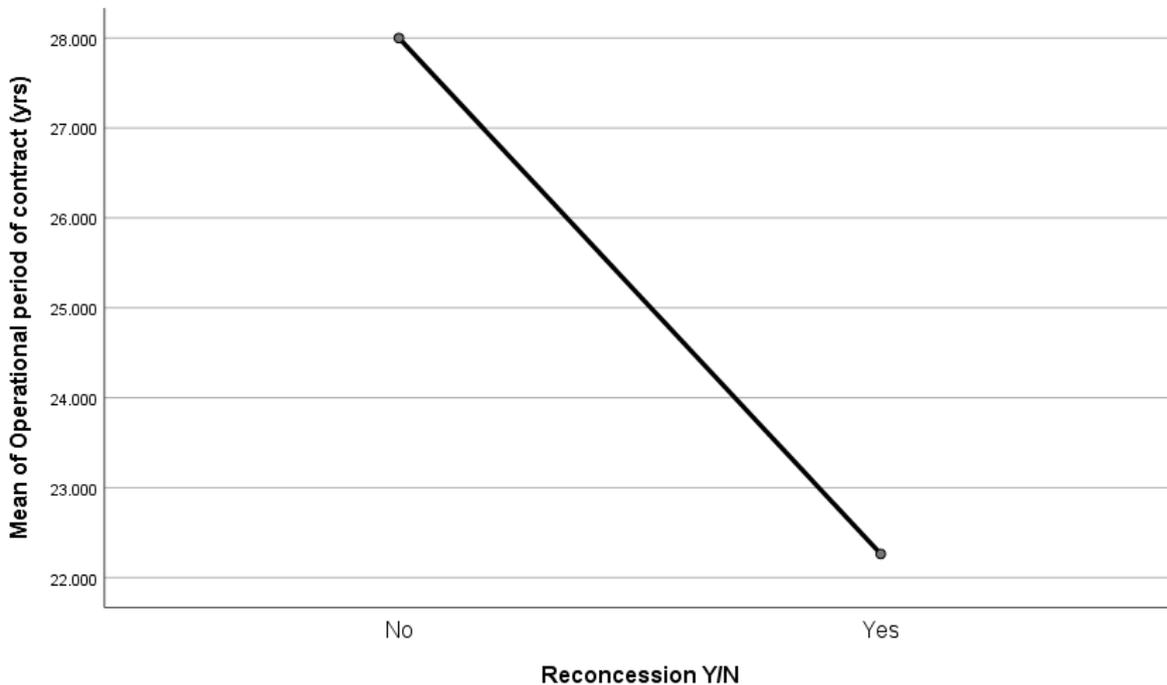
Graph 31 One-Way ANOVA mean graph for reconcession Y/N and Operational period of Contract (Yrs.)

