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Privatizing Retirement: The Case of the Female Chilean Worker

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Privatizing Retirement: The Case of the Female Chilean Worker

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Introduction

Chile has been called the "promised land" of Latin America, a First World country, and an economic miracle. Privatizing social security in Chile has often been hailed by economists as the key for their unprecedented economic growth and success within the past few decades—so much so that other countries have adopted similar pension models within their own countries. Somewhere along this path of astonishing economic growth, Chile, like other developed nations, has arrived at a point where it can no longer assume that the typical worker is a man. Yet as the gap continues to decrease between female and male labor force participation, the gap between female and male retirees remains ever present. In other words, the typical retiree is still a man. Because the calculation of retirement benefits is based on the idea of individual insurance, the uncontrollable economic, cultural, and demographic characteristics that shape the present reality of the Chilean woman are also shaping her future. Chile's transition from a pay-as-you-go system to a system of individual accounts was economically sound and macroeconomically successful, yet I argue that it wasn't pareto optimal, as the variable of gender was lost in the calculation of transition costs.

Through constructing the economic profile of the average female Chilean worker—observing female wages, fertility, life expectancy, education, and retirement age—this study aims to replicate and demonstrate the gender pension differential that has existed under the privatized model of retirement in Chile since 1981 by means of simulation. Additionally, the results of this study of Chile's past and present will bridge significant discussion into Chile's future. Hypothetically having the ear of the Chilean Constitutional Congress, my research will foster suggestions for system design and policy changes, such as an increase in the female retirement age or expanding the benefits of maternity leave and childcare that could significantly improve the position of the average Chilean female retiree under a system of privatized retirement.

This study is structured as follows; Section I provides relevant historical background on Chile's systems of retirement, Section II is the literature review, Section III details the theoretical framework, Section IV explicates the empirical framework and analysis, Section V describes the data and summary statistics, and Section VI concludes with the results and discussion.

I. Historical Background

The Pre-Reform Evolution of Retirement in Chile: 1924-1980

It's impossible to measure the success of anything without simultaneously comprehending the reason for its existence; success is virtually inseparable from the achievement of goals. Any study attempting to measure the success of a policy, for example, ought to start by identifying why that policy was originally created. This is precisely where this study begins.

The success of the Chilean retirement pension system—past or present—is assessed by the extent that it achieves the end it was created for. To identify these 'ends', this chapter begins

with the origin story of social policy and retirement within Chile in the 1920s. It is then preceded with a section detailing the particular design and deficiencies of the distribution retirement system as it existed shortly before the reform of 1981—laying out the 'ends' for which the 1981 reform was then created to achieve.

Age of Formation: 1924 – 1951

The development of a 'welfare state' has generally been a milestone reached first by larger, more developed nations. Yet despite happening later in time, the adoption of social policy within Latin American countries has actually been introduced at an earlier period in development than these industrialized nations—in large part due to the seriousness of poverty and socioeconomic inequalities that exist in underdeveloped countries (Arellano, 1985). The Chilean experience is of particular interest because it was one of the pioneers in Latin America for the development of social policies, leading the charge for greater equality of opportunities. This section will review the rapid and strong development of social policy, and more specifically of social security and a retirement pension system that took place in Chile between 1920 and 1972.

During the 19th century, and up until the Great Depression in 1930, the driving force behind Chile's economic development was external demand. Minerals[1] and agricultural exports were the leading sectors of their economy. Saltpeter extraction was considered the main driving economic force during the last two decades of the 19th century up until the First World War. The role of the State, consequently, was therefore oriented toward the construction of basic infrastructure for exportation. For the benefit of their domestic economy, the State found mechanisms to capture part of the fruits of export. The resources of export taxation accelerated the construction of railways and basic infrastructure (Arellano, 1985).

The forces of industrialization gave rise to a strong migration of labor from rural Chile, leading to an extremely significant diversification of the economy and social structure (V., H.C. 1991). Yet with this new age of industrialization came new social problems, derived from the living and working conditions of workers[2]. It was during this period that the 'social question' came into play, brought to the forefront by many workers' formations and street protests—many of which turned violent[3].

With the election of Arturo Alessandri in 1920 came a wave of new legislation to address this social question. These social laws were presented in 1921 and were passed in September of 1924 under military pressure—including the first and most significant step towards a system of social security and retirement within Chile—the Cajas de Previsión[4].

"La Caja de Seguro Obrero" (predecessor of the SSS), "La Caja de Empleados Particulares" (Private Employees) and "La Caja de Empleados Público" (Public employees) were enacted by these laws. All of these held in common the establishment of some sort of compulsory insurance mechanism to cover risks of disability, old age, and illness. They were subsequently expanded

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[1] Copper, silver, gold
[2] No regulations for safety or hygiene in the workplace, resulting in many labor accidents, extremely low wages, and no maximum workday. Child and female labor especially lent itself to numerous abuses.
[3] Even though strikes were illegal, there were 200 strikes in the last decade of the 19th century alone. Within the earlier years of the 20th century, strikes intensified and became so violent that thousands of workers' lives were lost (SOURCE).
[4] Directly translated into English: Provident Funds

over the next few decades to improve protection and to cover other risks. The administration of these institutions was in the hands of the State.

The system was continually reformed and expanded in the years beyond 1924, with its most notable reformation happening in 1952. New workers were covered, and new benefits were gradually established. Special attention was also paid to the female worker's entry into the workplace. Despite having a longer lifespan than men, women were given the right to an earlier pension, and was exempted from the obligation of recording a minimum number of contributions during working years in order to qualify for a pension. This was done in order to consider and recognize women's unpaid work in the home (Arellano, 1985).

At the same time during this period of reform, the administrative structure of the "Caja de Seguro Obrero" was reorganized, giving rise to the Servicio de Seguro Social (SSS).

The increase in benefits that occurred during this period was reflected in higher tax expenditures on social services, which more than tripled between 1930 and 1955. This expansion in social spending is particularly visible in the increased coverage of the social security system that took place. In 1935, just over 900,000 workers were affiliated with the 'Cajas,' while in 1955 there were 1,600,000 affiliates, which represented roughly 65% of the working population at the time (V., H.C. 1991).

However, the increase proportion of the population that was favored by social spending was not actually uniform. Particular unions and workers' groups sought out laws creating benefits in their favor. The result was a complex legislation that resulted in highly unequal structures of benefits and contributions across sectors and occupations. At the end of this expansion period, there were more than 32 different 'Cajas' with very different benefits, contributions, standards, and regulations (V., H.C. 1991).

Pre-Reform Design and Deficiencies

The reforms underwent by Chile's social security system between the years of 1924 and 1980 were numerous and extensive[5]. This section, however, pays particular attention to the design of the social security system of retirement as it existed shortly prior to the 1981 reform, specifically during the late 1970s. This period is examined in order to starkly observe the deficiencies in the design of the distribution system—as it was these deficiencies that provided the presumed justification for the 1981 privatization reform, and the basis for assessing its success.

Description of the 1970s Social Security System

The version of Chile's retirement system that existed shortly prior to the 1981 reform is often described as occupation-based, complex, and, quite frankly, out of control. Until the radical privatization in 1981, the Chilean system was structured based on semi-public institutions, mentioned previously, called 'Cajas de Previsión,' which collected the contributions that had to be made by workers and their employers and were responsible for paying the benefits granted by the system. Although there are some discrepancies as to the classification and nature of this

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[5] For discussion on the reforms occurring between this period, reference Arellano, J.P (1895), pp. 27-62

system[6], the system as it existed for the 55 years prior to the reform is most often characterized as a pay-as-you-go (PAYG) system.

By the 1970s, roughly 75% of the country's workforce was affiliated with this system, based on more than 32 Cajas (Arellano, 1985). Most workers in Chile were affiliated with one of these three main institutions:

1. El Servicio Seguro Social (SSS) – 45% of the workforce
2. La Caja de Empleados Particulares (EMPART) – 11% of the workforce
3. La Caja de Empleados Públicos y Periodistas (CANAEMPU) – 7% of the workforce

The 30 or so remaining Cajas accounted for 12% of the workforce

TABLE 1.0

ACTIVE DEPOSITORS BY 'CAJA' IN 1979		
NAME	TRANSLATION	%
Servicio de Seguro Social (SSS)	Social Security Service	64.88
Caja de Previsión de Empleados Particulares (EMPART)	Provident Fund of Private Employees	17.59
Caja Nacional de Empleados Públicos y Periodistas:Sector Empleados Públicos (CANAEMPU)	National Fund of Public Employees and Journalists: Public Employees	11.62
Caja Nacional de Empleados Públicos y Periodistas: Sector Periodistas (Periodistas)	National Fund of Public Employees and Journalists: Journalists	0.67
Caja Bancaria de Pensiones (Bancaria)	Bank Fund of Pensions	0.58
Caja de Previsión y Estímulo de los Empleados del Banco de Chile (Banco de Chile)	Provident and Stimulus Fund of Employees of the Bank of Chile	0.12
Sección Previsión Social del Banco Central (Banco Central)	Social Security Section of the Central Bank	0.05
Caja de Previsión y Estímulo de los Empleados del Banco del Estado (Banco del Estado)	Provident and Stimulus Fund of Employees of the Bank of the State	0.32
Caja de Previsión de la Defensa Nacional (Defensa)	Provident Fund of National Defense	ND
Dirección de Previsión de Carabineros de Chile (Carabineros)	Provident Fund of Law Enforcement of Chile	ND
Caja de Previsión de la Marina Mercante Nacional: Sección Tripulantes de Naves y Operarios Marítimos (TRIOMAR)	Provident Fund of National Merchant Marines: Ship Crew and Maritime Operators	1.24

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[6] See Lindert, P.H. (2021), pp. 292 - 296

Caja de Previsión de la Marina Mercante Nacional: Sección Empleados y Oficiales (CAPREMER)	Provident Fund of National Merchant Marines: Employees and Officers	1.03
Caja de Previsión de Empleados del Hipódromo Chile (Hipódromo Chile)	Provident Fund of Employees of Horse Racing Track of Chile	0.02
Caja de Retiro y Previsión Social de Empleados del Club Hípico de Santiago (Club Hípico de Santiago)	Retirement and Social Security Fund of Employees of the Horse Racing Club of Santiago	0.03
Caja de Retiro y Previsión Social del Valparaíso Sporting Club (Sporting Club)	Retirement and Social Security Fund of Employees of the Horse Racing Club of Valparaíso	0.02
Caja de Retiro y Previsión Social de Empleados del Club Hípico de Antofagasta (Club Hípico Antofagasta)	Retirement and Social Security Fund of Employees of the Horse Racing Club of Antofagasta	NS
Caja de Ahorro y Retiro de Empleados del Club Hípico de Concepción (Club Hípico Concepción)	Retirement and Social Security Fund of Employees of the Horse Racing Club of Concepción	NS
Caja de Previsión Social de los Profesionales Hípicos de los Hipódromos Centrales (Hipódromos Centrales)	Social Security Fund of Professional Jockeys from the Central Racetracks	0.05
Caja de Ahorro y Retiro de Preparadores y Jinetes de Antofagasta (Preparadores y Jinetes Antofagasta)	Retirement and Social Security Fund of Trainers and Jockeys of Antofagasta	NS
Caja de Ahorro y Retiro de Preparadores y Jinetes de Concepción (Preparadores y Jinetes Concepción)	Retirement and Social Security Fund of Trainers and Jockeys of Concepción	NS
Caja de Previsión para Empleados de Salitre (Salitre)	Provident Fund for Saltpeter Employees	0.15
Caja de Previsión Gildemeister (Gildemeister)	Provident Fund for Gildemeister	0.04
Sección Especial de Previsión para los Empleados de la Compañía Cervecerías Unidas (CCU)	Special Section Fund for Employees of the United Brewing Company	0.04
Sección de Previsión Social de los Empleados de la Compañía de Consumidores de Gas de Santiago (Compañía de Gas)	Section of Social Security for Employees of the company of Consumers of Gas in Santiago	0.03
Sección de Retiro de los Empleados de Mauricio Hochschild y Cía. Ltda. (Hochschild)	Retirement Fund for Employees of Mauricio Hochschild y Cía. Ltda.	NS
Caja de Previsión Social de los Ferrocarriles del Estado (FF.CC.)	Provident Fund for the State Railways	0.55
Caja de Retiro y Previsión de los Empleados Municipales de la República (EE.MM. República)	Retirement and Provident Fund for Municipal Employees of the Republic	0.24
Caja de Previsión Social de los Empleados Municipales de Santiago (EE.MM. Santiago)	Social Security Fund for Municipal Employees of Santiago	0.08

Caja de Previsión Social de los Empleados Municipales de Valparaíso (EE.MM. Valparaíso)	Social Security Fund for Municipal Employees of Valparaíso	0.01
Caja de Previsión de Empleados y Obreros de la Empresa Metropolitana de Obras Sanitarias: Depto. Empleados (EE. EMOS)	Provident Fund for Employees and Manual Workers of the Metropolitan Sanitary Works Company: Employees	0.05
Caja de Previsión de Empleados y Obreros de la Empresa Metropolitana de Obras Sanitarias: Depto. Obreros (OO. EMOS)	Provident Fund for Employees and Manual Workers of the Metropolitan Sanitary Works Company: Manual Workers	0.04
Caja de Previsión Social de los Obreros Municipales de la República (OO. MM. República)	Social Security Fund for Municipal Manual Workers of the Republic	0.55

Source: *Superintendencia de Seguridad Social*
NS: "Not Significant"
ND: "No Data"

The broad protection of members, as well as the proportion of members covered by the system put Chile at the head of Latin America in terms of social security. Yet even so, the design of the distribution system was riddled with significant deficiencies.

Deficiencies Created by the System's Design

Several evaluations were conducted to scrutinize the performance of and diagnose deficiencies in the old pay-as-you-go system—the most notable and useful of these being the Klein-Saks mission[7] and a report by the Oficina de Planificación Nacional, or ODEPLAN, in 1971. Each study provided a snapshot of the Chilean pension system as it stood up until the second half of the 1900s, varying in detail, and varying in results. Yet the most common and significant source of deficiencies found across studies was the occupation-based design of the social security model, resulting in significant unfairness and wealth inequality between workers, and the inefficient management of the 'Cajas,' resulting in the system being significantly underfunded.

1. *Occupation-Based Design: Unfairness*

The occupation-based design of the old system is apparent after reviewing Table 1.0 above, as it details specific Cajas de Previsión that existed for a wide array of workers, from the employees of the Bank of Chile to the jockeys and trainers of Antofagasta.

As mentioned previously, the increase of the population that was favored by social spending during the age of expansion was not actually uniform. Benefits were higher for the groups that exerted the most pressure. The result was a complex legislation that resulted in highly unequal structures of benefits and contributions across sectors and occupations. By the 1970s, there were

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[7] Misión Klein-Saks (1958), El programa de Estabilización de la Economía Chilena y el Trabajo de la Misión Klein-Saks

more than 32 different 'Cajas' with very different benefits, contributions, standards, and regulations.

This section will review the varying standards that existed to obtain old-age pensions between six different Cajas (SSS, EMPART, CANAEMPU, Bancaria, Banco de Chile, Banco del Estado).

These observations are based on the situation of these Cajas in decades well in advance to the changes made over the last 15 years of the old system. This is done in order to show what the old system was truly like before fundamental changes were made to it during the period from 1974 to 1980, so that an appropriate comparison can be made with the new pension system. It should also be noted, that the Cajas provided several forms of "pensions," such as sickness, widowhood, orphanhood. However, for the sake of relevancy to the overall study, this comparison is limited to the comparison old age pensions.

I. **Servicio de Seguro Social (SSS)[8]**

Beneficiaries: All workers (obreros: manual workers) earning a salary, apprentices, some groups of self-employed workers, etc.

Requirements for Old-Age Pension
- Men: 65 years of age
- Women: 55 years of age
- Minimum of 800 weeks of contributions (approximately 15 years)
- Density of contributions no less than 0.5 in the period of affiliation

Calculation of Pension
Base amount (50% of the monthly base salary), plus 1% of said salary for every 50 weeks in excess over the first 500 weeks, with a maximum limit of 70% of the monthly base salary

Definition of Base Monthly Salary
The sum of the incomes on which taxes have been made during the five calendar years prior to the date of retirement, divided by 60

II. **Caja de Previsión de Empleados Particulares (EMPART)** [9]

Beneficiaries: Private employees that make deposits to this Caja

Requirements for Old-Age Pension
- Men: 65 years of age
- Women: 65 years of age

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[8] Law No. 10.383 (1952)
[9] Law No. 10.475 (1952)

Calculation of Pension

Base salary multiplied by the number of years of service/contributions, divided by 35. The pension may not exceed the base salary.

Definition of Base Monthly Salary

Average of the taxable wages affecting the pension amount (wages received in the 60 months prior to the collection of the benefit).

III. **Caja Nacional de Empleados Públicos y Periodistas: Sección Empleados Públicos (CANAEMPU)[10]**

Beneficiaries: contracted employees of the Public Administration, employees of services or institutions independent of the State; employees of the Sociedad de Fomento Fabril, Sociefad Nacional de Agricultura and Sociedad Nacional de Minería.

Requirements for Old-Age Pension:
- Minimum of 10 years of contributions
- 65 years of age

Calculation of Pension:

Base salary multiplied by the number of years of service, divided by 30. The pension cannot exceed the base salary amount.

Definition of Base Monthly Salary

Average of the salaries, wages, fixed fees, commissions, and gratuities received by the depositor in the last 30 months served, and on which contributions have been made.

IV. **Caja Bancaria de Pensiones:[11]**

Beneficiaries: Employees of commercial, mortgage, and development banks

Requirements for Old-Age Pension:
- 55 years of age
- Minimum of 3 years of contributions

Calculation of Pension:

Base monthly salary multiplied by the number of years of contributions, divided by 35

Definition of Base Monthly Salary

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[10] DFL No. 1.340 (1930)
[11] Law No. 8.569 (1946)

Average of the salaries, wages, fixed fees, commissions, and gratuities received by the depositor in the last 30 months served, and on which contributions have been made.

V. Caja de Previsión del Banco de Chile

Beneficiaries: Employees of the Bank of Chile

Requirements for Old-Age Pension:
- 55 years of age
- Minimum of 13 years of work

Calculation of Pension:
Base monthly salary multiplied by the number of years of contributions, divided by 35

Definition of Base Monthly Salary
Average of the salaries, wages, fixed fees, commissions, and gratuities received by the depositor in the last 36 months served

VI. Caja de Previsión de Empleados del Banco del Estado de Chile [12]

Beneficiaries: Employees of the bank of the State of Chile, the Superindendency of Banks, the Caja of Labor Accidents, and the Caja itself.

Requirements for Old-Age Pension:
- 55 years of age
- Minimum of 15 years of contributions

Calculation of Pension:
Base monthly salary multiplied by the number of years of contributions, divided by 35

Definition of Base Monthly Salary
The average taxable wages of the depositor in the last 24 months, and on which taxes have been made. In the case of depositors who have completed 35 years of service, this will correspond to the average of the last 12 months.

Additionally, all the Cajas mentioned above, with the exception of the SSS, included within their benefits the granting of "pensiones de antigüedad" (seniority pensions[13]). For EMPART, to receive a seniority pension, 35 years of work was required, for CANAEMPU it was 30 years,

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[12] Statues published in 1948

[13] Defined: if a worker completes the required years of contributions/service, you can retire at any age without pension reduction

and for the Caja Bancaria de Pensiones and the others in its sector, 24 years was required (V., H.C. 1991).

For example, in the Caja de Bancarias, where the requirement for a seniority pension was 24 years of work, an employee who began working at age 18 could then retire at the age of 42 with no pension reduction. In contrast, a worker affiliated with the SSS—the Caja whose number of members represented approximately 65% of the total members within the social security system in 1979—who also began working at age 18, had to wait until the age of 65 to receive an old-age pension.

It's also notable that the Cajas de Previsión used different methods to estimate the monthly base salary—a measurement directly tied to the calculation of the pension amount of a worker. In the case of SSS and EMPART, the base salary was calculated considering the salaries received during the last 5 years, while in CANEMPU and the Caja de Bancaria de Pensiones and others within its sector, only the last 3 years were considered in calculations. The calculations were based on an average of nominal wages, so those workers whose average was calculated considering a smaller number of months were less harmed.

All these observations aside, the discrepancies between the Cajas de Previsión are put into the clearest perspective when comparing their replacement rates, or in other words, the amount of pension calculated as a percentage of the last taxable salary.

TABLE 1.1

CAJA DE PREVISIÓN	REPLACEMENT RATE (%)
SSS	60.8
Caja Bancaria de Pensiones (and others in its sector)	Began work at age 18: 81.3 Began work at age 25: 69.6
EMPART	86.8
CANAEMPU*	78*

Source: *V., H.C. 1991*

*The 78% replacement rate of CANAEMPU was a lower limit for some employees, as they were entitled to the special benefit called "pensiones perseguidores," or "matching" if they obtained a managerial position or reached the top in the respective ranking. This meant that the pension they received upon retirement was readjusted according to variations in the salaries of active workers in the jobs that they had held previously (Acuna R., Rodrigo & Iglesias P., 2001).

According to this analysis, it reveals that those in the most disadvantaged sector were affiliated with the SSS, which, as mentioned previously, made up 65% of all affiliates in the system.

2. *Inefficient Management of 'Cajas': Underfunded*

The ratio of contributors to pensioners within the first few decades of the system's operation generated a significant surplus—enticing the government to increase benefits. However, these benefits would not be sustainable as the system matured (OECD, 1998). The two options for confronting this situation were to either reduce benefits, or to work up a fiscal surplus large enough to finance the deficit of the pension system. In response, contribution rates were raised. To put this increase in generosity into perspective, in 1955 there were 12.2 active contributors for every one retiree, and by 1980 there were only 2.5 contributors for every one retiree (Acuna R., Rodrigo & Iglesias P., 2001).

TABLE 1.2

Contribution Rate Among Main Cajas (%)		
CAJA DE PREVISIÓN	**1974**	**1980**
Servicio de Seguro Social (SSS)	56.60%	33.20%
EMPART	64.50%	41.04%
CANAEMPU	54.75%	32.50%

Data Source: *Superintendency of APFs*

The rate of contribution for all Cajas de Previsión maxed out in 1974, with levels as high as 64.50% of the taxable wage. Rather than easing the financing problem, raising the contribution rates to such levels as in TABLE 1.2 encouraged contribution evasion—serving to drive the system into an even deeper state of financial imbalance (Acuna R., Rodrigo & Iglesias P., 2001). Although the contribution rate was cut down by roughly 20% by 1980, it still represented roughly an obscenely large portion of the taxable salary.
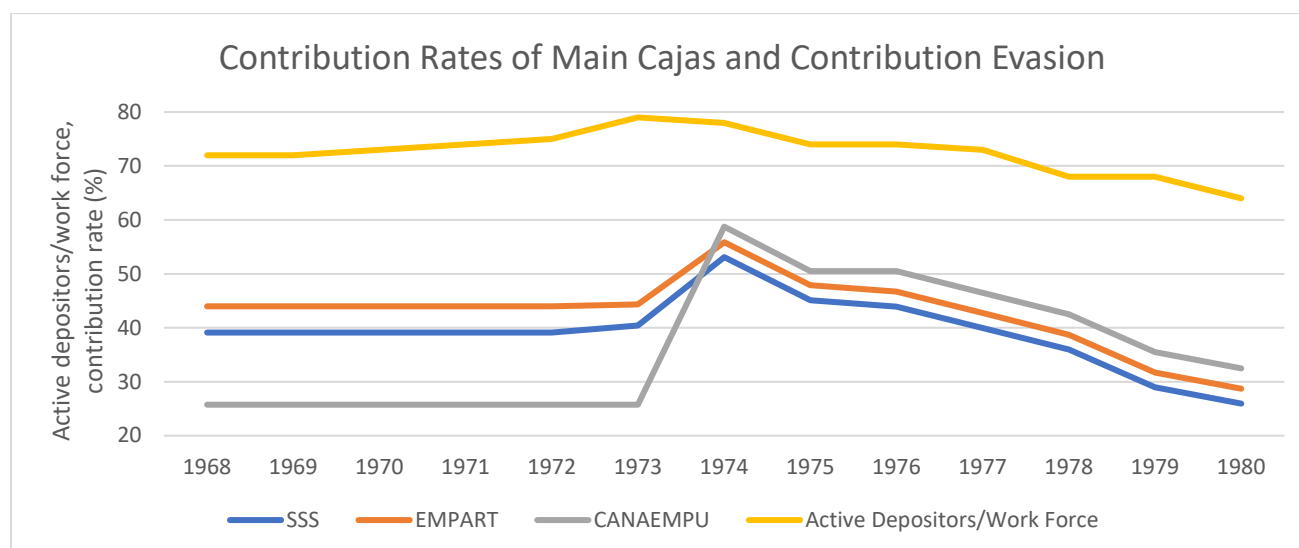
Data Source: *Superintendency of APFs*

The maximum coverage of the old system peaked in 1973, with 79% of workers were active depositors into the system. With the sharp increase in contribution rates introduced in 1974, coverage slowly decreased, and by 1980, only 64% of workers were active depositors into the system—suggesting that the higher rates of contribution generated higher rates of contribution evasion among workers. This is a singular explanation of this trend, as other sources have also cited an increase in the unemployment rate during this time as an additional factor (OECD, 1998). In the last few years of the old pension system, because contributions were not sufficient to cover the payout of pensions, fiscal grants had to increase to finance the system.

Salvador Allende attempted to bring equilibrium to the social security system by increasing benefits and extending coverage to 90% of the working population. New coverage was extended to merchants, small industrialists, and some self-employed workers in the informal sector of the economy. However, since those already within the system maintained their benefits without increased taxation, this generosity spent on a newly covered population translated into financial chaos (Lindert, P.H., 2021).

The 1981 Reform: Privately Managed Individual Pension Accounts

With the design and deficiencies of Chile's PAYG system laid bare, we can more clearly perceive the main ends of the 1981 reform: decreasing wealth inequality between retirees and creating a more efficient style of management to improve the overall funding of the system.

Before analyzing how successful the new system was at achieving these specific microeconomic needs, this section begins with a description of the design of the privatized pension model, which reveals how the system intended to fulfill those needs. The following section provides a brief and selective overview of the macroeconomic effects of the reform.

Description of the 1981 Reform

Los Chicago Boys and the Introduction of Free Market Economics

Although the reformation of the PAYG system to a system of private accounts didn't officially occur until the 1980s, one could argue that the transition was put into motion much earlier than that with the cultivation of market liberalism in Chilean economic ideology. In the 1950s, an exchange program of professors and students was established between the University of Chicago and the Universidad Catholica de Chile. This led to the training of approximately one hundred students in both masters and PhD programs in the United States, under a curriculum of free-market economics. The group of Chicago-trained Chilean economists made a name for themselves as "Los Chicago Boys," not only because of their collective education, but also due to their continued collaboration with each other upon their return to Chile. Among them was Jose Piñera, who would become the chief architect of Chile's 1981 retirement pension model (Brender, V., 2010).

Chile, like most Latin American countries during that time, was predominantly gripped with a structuralist and Marxist economic ideology. Consequently, Los Chicago Boys were not able to play an integral role in Chilean policymaking until the military coup of 1973 that brought Augusto Pinochet to power (Valdés, 1995).

At the age of 30, Jose Piñera was recruited by Augusto Pinochet to spearhead structural reform in the social sectors. Under this position, Piñera's brainchild of a revolutionized model of retirement pensions was able to become reality by 1981 (Brender, V., 2010).