6.7. Finished Concessions

Finally, the third part of the analysis is focused on Finished Concessions, that correspond to 29 projects (34%) of the active contracts on the Chilean PPP Program) and that provides important insights about the reconcession policy that characterizes the Chilean model.
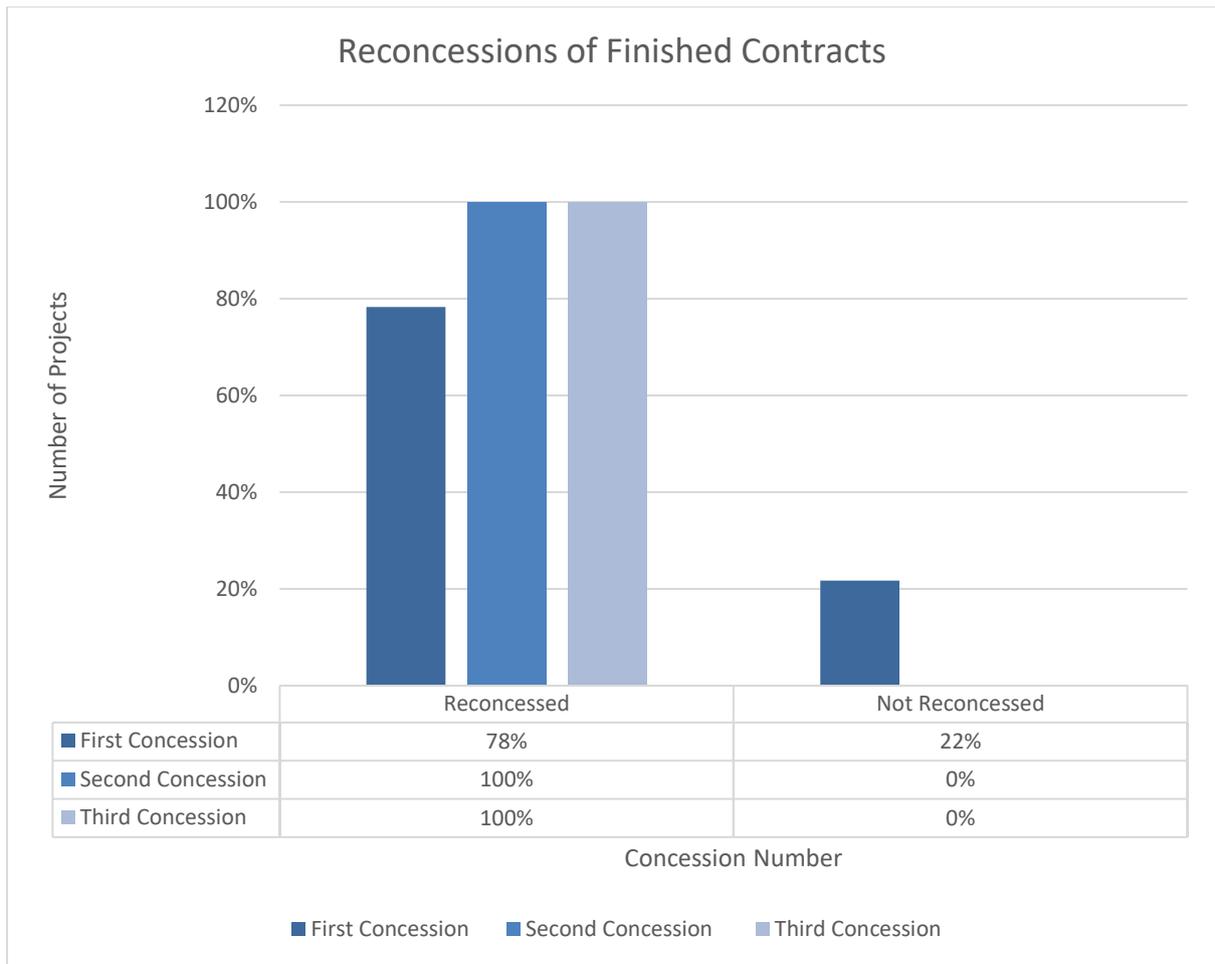
Graph 32 Reconcessions of Finished Contracts

The Chilean program has the tendency and, as how it was stated previously, the structural policy to reconcession a project once the contract is finished. It is important to mention that around the world there are not many programs that have arrived to re-concession a project, and even less programs that have the policy to do so when a contract arrives at the end of the agreed operational period. A rate of 83% of reconcession is not only high, but it has important implications for the future of the program and the Chilean public economy and resources, especially due to the 91 new projects shown in Table 7 Chilean PPP Summary by Concession Number that are considered in the program and that could be reconcessed in the future. When we talk about the implications, we are referring to the cost of maintenance of the public infrastructure and the dependance from the private sector that the public system is growing in Chile.

According to the data analysis first concession have a 78% of reconcession where the exception is built by the following projects:

I. Embalse La Punilla

II.   Conexión Vial Suiza - Las Rejas

III. Corredor de Transporte Publico Av. Santa Rosa

IV.   Estaciones de Transbordo para Transporte Publico

V.   Estación Intermodal Quinta Normal

These five projects correspond to exceptional contracts that arrived at an early termination because of problems and discrepancy with the data considered in the procurement project and what afterwards was the real scenario in the construction and/or operation of the project impacting in a negative way the financial and economic aspects of the project.