A Privatized Model of Individual Retirement Accounts

"The worker is a king in the sense that he owns his money; he is a capitalist." (Jose Piñera)

Jose Piñera had a driving vision of aligning the needs of workers with economic success. His model for retirement pension funds was considered so revolutionary because it was the first of its kind in the history of the world where every worker was entirely responsible for his or her own retirement. Instead of a burdening the active worker with funding the pensions of current retirees, Jose Piñera harnessed the power of capital markets through what is known as the AFP system. Under this scheme, workers are mandated to contribute a proportion of their monthly wages that will fund their future retirement pension. Workers may receive their pension through any or all the three pillars that make up the system:

First Pillar – Capitalization Accounts

10% of monthly salaries are withheld from a worker's paycheck. For-profit firms, known as the Administradores de Fondos Pensiones (AFP) then invest these funds in the financial market and that money grows over the course of the worker's life until retirement with compound interest. Workers are free to choose among seven different competing AFP corporations to invest their withholdings: Cuprum, Provida, Planvital, Uno, Modelo, Habitat, and Capital (Cumsille Rojas, B. D. L. P. 2015).

Additional payments to the AFP include 7% for health, 0.8% for disability and survivorship, and a 2.6% average fee to the AFP (Joubert and Todd, 2011).

Second Pillar – Voluntary Savings

Offers workers the possibility of saving above the mandatory 10%, receiving tax benefits, in accounts known as APVs, or an Ahorro Previsional Voluntario[14]. If workers are able to invest more than 10% of their wages in this pillar, they are able to access those funds before retirement age (Cumsille Rojas, B. D. L. P. 2015).

Third Pillar – Solidarity Pillar

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[14] Institutions that can manage these accounts include the AFPs, Administradores de Fondos Mutuos, Administradores de Fondos de Inversión, Administradores de Fondos para la Vivienda, Administradores Generales de Fondos, Banks, and Life Insurance Companies.

State-run pillar that guarantees a minimum pension amount to the most vulnerable members of society through either the Basic Solidarity Pension (PBS/Pensión Básica Solidaria) or the Solidarity Pension Supplement (APS/Aporte Previsional Solidario).[15]

The Basic Solidarity Pension acts as a non-contributory pension for those most vulnerable upon retirement—those without other pensions. This benefit is means tested; it's payable to the poorest 60% of Chile's population at the age of 65 for both men and women. Recipients must also have been a resident at least four or five years prior to the claim, with a total of 20 years of residency in Chile (OECD, 2019).

The Solidarity Pension Supplement is a supplementary welfare pension which targets APF affiliates with low pensions. The amount given as a supplementary pension depends on the existing pension amount of each individual worker (Joubert, C. J. E. & Todd, P.E., 2020). Pensioners can claim this benefit if they have a defined contribution benefit lower than a specified amount known as the maximum welfare pension (PMAS). The remaining qualifying conditions for this benefit are the same as the Basic Solidarity Pension (OECD, 2019).
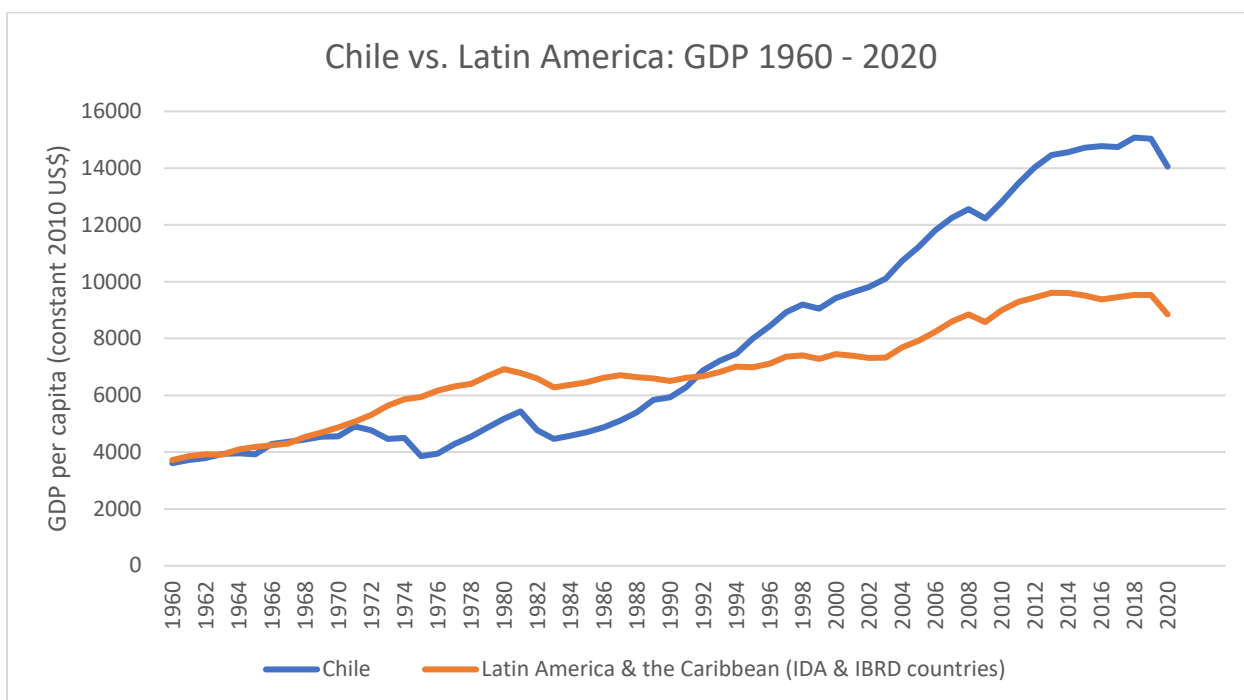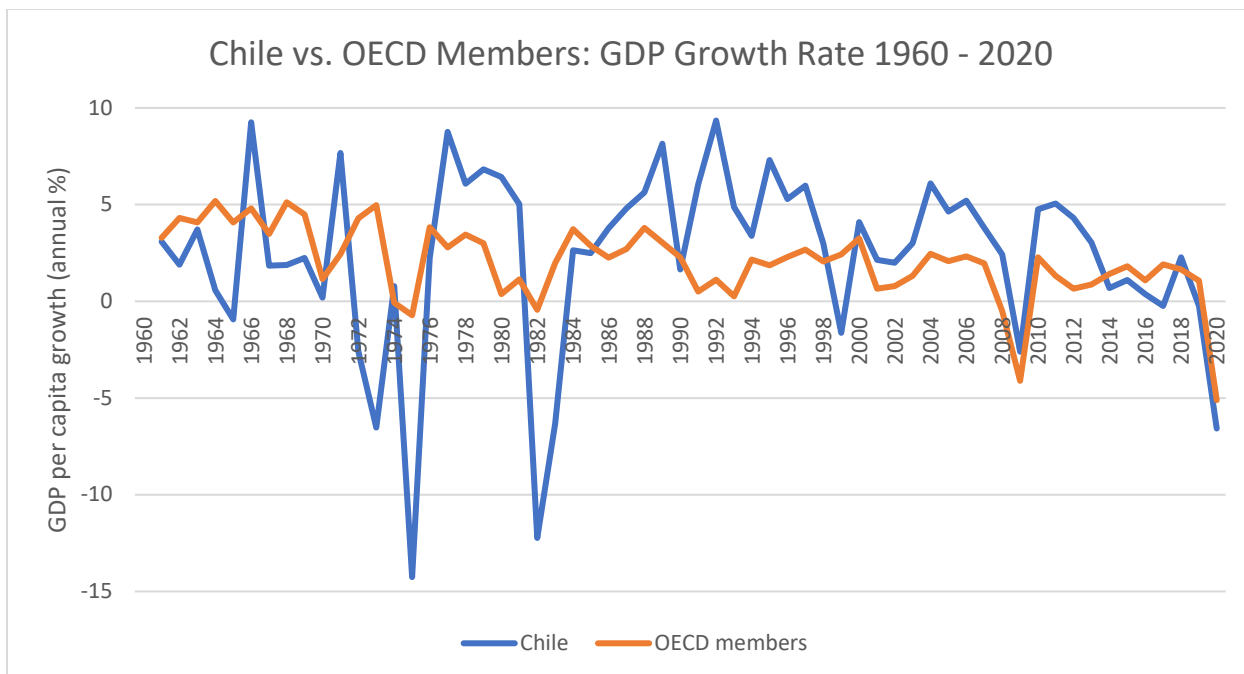
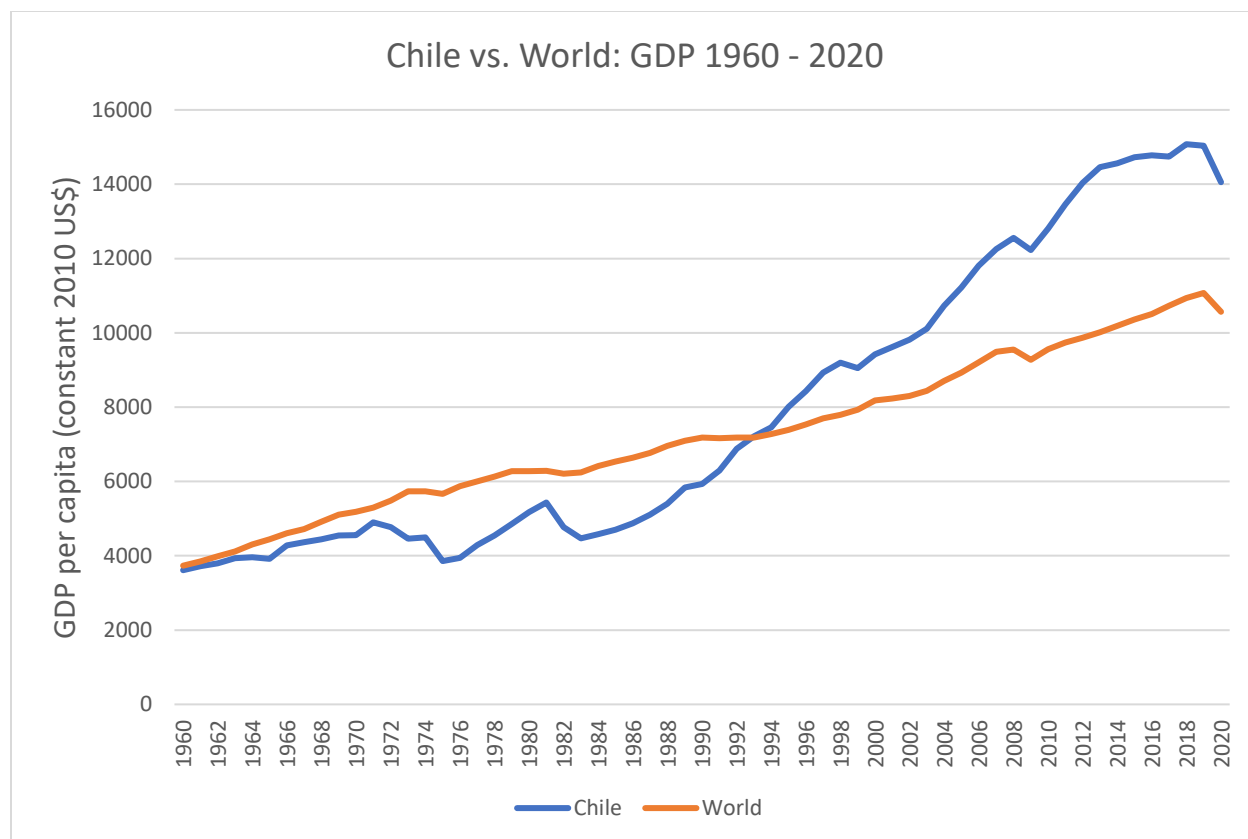**Macroeconomic Impact of the 1981 Reform: A Brief and Selective Overview**

Roughly the first half of the twentieth century in Chile was characterized by a relentlessly increasing role of the state in an attempt to accelerate economic growth. Yet instead, the country found itself crippled with hyperinflation and plagued with of the lowest growth rates in Latin America (Edwards 2002).

The military coup of 1973 marked the largest threshold between structuralist and neoliberal economic thought in Chile—one that many economists claim provided the launching pad for the rapid economic growth that followed. In stark contrast to what came before, this period following the coup was characterized by a minimalist perspective on the provision of social services and a reduction in state intervention by targeting only the poorest groups for social expenditures (De Mesa & Montecinos, 1999).

As a result of the bold market-oriented reforms initiated under this new regime, Chile's average rate of growth bordered on 7 percent between 1986 and 1995 (Edwards, 2002). With such a dramatic growth rate, Chile became a star performer not only among Latin American countries, but among all countries of the world. It was what became known as "the Chilean Miracle".

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[15] With the 2008 reform to the system, PBS and APS replaced the originally conceived PASIS (Assistance Pensions/Pensiones Asistenciales) and the PMG (Minimum Guaranteed Pension/Pensión Mínima Garantizada) in order to more aggressively address old-age poverty (Cumsille Rojas, B. D. L. P. 2015)

Chile vs. OECD Members: GDP Growth Rate 1960 - 2020

Chile vs. Latin America: GDP 1960 - 2020

Chile vs. World: GDP 1960 - 2020

SOURCE: World Bank national accounts data, and OECD National Accounts data files.

Perhaps the most revered aspect of Chile's neoliberal reform was the implementation of Jose Piñera's revolutionary privatized model of social security. Until the 1900s, Chile was the only Latin American country that had privatized its public pension system, but within fifteen years following this reform, seven other Latin American countries had fully or partially privatized their public pension schemes (Williamson, J. B., 2001). Among experts, there has been a mixed consensus on the exact contribution of this pension reform in Chile's economic boom. Regardless, there has been a resounding notion among many economists that the experience of Chile has been a clear macroeconomic success story (Arenas de Mesa & Bertranou, 1997; Roldos, J., 2007; Piñera, J., 1999; Kay, 1997; Edwards, 1998; Queisser, 1999; Corbo and Schmitt-Hebbel, 2003, to name a few).

While controlling the effects of other aspects of this period of reform[16], the creation of a privatized system of individual accounts has been credited with a central role in helping develop Chile's capital market, stimulating labor force participation and productivity, and boosting Chile's traditionally anemic savings rate (Edwards, 1998; Corbo and Schmitt-Hebbel, 2003).

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[16] Structural reforms of the 1980s in addition to the reform of social security included trade liberalization, privatization, fiscal reform, and financial reform (Edwards, 2008).

Corbo and Schmidt-Hebbel (2003) found that the pension reform increased Chile's average annual GDP growth rate by approximately 0.5%, manifesting itself within Chile's saving and investment, labor market, and capital market.

Total Estimated Effects of Pension Reform on GDP Growth (%)	
Real average growth of the GDP in 1980-2001	
	4.63
Estimated effects of the reform on GDP growth	
Saving and investment	0.13
Labor markets	
Increase in employment	0.07
Increase in productivity	0.03
Capital market development and TFP	0.2
Total	0.49

SOURCE: *Corbo and Schmidt-Hebbel, Macroeconomic Effects of Pension Reform in Chile*

Concerning saving and investment individually, Corbo and Schmidt-Hebbel (2003) found that average domestic saving increased from 0.7% to 4.6% of GDP per year during the twenty-one years following the reform, while the investment rate increased by 1.2% of GDP during the same period.

With regard to the labor markets, this study noted that with the reform came a sharp decrease in the implicit labor tax, consequently leading to an estimated increase of 1.3% and 3.7% in total employment in the Chilean economy. Informal employment contracted, while formal employment was estimated to have increased somewhere between 7.6% and 32%. This compositional change in the labor force was also reflected in an increase of average labor productivity.

The pension reform also contributed significantly to deepening the financial maturity of Chile's economy, one of the most important determinants of GDP growth and of total factor productivity. Corbo and Schmidt-Hebbel (2003) estimated that somewhere between 31% and 46% of the increase in the rate of financial assets to GDP was accrued to the growth of the pension funds between 1981 and 2001.

The economic transformation of Chile in the 1980s was nothing short of a marvel. The country was growing at an unprecedented rate, unemployment hovered around 5%, and poverty was seemingly in retreat (Edwards, 1998). The sources of this economic boom are constantly in dispute among economists, yet more often than not, the pension reform is held up as one of the central aspects of the Chilean Miracle.

II.   Literature Review

Over the past four decades, the country of Chile has pushed past all others in Latin America at an astonishing rate, becoming the wealthiest and most economically developed country therein (Francisco, P. G., & Loreto, R. R., 2019). As previously explored, many economists have attributed Chile's rise to the top to the neoliberal economic policies of the 1980s, most often hailing the private pension scheme as the shining star. Under this model, the calculated retirement pension of any given worker is directly determined by their labor force participation over their entire working life, the wages that they earn, and their life expectancy. Thus, in order to accurately simulate the gender pension differential of Chile, one must first pinpoint and understand the unique profile of the female Chilean worker with regard to her labor force participation, wages, and life expectancy[17]. The aim of this literature review is to do exactly that.

After first providing an overview of literature that details how female workers have fared under the privatized system of retirement, this review will then cover studies that examine select determinants of female labor supply in Chile: fertility and childcare, marriage and divorce, and cultural attitudes surrounding labor force participation and educational attainment[18]. Next, there will be a reviewal of studies observing the gender wage differentials in Chile, either due to differing labor supply elasticities between men and women, or labor market discrimination. Each of pension determinant represents a separate subsection of this review.

How Female Workers have Fared Under the Privatized Model of Retirement of 1981

Previous studies analyzing the success of Chile's privatized retirement pension system have either ignored or insufficiently glossed over the gender dimension of the transition from a pay-as-you-go (PAYG) regime to defined contribution accounts. It is only until more recently that studies have focused specifically on the gender dimension. It is thus critical to begin this review by analyzing the economic situation of female retirees in Chile before and after the 1981 reform and to generally observe the magnitude of the reform on women's welfare in Chile.

The fact that the new system is mandatory to all workers has created certain consequences, especially for women. Arenas de Mesa and Montecinos (1999) found that although women's lower salaries and their obstacles to formal employment greatly reduced their social benefits in the PAYG system, the treatment of women in the area of retirement was actually favorable. Within the old system of retirement, the pensions received by men and women—with the same salaries and the required years of contributions—were equal, even despite differences in life expectancy and retirement age. Additionally, women faced fewer requirements than men in obtaining pensions; they could receive pensions 5 years earlier than men, were required to work 5 years less than men, and under some Cajas, women retire one year earlier per child.

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[17] However, life expectancy will not be observed in this literature review, as it only is relevant to the actuarial formula for calculating individual pension amounts.

[18] Educational attainment alone will not need to be examined in this review, as the effect of attaining certain years of education can easily be simulated (i.e., 1 year of post-secondary education = 1 year less of pension earnings). The same cannot be said about how cultural attitudes surrounding educational attainment impacts female labor force participation.

When the privatized system was devised, it was expected to produce replacement rates of around 75%, meaning that workers were expected to receive 75% of their average earnings in working life in the form of an old age pension—yet only 1/3 of the members of the system achieve this (Berstein et al., 2006). Using the OECD methodology to calculate replacement rates, Berstein et al., (2006) found that the average male affiliate would receive 58% of his last salary as a retirement income, while an average female affiliate would only receive 39% of her last salary. Berstein et al., (2006) attributed this greatly to the actuarial formula for pension calculation in the 1981 reform.

This formula included gender differentiation by integrating the actuarial factor of life expectancy within its design, while at the same time keeping the retirement age of women at 60 years of age, 5 years below that of men. Because women tend to live 5 years longer than men on average, this meant a relatively longer retirement period for women, and, in conjunction with their lower legal retirement age, meant fewer available years of contributions to accumulate those funds. Additionally, while the old system's calculation of benefits reflected earnings of the last working years, the new privatized system, based earnings over an entire career, with at least 20 years of required contributions. Berstein et al., (2006) concluded that women are especially vulnerable under this design, as they are more likely to experience periods of unemployment due to their culturally shaped role as homemakers. This disadvantaged position of Chilean women is also compounded by the fact that, on average, women's salaries were found to be lower than men's for equivalent roles (Berstein et al., 2006).

Arenas de Mesa and Montecinos (1999) found that if no differences in salaries existed between men and women in Chile, the inequalities in pension funds between male and female would be partially eliminated, but substantial inequalities would remain if men made contributions 5 years longer than women do[19]. Arenas de Mesa and Montecinos (1999) then went on to analyze the effect of raising the legal retirement age for women to 65, the same as men. If women and men retired at the same age (assuming labor-market inequalities do not exist), inequities would decrease significantly, yet some would remain due to the actuarial formula's inclusion of life expectancy used to calculate pensions.

Berstein and Tokman (2005) conducted a similar study, focusing on why the relative income position of women compared to men gets worse off in old age and how different individual and labor-market characteristics of the system affect it. This analysis is centered around a specific cohort of those born between 1960 and 1965—those that started working around 1981 and who will retire in 2020 and 2025. This is the first generation that will enter the privatized system without having been involved in the old system. Similar to the findings of Arenas and Montecinos (1999), they found that the years women spent away from the workforce during childrearing had a large if not the largest effect on retirement income—especially because the period of childbearing replaces their earliest years of contributions—the years that could have accumulated the largest portion of their retirement funds over their working life.

Berstein and Tokman (2005) also analyzed the intricate features of the retirement pension system in relation to a counterfactual change—raising the female retirement age to 65 years, similarly to Arenas de Montecinos (1999). They found that financing five fewer years of retirement lead to increases of 9, 10, and 14% in the annuity of women in basic, middle, and higher education. They then measured the impact on retirement income with the extra five years added to the working life of a woman. First assuming that no contributions were made within

[19] Assuming women and men retire at the legal retirement age (60 for women and 65 for men).

these five additional years, the balance of the APF account increases simply because it is profitable for five more years. Under their assumption of a 5% rate of return, they found that the balance in the APF account increased by 28% with the extra 5 years of contributions—seen more visibly in the higher educated, because with those of low-income, the minimum pension partly hides the effect. If the income and the contribution of women are estimated in these additional five years using the same methodology with the probability of working and contributing updated recursively, they found that the final effect would be even greater, between 31% and 43%. Without this change in retirement age in women, Berstein and Tokman (2005) found that women would either have to increase their number of working years or make extra contributions in their pre-retirement periods. Overall, they found this to mean that women would have to retire at 66 or 67 to receive pensions roughly equal to men earning the same salary.

Labor Supply Determinants of the Chilean Woman

Fertility and Childcare
    Among the studies examined, parenthood seems to be the leading cause of a reduced labor supply in women. Childbearing directly impacts labor supply, through both years spent outside of the labor force and in shortened working hours—reducing a female's accumulation of human capital (Cools, S., Markussen, S., & Strom, M. 2017). Using a simplistic model of labor supply, known as the labor-leisure model, Cools, S., Markussen, S. & Strom, M. (2017) demonstrated that a woman aims to maximize her level of utility under the restrictions of income level and time. In this model, it is assumed that utility is dependent on her individual consumption of goods and leisure. In order to consume, she must sacrifice hours of leisure time and join the workforce to accumulate earnings. Yet in making these decisions, individuals are always confronted with several restrictions.
    In the case of a working-age woman, these restrictions span far beyond her level of non-labor income, but also from the number of children in her household and the many social restraints that come with that (Contreras, D., & Plaza, G. 2010). Contreras and Plaza (2010) argue that with all else equal, a Chilean woman who has two children will have more restrictions on her ability to participate in the labor force than a woman who has only one child—even more so if the children are not yet of a school-going age.
    Cools, Markussen and Strøm (2017) studied how family size affect parents' labor market decisions over their whole career until retirement by analyzing data from Norwegian men and women—not the subjects of this study's concern, but still regarded as generally and theoretically appropriate. This study found that having additional children after the first two children causes a sizable reduction in labor force participation of women. They observed that this effect eventually fades as the children mature and will eventually produce an opposite, positive effect on the labor force participation of women in the long run with no college degree. In other words, in the short and medium run, additional children have an impact on labor force participation, while in the long run, labor supply is restored. The study conducted by Cools, Markussen and Strøm is unique from Contreras and Plaza (2010) in that it observes labor supply 20 years after childbirth. Using an OLS regression, they concluded that hours worked weekly by women are, on average, reduced by 5 hours per week during the first ten years of parenthood, and then by 1.8 hours a week during the next ten years—showing that women who have relatively more children may give less priority to providing labor in the workforce.

While both of these sources presume that economic growth is impacted by the number of children women have in their household, the study conducted by Parro and Reyes (2019) differs in that it conjectures that it is economic growth that incentivizes women to have fewer children. In particular, they cite technological advances as a strong source of economic growth for Chile in the last few decades, leading to an increase in the productivity of workers and a consequential rise in the going wage. With this increase in wages, the opportunity cost of staying home for women has increased greatly, as motherhood becomes more expensive. Yet technological change requires a workforce of more qualified workers, which then incentivizes mothers to have fewer children, allowing them to achieve higher levels of human capital outside the home and eventually participate more actively in the labor market.

All studies reviewed on this determinant of labor force participation, though conducted differently, seem to reach the general consensus that the number of children a woman has is negatively correlated with labor force participation.

A determinant of female labor-supply that is more policy-relevant is the issue of childcare availability. As the explored literature has shown, the number of children per household in Chile directly impacts a woman's labor force participation rate, yet one could question that if childcare were to be made more readily available to Chilean mothers, perhaps the number of children per household would become a weaker or even insignificant determinant of female labor force participation. There is a potential for policy action in this area, by facilitating access to childcare for working mothers or mothers who would like to work.

Contreras, Mello, and Puentes (2011) concluded from a survey conducted in 2003 that 16% of women between the ages of 25 and 39 said that they abstained from looking for a job because they had no options for childcare. They also found this to be the case for female youth, whose labor supply is discouraged by the presence of young children in their household—implying that they too play a role in at-home childcare and could be the explanation as to the high percentage of young Chilean women who neither work nor go to school (Contreras, D., de Mello, L., & Puentes, E. 2011). If this is the case, then there would be reason to speculate that policy action for increased access to childcare would go far beyond labor supply of prime age women but prepare younger women to obtain the human capital to supply labor in the long run.

Blagrave and Santoro (2017) took this study a bit further, by adding that better-located childcare facilities open for longer hours have a positive impact on female labor supply, especially in the case of Chile, where the infrastructure for transportation, especially among poor communities, could be a restricting factor. 50% of women would benefit from adequate childcare, and it is estimated that the labor participation would increase from anywhere between 1 and 8 percent (Blagrave, P., & Santoro, M. 2017).

As long as policies become more gender-friendly, like how adequate provisions of childcare give women more free time to supply labor, it appears that the female participation rate will continue to steadily increase. In addition to childcare, research has shown that the 1997 policy that lengthened the school day from part-time to full-time positively impacted female labor supply (Blagrave, P., & Santoro, M. (2017).

Yet the study conducted by Contreras and Sepúlveda (2017) is skeptical of this, introducing the idea that not all mothers responded the same way to this reform, as it will depend on their individual preferences of leisure and consumption. They estimated that 5% of single mothers without younger children entered the work force because of the policy—a relatively small effect, but possibly explainable by the fact that the school day was still not fully compatible with a full workday. They also estimated a negative and significant impact in hours

worked per week on average, possibly explained by the fact that the increased length of the school day decreases women's spending on childcare, which increases disposable income, and thus decreases hours they originally dedicated to the labor market. A secondary explanation could also be that they are opting for part-time jobs, as they are more compatible with the new school day (Contreras, D., & Sepúlveda, P. 2017). They also argued that the policy could have been more effective if it had targeted earlier levels of education, like 1st and 2nd grade, as they estimated that this would have had the strongest impact on female labor force participation. In most developed countries, the length of the school day is highly compatible with the workday of a woman, while in developing countries this is not the case—an integral detail of the economic profile of the Chilean woman (Contreras, D., & Sepulveda, P. 2017).