From the second and third concessions, we can confirm the policy of reconcessions due to the perfect rate to concession the finished contracts, in these two levels there are currently seven projects that concluded their firs cycle and that have been reconcessed, these projects are:

I.   Second Concession Aeropuerto Carlos Ibañez del Campo de Punta Arenas

II.   Second Concession Aeropuerto Diego Aracena de Iquique

III. Second Concession Aeropuerto El Tepual de Puerto Montt

IV.   Second Concession Aerodromo La Florida de La Serena

V.   Third Concession Aeropuerto Diego Aracena de Iquique

VI.   Third Concession Aeropuerto El Tepual de Puerto Montt

The common characteristic that all six projects have in common is that there are only airports on the second and third concessions finished and reconcessed. This peculiarity induced the analysis to study the reconcessions under the scope of infrastructure Type and as shown in Graph 33, where the 24 reconcessed projects correspond only to airports and interurban road infrastructure. This last characteristic can be explained by the higher costs and higher complexity of these infrastructure types.
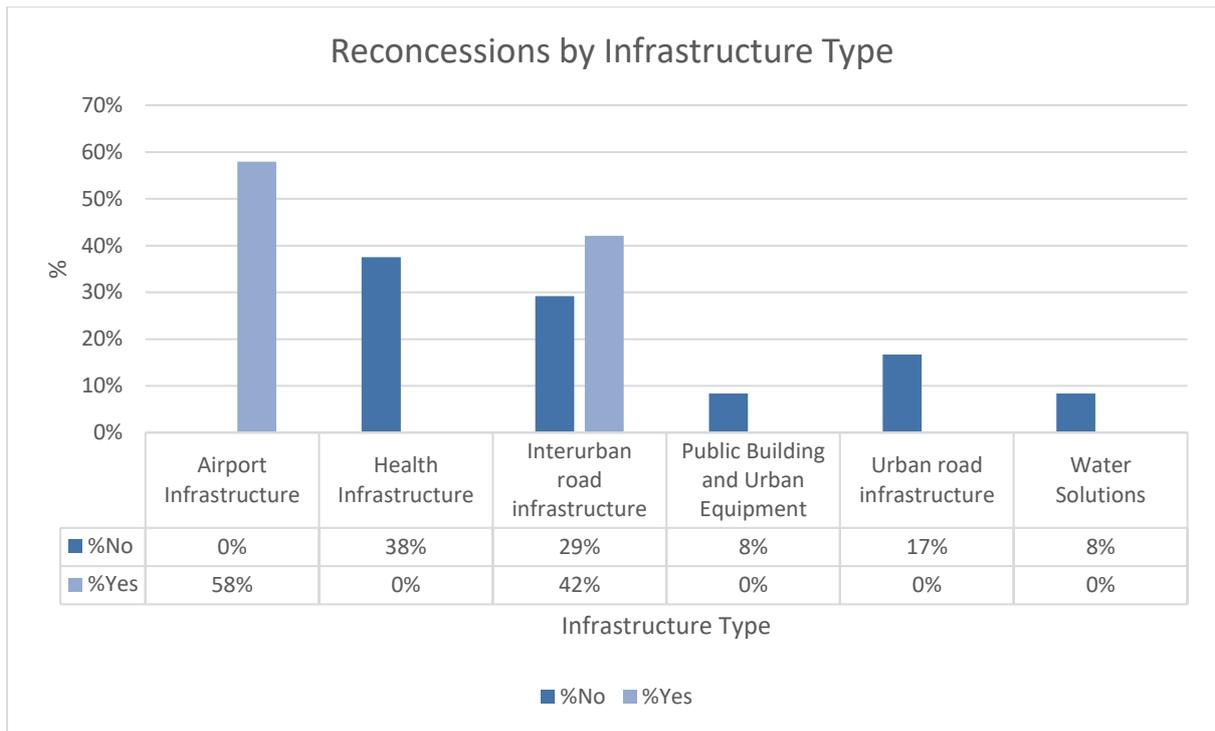
Graph 33 Reconcessions by Infrastructure Type

7. Conclusion

The Chilean Public-Private Partnerships Program with more than 30 years of development has proven to be a complex, well organized, and advanced PPPs Program in the world. From the early years of 1993 the public sector has managed to capture and harness the efficiency and experience of the private sector to empower the country's public infrastructure. These three decades of development have had ups and downs, successes and failures, but most of all, it is full of lessons.