Marriage and Divorce

In addition, a lot of what the family was and could be was dependent on the influence of the Catholic Church. Up until 2004, couples were not allowed to divorce (Gallegos, J. V., & Ondrich, J. I. 2017). It was only until that year that the regulation of marriages changed from the Catholic Church to the State, providing a clear-cut observation starting point for a female's labor supply decisions post-divorce.

A study regarded as theoretically appropriate, conducted by Gert and Dimitri (2019), used data from Flemish women to estimate the probability of female employment increasing around the time of the divorce. In summation, they found that women were twice as likely to increase their employment for a short period of time after the separation—a positive effect on labor supply, as family income decreased, there was found to be a strong incentive to begin work or increase working hours. Whether or not this effect is generalizable across-countries is another question of further research.

Given the literature found specifically for Chilean women post-divorce, much of a woman's post-divorce labor supply decisions rely on previous determinants discussed previously—number of children and childcare. A study conducted by Gallegos and Ondrich (2017) looked specifically into the country of Chile, investigating the impact of the 2004 divorce law on a woman's decision to have a first child. Before the divorce law, no monetary compensation was required if couples separated, and many men could avoid making spousal support payments (Gallegos, J. V., & Ondrich, J. I. 2017). Most relevantly to this study, Gallegos and Ondrich (2017) found that if the cost of raising a child falls mainly on the woman, her career prospects are reduced post-divorce. Yet with the enforced mechanism that the law implemented of spousal support, the impact on labor supply appears to be less steep, and positive in some cases. Another relevant conclusion made by Gallegos and Ondrich (2017) was that the overall fertility rate in Chile has decreased from 2.09 to 1.9 births per women between 2003 and 2010, a trend possibly explained by the Divorce Law. More research should be found in this area to connect more dots on what this means for a female's labor supply, but from the previously identified determinants, it might be reasonable to say that the divorce law aided in raising female labor force participation in Chile, simply based on the fact that aggregate fertility decreased.

Cultural Attitudes Surrounding Female Work and Higher Education

All of these relatively classic determinants aside, Contreras and Plaza (2010) argue that the cultural factors specific to Latin America and Chile cannot be discounted and are equally as important, if not the most important determinants of female labor supply. Mainstream economics has seemed to come up short in quantifying the importance of gender and its impact on the

acquisition of knowledge. This is especially applicable for labor economics in Latin America and Chile specifically (Contreras, D., & Plaza, G. 2010). Textbook economic models and studies can only say so much about a Chilean woman's labor choices—they do not take into account the cultural determinant in Chile and how it could dissuade women from seeking higher education or from entering the labor force.

More specifically, the study by Contreras and Plaza (2010) looks at the 'machismo,' or, male-dominated culture in Chile and its impact on female labor supply and human capital attainment. They conclude that women who have adopted more conservative cultural values (meaning that they are more submissive to 'machismo') participate less in the labor market. This article references several other works that analyze female participation in Chile, yet it criticizes them because they fail to take into account the women that are influenced to join or not join the workforce by cultural factors unique to Chile, such as cultural models of the family, social roles, and established family attitudes towards these things. This study hypothesizes that in the short run, cultural factors determine female labor force participation. They measure cultural factors that might influence participation by first measuring the extent to which females have internalized 'machismo', and second, measuring whether a woman can be considered conservative or moderately conservative. Lastly, the study demonstrates that the presence of a partner reduces the probability of female participation. All in all, the study concluded that these cultural factors play a larger role than the effect of human capital accumulation. It would also be reasonable to assume that these cultural factors could also affect a woman's pursual of higher education, and in turn, limit the potential wages she could receive across her lifetime. All in all, the role of cultural attitudes surrounding an educated or working woman in Chile is not one easily discounted.

Gender Wage Differentials

The diminished economic power of women represented through relatively lower wages has a direct and detrimental impact on her retirement pension. The majority of previous studies on the gender wage gap in Chile have assumed perfectly competitive labor markets with perfectly elastic labor supply. This popular approach assumes that if two workers have the same job and identical characteristics will be paid identical wages. Any residual difference is then considered to be as a result of discrimination. However, these studies have been gradually challenged, due to the existence of frictions in the labor market (Robinson, 1933; Madden, 1973; and Black, 1995). This is especially important in an analysis in a developing economy such as Chile. Only recently have studies started to consider the effect of imperfect competition in the labor market on the gender wage gap. Newer literature suggests a "monopsonistic" framework to explain how discriminatory wages between genders arise and persist if firms hold greater monopsony power over female workers relative to male workers. For this to hold, the labor supply of women to firms must be less wage-elastic then that of men.

The most recent study of the gender wage gap in Chile comes from Sánchez, Finot, and Villena (2021). They use a dynamic monopsony model to estimate the labor supply elasticities at the firm level to explain the Chilean gender wage gap. They found that Chilean men earn approximately 19-28% more than women because of the difference in labor supply elasticities, *ceteris paribus*. In particular, the largest wage discrepancy was found to be in the elasticity of recruitment from nonemployment or informal employment. This could be interpreted to mean that search frictions for women keep them in a state of nonemployment or informal employment.

Potential explanations for this could be that for Chilean women, informality is more attractive due to the lack of sufficient childcare coverage, or, that cultural attitudes regarding a working woman dissuade them from engaging in formal work.

Additionally, Sánchez, Finot, and Villena (2021) found that in the long run, between-firm differences in labor elasticities is higher than within-firm elasticities, suggesting that the gender wage gap is also driven by structural factors generating gender sorting into firms. Lastly, they found that the labor supply elasticities for high-income countries are higher than those obtained in a middle-income country such as Chile for both men and women. This would suggest that middle-income countries demonstrate higher labor market frictions, thus justifying their monopsonistic approach.

From this sheer breadth of studies, the several intertwining and complex determinants of the female labor supply in Chile are laid bare. Obviously, this literature review presents a limited sample of studies and research, thus limiting potential determinants and perspectives on female labor supply in Chile—yet it is sufficient enough to demonstrate the vastness of studies on the labor supply determinants of wages, childcare and fertility, marriage and divorce, and cultural attitude. This current study fits into and contributes to the existing body of literature, as it ties Chilean female labor supply and her wages directly to the study of the gender pension differential. More specifically, instead of analyzing one single determinant of a female's labor supply and its effect on her retirement pension, this study will allow for a simulation of all these variables simultaneously, through meta-analysis of these previously explored studies.

III.   Theoretical Framework

Take an individual with the lifespan of [0,1]. This interval is split between working and retiring. Each point on this interval the individual is given one unit of time. When this individual chooses to work, this one unit of time earns the wage *w* in the labor market. The individual can then use this labor income to either consume or save at the interest rate *r*, assumed to be greater than the individual's subjective rate of time preference. Two types of goods are a general consumption good, denoted by *c,* and a leisure good, denoted by ρ. General goods produce an instantaneous utility of ln(*c*). If this individual is retired, then they are using their unit of time for leisure. Leisure goods produce a fixed utility level of ρ. It is also important to note that leisure goods are time intensive, requiring one unit of time to enjoy them. Thus, the leisure good can be "purchased" at the price of ρ.

The Retirement Decision: Lifetime Utility of an Individual

(1.1)

$$\int_0^1 \ln c(t)\exp(-\beta t)dt + \rho \int_R^1 \exp(-\beta t)dt$$

The parameter β represents the subjective rate of time preference, or, in other words, how much this individual prefers to consume when young to consuming when old. β must lie between 0 and 1. The individual discounts future utilities using β, which is assumed to be less than the market

interest rate ($\beta < r$). When $r > \beta$, the rate of return on savings, r, the postponement of consumption is favored, and general consumption grows over time.

The parameter $c(t)$ is time, t, general consumption. The parameter ρ is the fixed utility from consumption of a leisure good. R represents the date of retirement. Also note that $\exp(-\beta t) < 1$ for all $t > 0$, and is decreasing in time, t. The individual will only consume leisure goods during retirement, on the interval [R,1].

The budget constraint of this individual reads:

(1.2)

$$\int_0^1 c(t)\exp(-rt)dt + \int_R^1 p\exp(-rt)dt = \int_0^R w\exp(-rt)dt.$$

Here, the individual works on the interval [0,R] and consumes leisure goods during retirement, on the interval [R,1]. The left-hand side of the budget constraint represents the present value of the consumption of goods, whereas the right side of the budget constraint represents the present value of labor income. The present value is calculated using the market interest rate, r, because this is the rate that the individual can borrow or lend.

Using this developed model of retirement, the provision of tax-financed old-age social security can (individual's labor income at a rate, τ, and uses the taxed income to provide an old-age pension in the sum, s.

Thus, the individual's budget constraint now appears as
(1.3)

$$\int_0^1 c(t)\exp(-rt)dt + \int_R^1 p\exp(-rt)dt = \int_0^R (1-\tau)w\exp(-rt)dt + \int_R^1 s\exp(-rt)dt.$$

This individual will now take home $(1-\tau)w$ in after-tax labor income for each period in the interval of [0,R] that they work. In the interval of retirement, [R,1], they will receive an old-age pension of s.

However, under a privatized model of social security, the government instead mandates that a working individual saves the fraction of their income, τ, into a private savings account that earns the rate of return r over the interval [0,R]. Now, the date that an individual chooses to retire will have a direct impact on the size of the benefits that they receive upon retirement. The individual's budget constraint is still (1.3), however, with the realization that s is governed by their own actions through

(1.4)

$$\int_0^R \tau w \exp(-rt)dt = \int_R^1 s \exp(-rt)dt.$$

Within this equation, the present value of the fraction of their income, τ, exactly equals the present value of the old-age pension that this individual will receive upon retirement.

IV.   Empirical Framework

1.1 Estimating post-retirement well-being gender differential

To estimate the post-retirement well-being of Chilean women relative to men, I construct an equation that estimates the accrued pension under the rules and regulations of a privatized model of retirement as it exists specifically in Chile. This means assuming a 10% annual mandatory pension contribution across all workers, and a legal retirement age of 65 for men, and 60 for women, respectively. The equation begins with forming what is hereby known as the Lost Pension Principle, measuring the mandatory annual proportion of a worker's wage to be contributed to an AFP retirement fund, given by:

Lost Pension Principle = (0.10)(w(L))

where *w(L)* represents wages earned in a year. The equation is then completed by regarding the compounding effect of multiple years of fund contributions across a worker's lifespan at a specified market rate of return,

$(1 + r)^n$(0.10)(w(L))

where *r* represents the market rate of return, and *n* represents years of contributions, which is assumed to be equivalent to a Chilean's working life. In order to clearly estimate the post-retirement well-being gender differential, several assumptions are made. First, the assumed market rate of return to be used is calculated as the average rate of return across all seven AFP funds from 1981 to 2019. The rate of return given is thus representative of the average market performance of the entire AFP system across these given years, not just one AFP individually. Furthermore, this model assumes a fixed level of risk aversity among AFP affiliates, only choosing to observe the rates of return recorded from the moderate-risk pension fund, known as Fondo C. The working life, *n*, of a worker in this estimation is assumed to be the difference between their respective legal retirement age and their age upon entry in the workforce, post-education. The level of education is fixed across male and female workers, assuming secondary graduation within 4 years at the age of 18. The working life of women is thus given by *n* = 42 whereas for men, it is given by *n* = 47. Additionally, the working life of both the male and female worker is assumed to be uninterrupted, and wages between male and female workers are assumed fixed and equal.

In summation, the aim of this section of my empirical analysis is to estimate the retirement pension differential if a female and male worker choose to retire as early as legally permitted, *ceteris paribus*, or, assuming all other factors between them are equal. In plainer words, how

much of a difference in post-retirement well-being is created between the female and male retiree, simply based on the fact that men retire 5 years later than women do?

1.2 Counterfactuals: Wages and Contribution Densities

Using this model for simulation, I then go on to pose several counterfactuals, in order to examine how a change in wages, fertility and education contribute to the retirement pension gender differential in Chile.

Differential Wages

This simulation rests on the assumption that Chilean men earn, on average, 19% - 28% more than women as a result of the differences in labor supply elasticities, *ceteris paribus* (Sánchez, 2021). Using these findings, this simulation adjusts *w(L)* for men to be 19% higher than *w(L)* for women at every income level. In order to purely observe the impact of a wage differential, it is now assumed that men and women choose to retire at the age of 65. Education level between men and women remains constant, with graduation from a secondary institution at the age of 18, with no workforce interruptions beyond this point. This simulation will serve to show the retirement pension differential that is produced through the gender wage differential, *ceteris paribus*.

Differential Wages and Retirement Ages

This simulation reincorporates differing retirement ages into the differential wage counterfactual. While holding the *w(L)* of men to be 19% higher than *w(L)* of women, working life in years is adjusted to be *n = 47* for men and *n = 42* for women. This simulation will serve to show the retirement pension differential produced through differential wages and retirement ages, *ceteris paribus*.

Incorporating Life Expectancy

I will then incorporate the factor of life expectancy by calculating the replacement rate of women compared to that of men under the same rules and assumptions of the last two counterfactuals. Replacement rate is defined as the percentage of an individual's annual employment income that is replaced by retirement income. To begin calculating the replacement rate, the retirement annuity is found, using the formula

$$\frac{Ri}{r} = \text{Retirement Annuity} = Ra$$

where *Ri* represents the total income earned in retirement, assumed to be an individual's retirement pension, and where *r* represents the length of an individual's retirement in years. This is found by subtracting an individual's life expectancy with their retirement age. It is assumed that the average female life expectancy at birth is 82 and the average male life expectancy is 77. The replacement rate is then calculated by taking the ratio of yearly income earned in retirement to yearly income earned during employment,

$$Replacement\ Rate = \left(\frac{Ra}{i}\right) * 100$$

where *Ra* represents the retirement annuity, or, yearly income earned in retirement, and *i* represents yearly income earned during employment. Holding constant the assumptions of the last two counterfactuals, I will calculate the retirement pensions to estimate replacement rates of the male and female Chilean retiree.

Additional Counterfactuals: Education, Childcare and Fertility

From here, I conduct a couple further simulations, presenting hypothetical scenarios measuring changes in education and fertility to observe any impact on the retirement pension gender differential.

The first education simulation performed rests on the finding that Chilean women are more likely than males to reach higher schooling levels (Bravo, D., Sanhueza, C., & Urzúa, S. (2008). A scenario is then constructed comparing the retirement pensions of a female individual that began work after completing tertiary education and a male individual that began work after completing secondary education. In this scenario, assuming men and women retire at their respective retirement ages, working life in years, *n,* for women is assumed to be *38* years, whereas for men it is assumed to be *47* years. Although it is a strong assumption, wages are assumed to be equal between men and women, regardless of the female individual's higher attainment of human capital. This simulation serves to show the retirement pension gender differential that arises due to the age at which one chooses to enter the labor force.

A second education simulation performed rests on the finding that Chilean women who complete tertiary education receive 65% of the salary earned by Chilean men with the same level of education (OECD, 2018). Using these findings, this simulation adjusts *w(L)* for women to be 65% lower than *w(L)* for men at every income level. This simulation assumes both men and women graduate from university at the age of 22. It is also assumed that men and women retire at their respective retirement ages.

The fertility and childcare counterfactuals simulate the impact of the birth of a single child and an additional child on the retirement pension gender differential. Both simulations rest on the assumption that the average age of Chilean women at childbirth is 29 years of age and that access to free pre-school begins when the child is 4 years old (OECD, 2019). It is also assumed that the woman is a single mother, who graduated from university at the age of 22. Respective retirement ages of men and women remain in effect as well. The working life of a woman is then calculated by subtracting her age upon entry into the workforce after education and the years spent providing at-home childcare from her retirement age. In the first simulation, her working life is thus *n = 34*. In the second simulation, it is assumed that she has an additional child while her first child is 2 years of age. Thus, this requires her to take two additional years of at-home childcare, reducing her working life to *n = 32*. This simulation additionally assumes that the length of the school day is compatible with formal employment.

V.   Data and Summary Statistics

The values of the independent variables in the simulations were determined through data collection or meta-analysis. Those that used meta-analysis—education and fertility—are mentioned in the prior methods section. Those that were calculated based on data collection—rates of return, wages, and life expectancy—are described and summarized in this section.

To estimate the average rates of return across all AFP accounts, I used Chile's national pension database, *Superindendencia de Pensiones.* This dataset spans from 1981 – 2019, providing the real annual profitability of each of the six major AFP companies for each type of pension fund: A, B, C, D and E[20]. The nominal rate is deflated by the rate of U.F. of the given period, corresponding to the return obtained by the contributions that were maintained in the respective Fund during the entire period considered. Compiling this data, I calculated the average profitability across all AFP funds for each given year and fund risk level[21]. However, since the model used in this study assumed fixed level of risk aversity among AFP affiliates, I choose to observe only the rates of return recorded from the moderate-risk pension fund, known as Fund C.
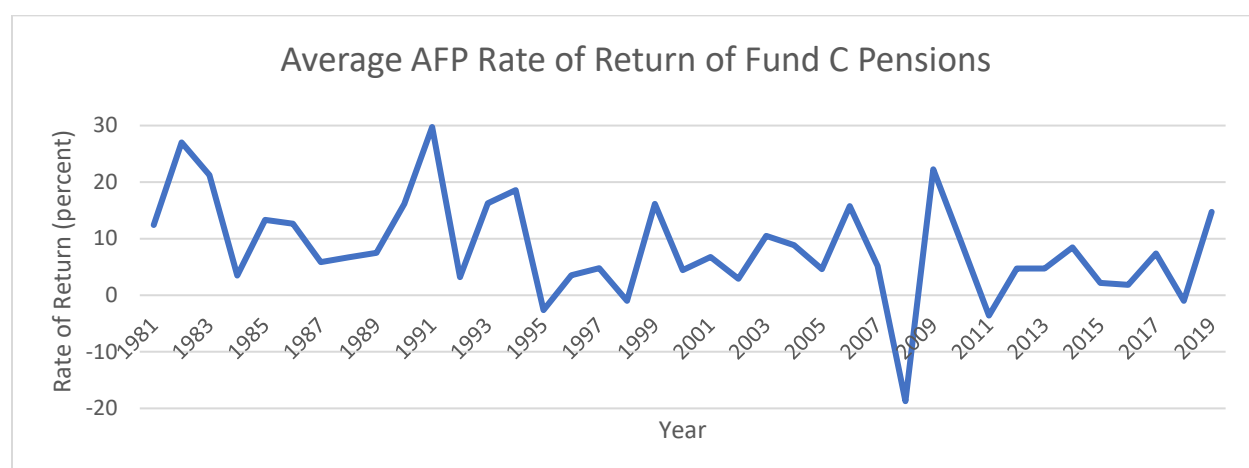
Source: *Superintendencia de Pensiones* and own calculations

Using this information, I found the highest rate of return, the lowest rate of return, and calculated the average rate of return across the years 1981 and 2019. The lowest rate of return was observed in 2008, at -18.73%, while the highest rate of return was observed in 1991 at 29.74%. The highest and lowest rates of return are used as the lower and upper bound values of *r* in each simulation. The average value of *r* found, 8.37%, is also used in each simulation as the main rate of observation. Values of *r* that lie between the lower-bound and average value of *r* as well as between the average value and upper-bound value of *r,* are filled in to provide a wider range of pension values produced from them. The range of values for *r* used across the simulations is summarized below:

Range of Rate of Return, *r*

Lowest *r*	-18.73%
	5%
	6%
Average *r*	8.37%
	10%
	12%
Highest *r*	29.74%

The value used for the average yearly wages and the minimum yearly wages across simulations was gathered from the *OECD* statistics on average annual wages across all OECD countries between the years of 2000 and 2020. The values used within each simulation reflect the average Chilean wage in 2020 constant prices at 2020 USD PPPs. The value used to represent average yearly wage across the simulations is $26,729USD, from the most recent measurement in 2020. The value used to represent the minimum yearly wage across the simulations is $7,930.50USD, from the most recent measurement in 2020. Placeholder values of roughly $50,000USD and $85,000USD are used in the simulations to showcase the pensions of those affiliates with above-average salaries, however, the results discussed from the simulations will focus on affiliates earning the average yearly salary. The range of wages used across the simulations is summarized below:

Range of Wages, *w(L)*	
Minimum Yearly Wage	$7,930.50USD
Average Yearly Wage	$26,729USD
Placeholder Higher Yearly Wage	~$50,000USD
Placeholder Highest Yearly Wage	~$85,000USD

Because there was a lack of sufficient data on women's yearly wages in Chile, I relied on meta-analysis to determine the wage values in simulations where a gender wage differential is taken into account. These simulations rest on the assumption from Sánchez (2021) that Chilean men earn, on average, 19% - 28% more than women as a result of the differences in labor supply elasticities, *ceteris paribus*. To estimate this, Sánchez used Chile's full administrative Unemployment Insurance database provided by the Unemployment Fund Administrator. In a sample of data ranging from January of 2010 to June of 2019, Sánchez considers individuals with 18-64 and 18-59 years of age for men and women. They calculated labor supply elasticities of 0.61 for men and 0.36 for women, and through using the main result of their theoretical model, they arrived at the empirical value of the gender wage gap of 19 - 28%.

Data on life expectancy was collected from *World Development Indicators,* sourced from census data from the United Nations World Population Prospects. Life expectancy at birth used in this data is the average number of years a newborn is expected to live if mortality patterns at the time of the newborn's birth remain constant. It is calculated in a period life table which reflects a population's mortality pattern at a given time. The values for life expectancy used in the simulations are the most recent values from 2020, given below:
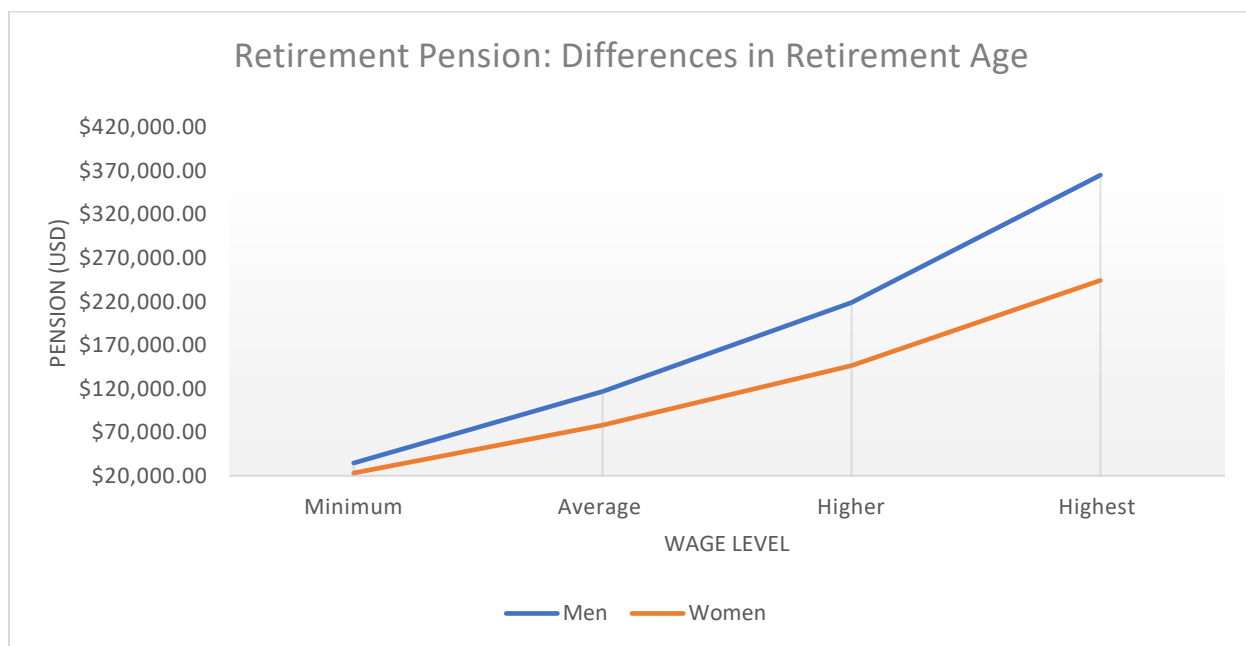
Chilean Life Expectancy by Gender, 2020	
Male	77.99 or ~78

Female	82.5 or ~ 83

Data on the mean age of Chilean women at childbirth was collected from the OECD Family Database. The value used in the fertility simulations is 29, the most recent value given for Chile in the year 2020.

VI.   Results and Discussion

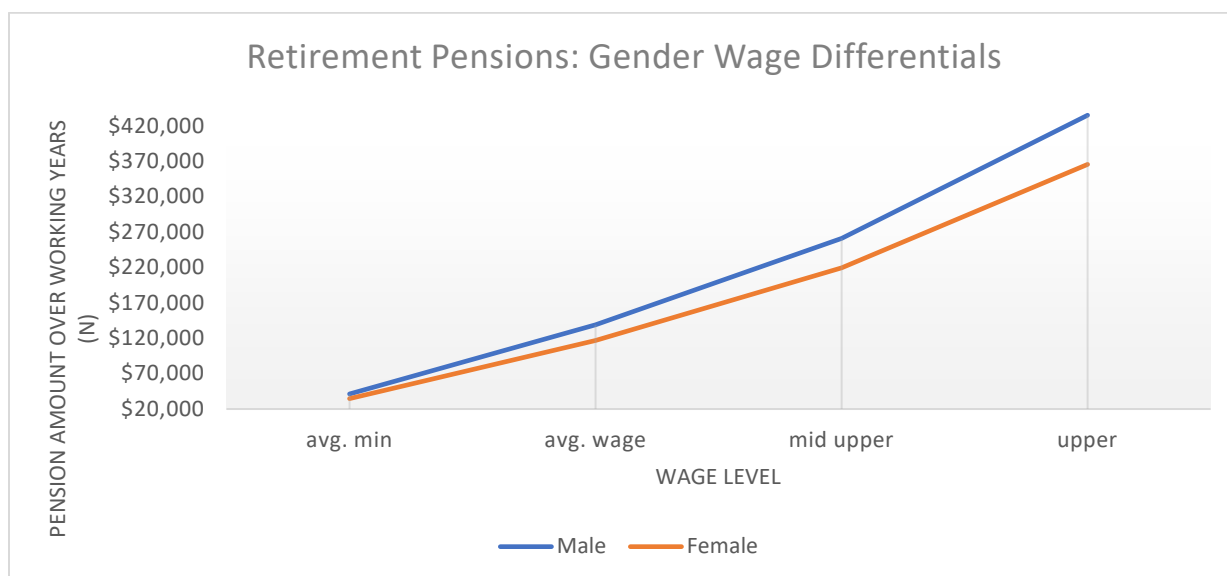*Simulation 1: Difference in Retirement Age*

The percent difference found between male and female retirees across all levels of income due to differences in retirement age, *ceteris paribus*, is 36.66%. Under the assumptions of this simulation, a female would only need to match the retirement age of men, working for an additional 5 years, to eliminate the gender pension differential. However, this simulation is grossly simplistic, as there are several other factors that come into play affecting a female's retirement pension in Chile.