The 2023 official accumulated materialized investment $ 18.378 MM USD shows that the program has reached a high level of complexity and that the Chilean authorities have been able to design an attractive, stable, and fair legal framework that not only protects the government interest, but that also facilitates the access for the private sector to invest and participate in the evolution of the program.

Through chapter 3 of the thesis, it was put into evidence how the Ministry of Public Works has invested economic and political resources to create a long-term project in which every decision is made with restraint, clear objectives, and based on public policies that aim at ensuring high quality development of the Chilean infrastructure. Furthermore, these decisions are based on long period of learning, along which there have been great success cases but also big failures from which the Chilean model has been molded. Later, through chapter 5, it was possible to extract from the big amount of information available in the public system a complete database of the past, current, and future PPP projects. Regarding these phase of the study lays the first big lesson from this thesis: the Chilean public system has a big commitment with transparency and therefore it has a big library of information available for the public, but to be able to organize, study, and learn from that information, there is still a big effort to be done to construct a normalized database that permits a better understanding of the concession program.

The most important learning from this research where registered in chapter 6 under the analysis and results of the data and it was possible to arrive to the following conclusions:

I. The Chilean PPP program is based on a model of Design-Build-Finance-Operate-Maintain-Reconcession process, which in contrast to other similar programs, introduces the "Reconcession" aspect to create a cycle for every project in the program. This aspect is due to main factor: first the program had an exponential growth that concentrated a high quantity of projects with maintenance costs levels that was not possible to transfer to the government and therefore the reconcession path was the best option. And second, the country's fast economic growth demanded a high and constant level of public infrastructure development, therefore the Chilean authority became expert on managing concession contracts rather than the projects itself.

II. The Chilean model, in contrast to other PPP program models, has developed the capacity to extend the spectrum of infrastructure type implementing diverse types of contracts for each one. Moreover, the Type of Contract variable, reviewed and studied in chapter 6, in relation to multiple dependent variables, proved to be of considerable importance to explain the behavior of the system. In this context, it is a great achievement from the Chilean model to be able to implement different rules depending on the need and expected benefit of the project subjected to the infrastructure type.

III. In 2010, the Chilean system implemented major legal modifications to address renegotiations and contract terms litigations. At the time, it was a necessary change for the current conditions of the programs and due to project failures and high economic expenses that the program was generating for the government. But the remarkable achievement was to set a legal framework with a long-term vision of the program, and that considered multiple benefits for the different stakeholders of the program. This legal landmark,

laid the foundation for the development that the program has achieved to date and, as stated in chapter 6, the major challenges for the Chilean program today are born from the variables: reconcessions, numbers of shareholders, renegotiations, and the tendering process. All factors somehow addressed and conditioned by the 2010 Actº20.410.

The conclusions from these study focus on identifying the challenges that the Chilean PPP program needs to address in the next decade of the program, in other words these are the lessons extracted from 30 years of experience:

A. Reconcessions are a Public Policy. This characteristic, which has become a norm on the Chilean model, is growing a portfolio of projects from which, the country depends on the private sectors resources, due to the incapacity of the state to assume the maintenance cost and transfer the projects to public administration. Furthermore, the economic burden of reconcession is paid by the users, and the program needs to develop a tariff management system that will be prepared for the complexity and the growth of the program in the next decade. Chile already had issues in this matter during 2019 riots and massive manifestations against excessive costs of public services.

B. The design, procurement, and public tendering process need to be improved and upgraded, especially those for reconcession that have been proved to be related to an increase in renegotiations and longer periods of Project development on the study of chapter 6. The focus that the Chilean program has put in improving the development process for first concessions must be improved and adapted for reconcessions due to the high numbers of projects that will enter to the reconcession cycle. Furthermore, the projects that had already been reconcession, have provided important insights of the variables that need to be observed (# of shareholders, type of contracts, and procurement and construction periods), and the program must include modifications to the system tendering process that ensure the

best possible outcome regarding competitiveness, benefits for the users and passive stakeholders, and efficiency in the development and operation of the project.

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