Simulation 1: Incorporating Life Expectancy

**Replacement Rates: Differences in Retirement Age**
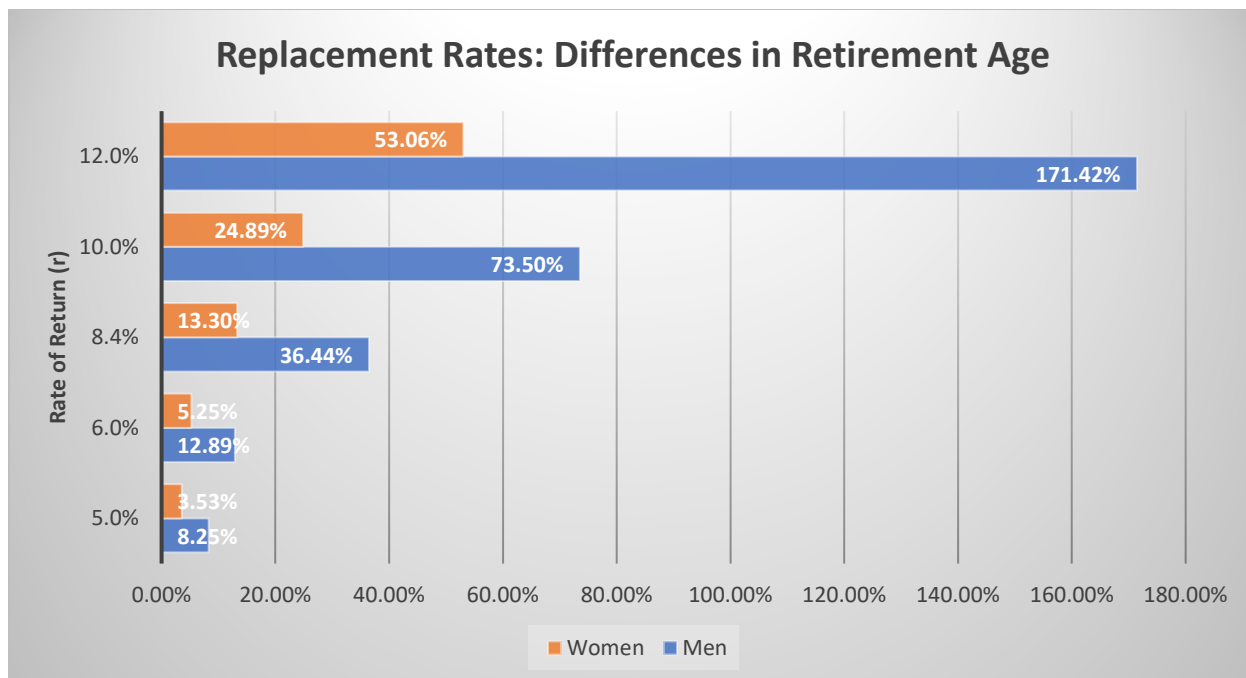
The pension differential is even further exacerbated through the incorporation of life expectancy. Females in Chile live, on average, 5 years longer than men, meaning that females must finance a longer retirement, while also retiring 5 years earlier. In total, this signifies a retirement period that is 10 years longer than that of the average Chilean male. Under the assumptions of this simulation, the impact of life expectancy on the retirement pension differential can be observed by calculating the replacement rate between the male and female retiree. At the average rate of return of 8.4%, replacement rates are 36.44% for men and 13.3% for women, respectively.

Simulation 2: Differences in Wages


Retirement Pensions: Gender Wage Differentials

The percent difference found between male and female retirees across all levels of income due to a 19% wage differential, is 17.35%, *ceteris paribus.* In other words, this result showcases the pension differential that exists between male and female retirees solely because of a wage differential. Following the assumption of this simulation that male and female retirees are now both choosing to retire at the age of 65, a female would have to work approximately 2.2 years longer than a man to eliminate the gender pension differential.

Simulation 2: Incorporating Life Expectancy
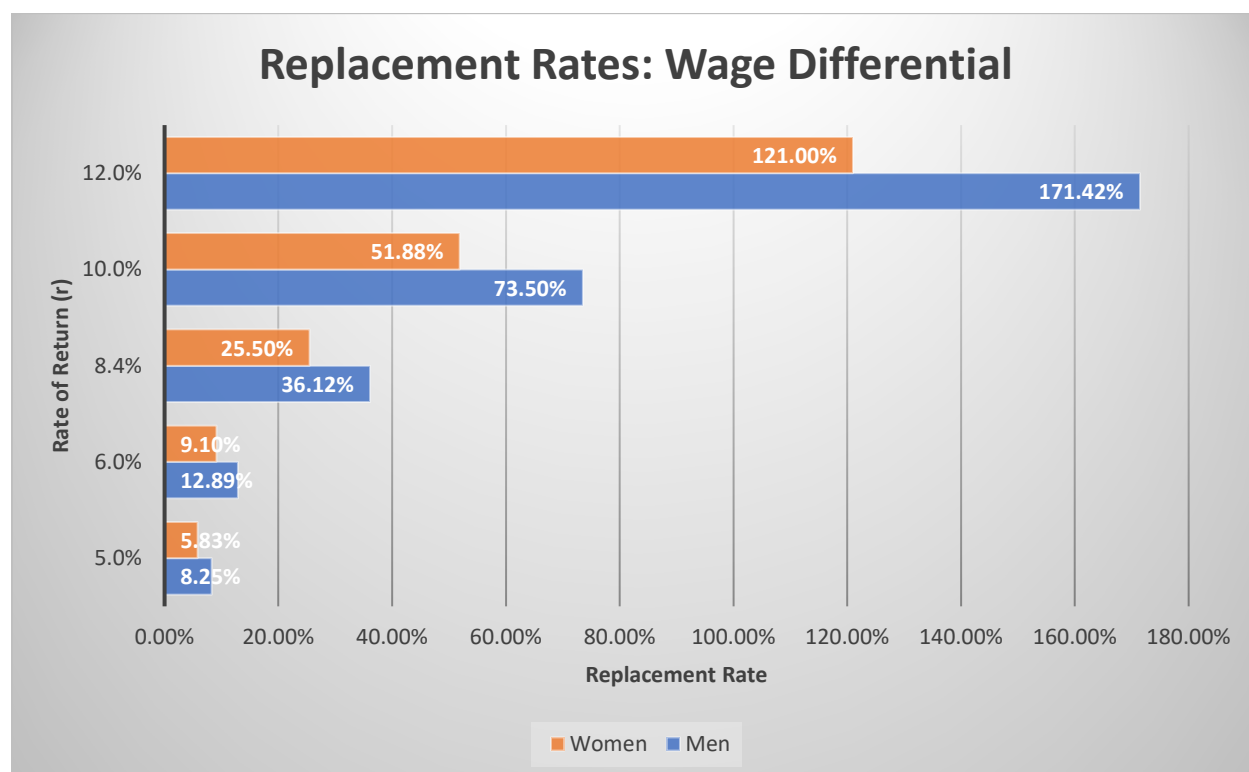
Solely considering differential wages between men and women, at the average rate of return of 8.4%, the replacement rate of men is 36.12%, whereas for women, it is 25.50%. In contrast with the previous simulation, the replacement rate of women actually increases with the incorporation of life expectancy. This result is assumed to be because of the extra five years added to the working life of a Chilean woman. During this added time period, she not only has the opportunity to make additional contributions to her retirement fund, but her retirement funds in total are given five extra years to accumulating, and thus, accruing a larger replacement ratio of her lower salary relative to a man.

Simulation 3: Considering Differences in Retirement Age and Wages

Retirement Pension: Wage Differentials and Differences in Retirement Age
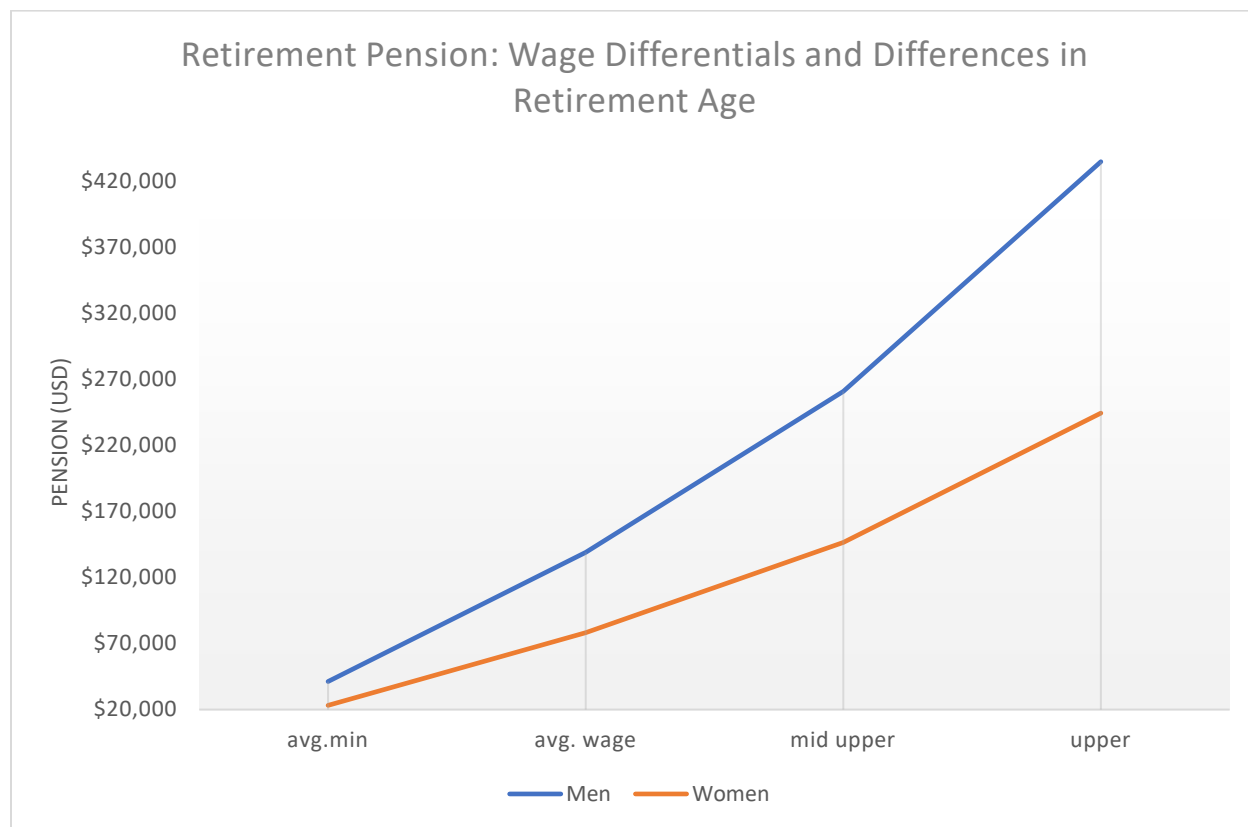
Considering the combined pension effect of differences in retirement age and wages between men and women, the percent difference between male and female pensions across all levels of income is 56.05%, *ceteris paribus*. In other words, this is the result of a woman funding 5 extra years of retirement while earning and income 19% lower than the average male salary. To eliminate the gender pension differential, the average female Chilean would have to work approximately 2.2 years longer than a man, and 7.2 years later than her legal retirement age of 60.

Simulation 4: Education

4.1 Assuming Chilean Females earn 65% of Male Earnings after Graduation from University
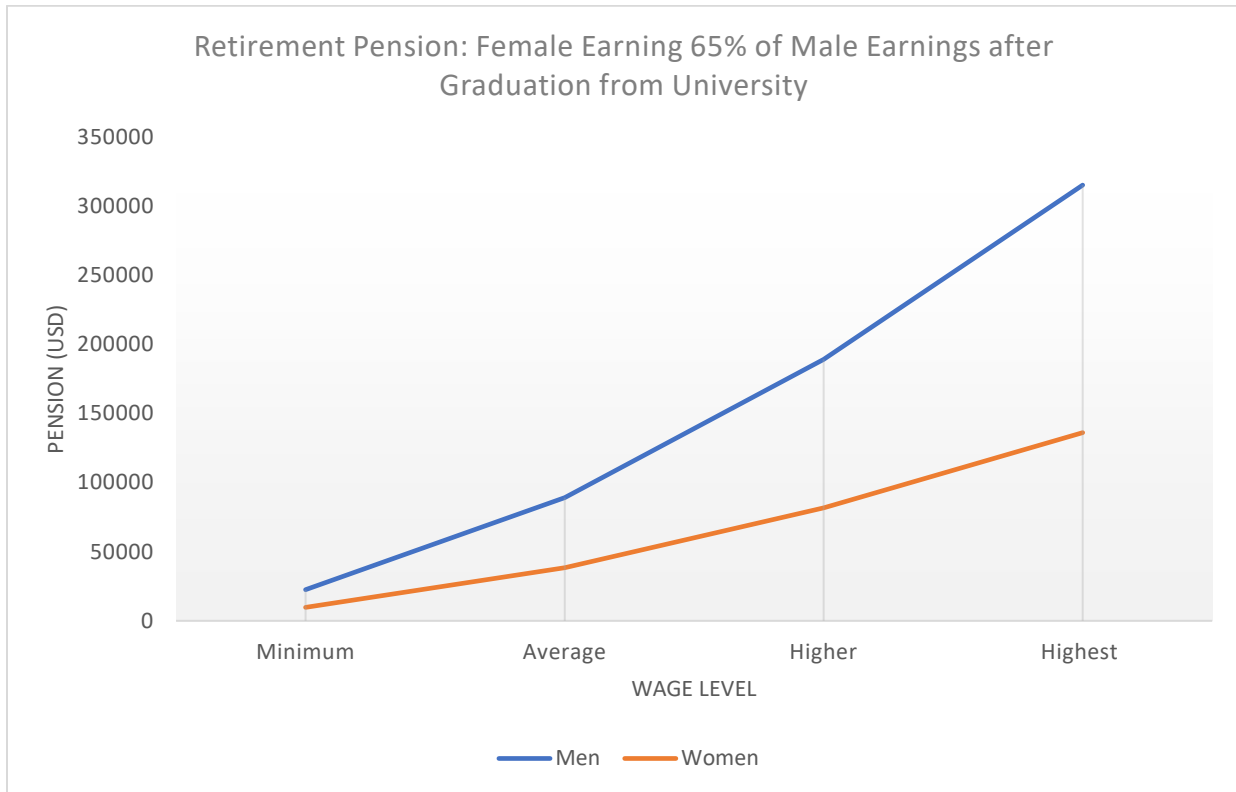
Under the assumption that Chilean females earn roughly 65% of the salary of their male counterparts, post-tertiary graduation, the percent difference across all levels of income between the pensions of men and women is found to be 79.36%. In this example, the average Chilean woman would have to work 5 years longer than the average Chilean man, under the assumption that they both retire at the age of 65, but 10 years longer than her legal retirement age of 60 to eliminate the gender pension differential.

4.2 Man with Secondary Degree vs. Female with Tertiary Degree
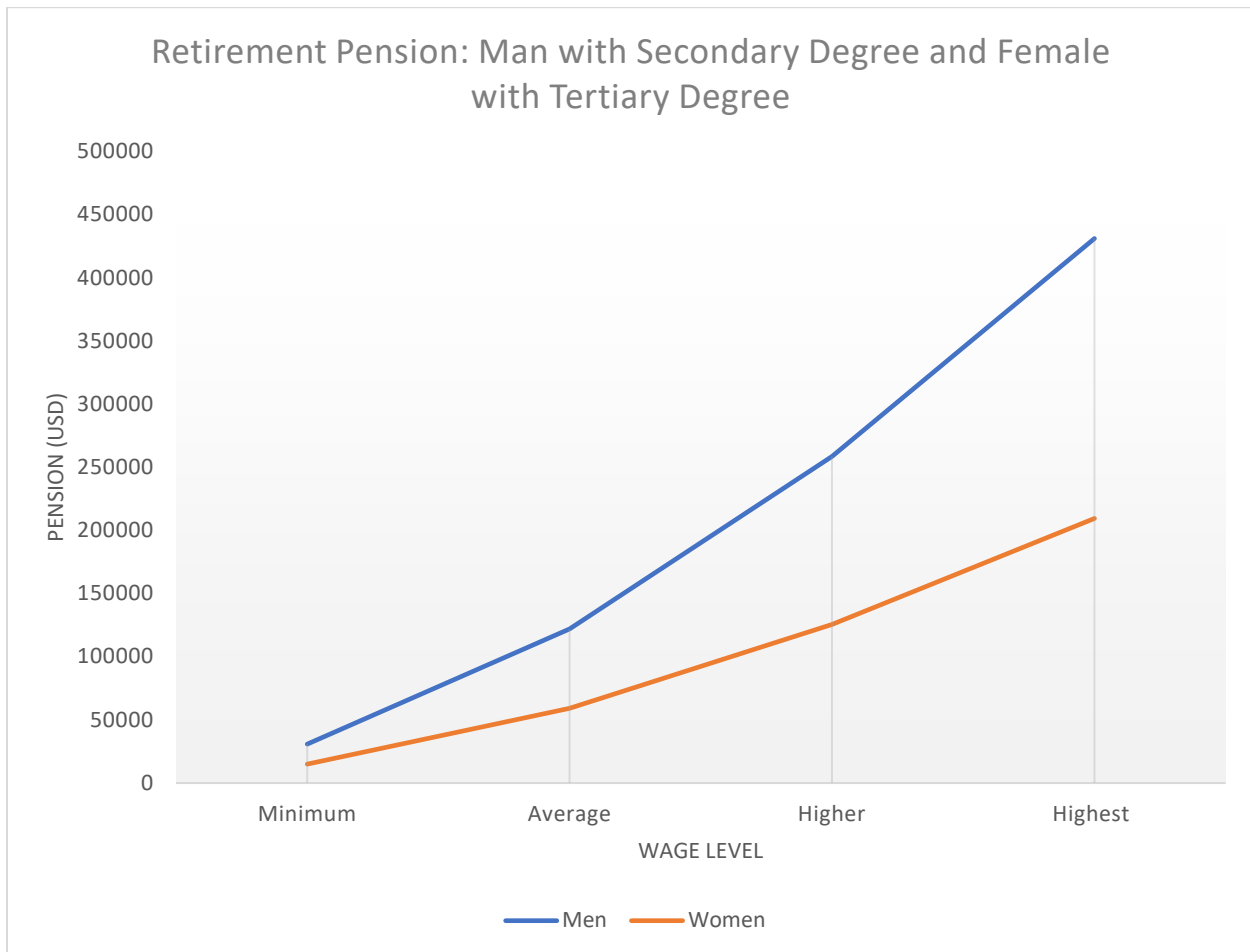
Under the assumption that a college-graduate female earns a 19% return on her education, the percent difference across all levels of income between the pensions of men and women is found to be 69.20%. Due to her increased earnings across her working life relative to a high-school graduate male, the average female Chilean only has to work approximately 1.8 years longer than a man, but 7 years longer than her legal retirement age of 60 to eliminate the gender pension differential. However, this wage differential of 19% is merely a placeholder, and nothing more than a guess. With further calculation, it was found that if a woman were to complete four years of tertiary education, start her working life at the age of 22 and retire at the age of 60, she will have to earn an average yearly income across her working life that is 106% more than a high-school graduate male who started work at the age of 18.

Simulation 5: Childcare

5.1 The Birth of One Child

Retirement Pension: Birth of One Child
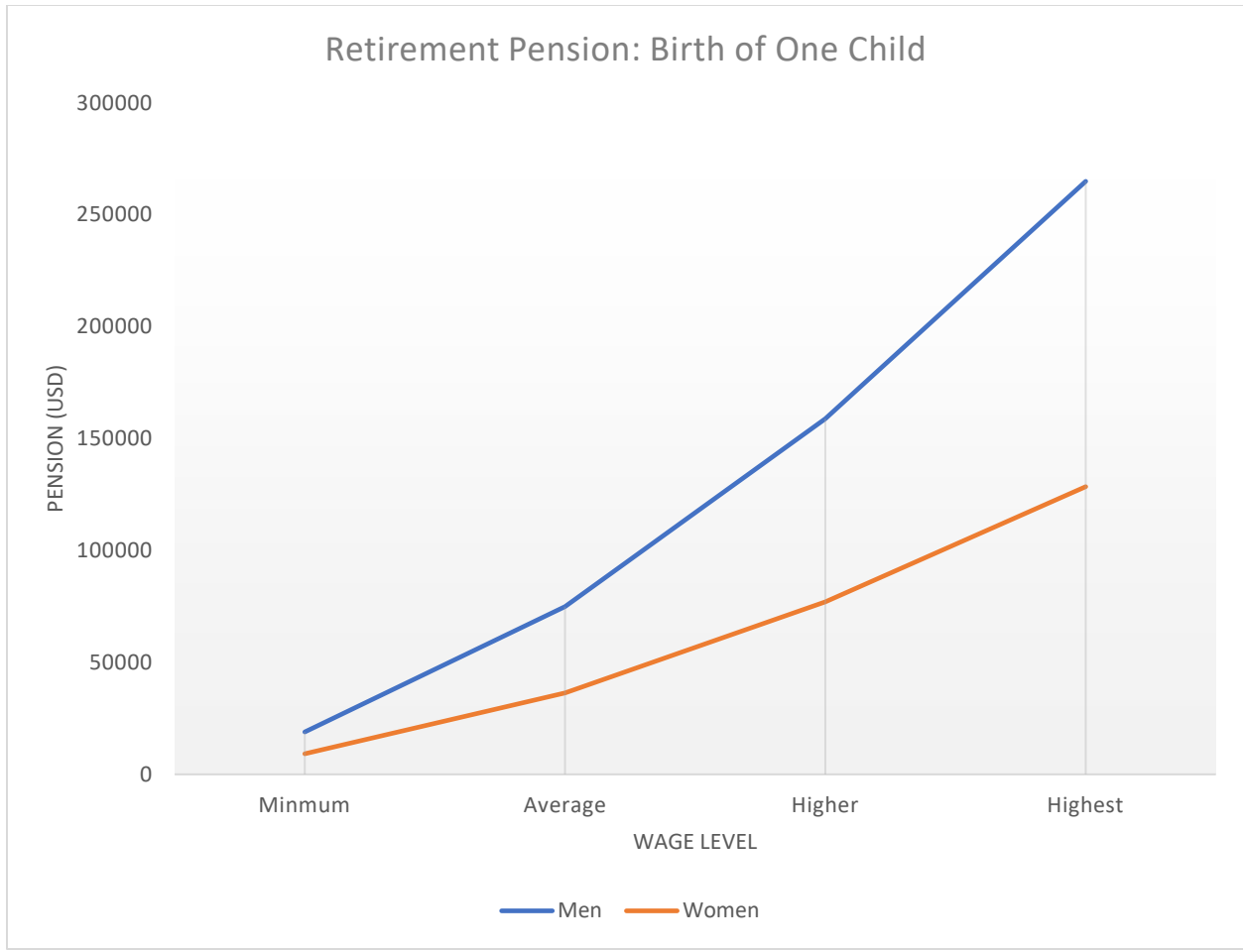
Under the assumption that the average female Chilean mother is a single mother who has her first child at the age of 29, graduated from college at the age of 22, and chose to retire at the age of 60, the percent difference across all levels of income between the pensions of men and women is found to be 69.20%. This is assumed to be the result of the four years of at-home childcare a mother must provide due to insufficient access to affordable childcare until the child is four years of age. With the birth of one child, the working life of a Chilean woman is shortened drastically relative to the Chilean man, providing her with fewer opportunities for pension contributions.

5.2 The Birth of a Second Child

Retirement Pension: Birth of a Second Child
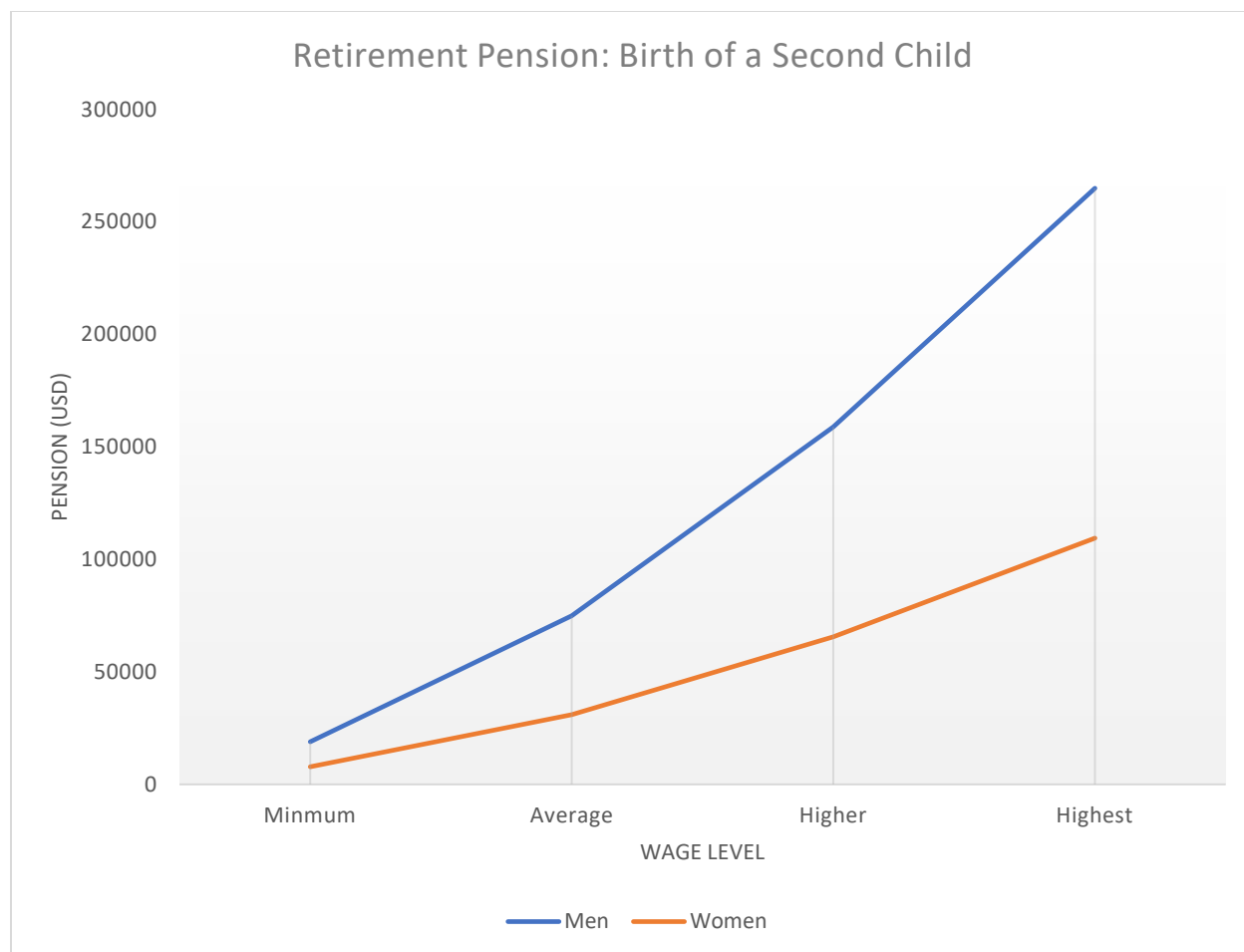
Under the same starting assumptions as Simulation 5.1, the impact of the birth of a second child is observed. The percent difference across all levels of income between the pensions of men and women is found to be 83.076%. This difference between pensions represents the largest difference found in this study and goes to show how far a policy created to expand affordable childcare or offer more flexible maternity leave would go in terms of diminishing the gender pension differential.

Limitations and Concluding Remarks

These counterfactuals tell a story, but they are extremely limited in their representation of reality as it exists in Chile. However, they aren't meant to display the most intricate and realistic of situations. What was intended with these simulations was instead the demonstrations of the simplest situations that great inequality, so that one can imagine the inequality produced from much more complex and real scenarios. The specific limitations of this study are as follows; it assumed a fixed rate of return across the working life of Chileans, it assumed a fixed wage instead of wage growth over the working life of Chileans. These are identified as areas for further study under more intricate methods of analysis and using ample data. Additionally, several of the simulations conducted had to be simplified using the results from previous studies and meta-analysis due to the lack of sufficient data. If sufficient data could have been located to explore this research question, the preferred method of analysis would have been a regression.

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