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Ph.D. Dissertation in Social Welfare

**Pension Reform Trajectories and
Their Effects on Pension Effort**

- Pension Effort: Pension Expenditure and Pension Generosity-

연금개혁 궤적이 연금노력에 미치는 영향

August 2020

Department of Social Welfare

The Graduate School

Seoul National University

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Pension Reform Trajectories and Their Effects on Pension Effort

- Pension Effort: Pension Expenditure and Pension Generosity

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夏美香

A DISSERTATION SUBMITTED TO THE
DEPARTMENT OF SOCIAL WELFARE AND THE
COMMITTEE ON THE GRADUATE SCHOOL IN
PARTIAL FULFILLMENT OF THE REQUIRMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN
SOCIAL WELFARE

**THE GRADUATE SCHOOL
SEOUL NATIONAL UNIVERSITY**

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이 논문을 사회복지학박사 학위논문으로 제출함

2020 년 5 월

서울대학교 대학원

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Abstract

Pension Reform Trajectories and Their Effects on Pension Effort

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This study characterizes 15 countries' pension reform trajectories and statistically examines how these pension reform trajectories affect pension effort during the CRP (Compound Reform Period 1990-2015). This study defines pension reform as either contractionary and expansionary reforms; pension effort refers to both pension expenditure and pension generosity. Conventionally, studies have often examined how socio-influential factors (e.g. socio-economic, institutional, and political factors) affect pension effort. However, these discourses have heavily emphasized contractionary pension reforms and pension expenditure, but have overlooked expansionary pension reforms and pension generosity. This study argues that the traditional retrenchment-focused approach to pension policy research is rooted largely in inherited theories of the 'Welfare State Crisis' and macro-socio-economics, that are not reflective of the recent post-industrial policy shifts occurring in the world. In particular to pension policy, in response to the 20th century old and new social risks, traditional Bismarckian and Beveridgean countries have implemented a mix of contractionary and expansionary reforms. These

reforms were designed to deal with pension financial sustainability and adequacy against old age poverty. Consequently, two primary limitations of previous studies have become apparent. The austerity-oriented and macro view of pension effort using socio-influential factors overlooks an important building block within the dynamic pension reform process. In addition, existing quantitative and qualitative studies have centered around institutions that examine pension policies from a static perspective - overlooking pension policy dynamic changes. During the CRP, pension systems have experienced two interconnected components - retrenchment and expansionary reforms - that ultimately define pension effort. Accordingly, it is necessary to comprehensively investigate how these components of dynamic pension reform affect pension effort in the context of both pension expenditure and pension generosity.

This study organized expansionary and retrenchment pension reforms using ten pension reform variables based on the work Häusermann (2010): insurance (e.g. parametric pension reforms), capitalization (e.g. DB to DC shifts), targeting (e.g. means-tested), and recalibration (e.g. pension credits). In order to evaluate how these pension reforms affected pension effort, this study utilized two analytical methods: unsupervised clustering characterizes pension reform trajectories, and an LMM (Mixed Effect Model) statistically evaluates their effectiveness with respect to pension expenditure and pension generosity. Pension reforms were categorized into four pension reform clusters: labor-activated pension (LAP) reforms, extended privatization pension (EPP) reforms, latecomer structural pension (LSP) reforms and extensive retrenchment pension (ERP) reforms.

The labor-activated pension reform (LAP) cluster is generally composed of advanced welfare states that experienced the highest unemployment rates and most pressing demographic changes prior to the CRP.

However, their transition into the CRP has been met with significant GDP growth and high employment rates. At the same time, this cluster is facing the highest level of new social risks in regions like: women's labor participation, employment in services and economic openness. In response to both old and new social risks, most of the countries in this cluster made significant reforms meant to mitigate their effects. Various parametric pension reforms (e.g. increasing retirement age, penalizing early retirement etc.) encourage individuals near retirement to continue working or re-enter the workforce, thus increasing labor supply. In addition, targeting and recalibration reforms incentivize participation in the labor market by lowering pension eligibility requirements.

The extended privatization pension reform (EPP) cluster is very similar in its macro-socio-economic structure to the labor-activated pension reform (LAP) cluster, in that it is defined by developed nations that experienced drastic macro-socio-economic changes before the CRP. However, in the CRP this cluster has the highest levels of aged 65 years and older individuals, coupled with a moderately high economic growth. Growth compared to the labor activated pension reform cluster may be lower due to this aging. When a higher proportion of a total population is elderly, a larger proportion of economic expenses must be spent on retirement care. However, another additional feature of this cluster's socio-economics is lower birth rates. Some new social risks of interest that have had a particular effect on this cluster are increasing service sector employment rates and higher economic openness. However, pension reform strategies are vastly different from the labor-activated pension reform (LAP) reform strategies. This reform cluster shifts enrollment in occupational or individual pension programs from voluntary to mandatory, and these programs then work in conjunction with existing public pension systems. However, in order to compensate

disadvantaged groups and unpaid workers, various expansionary pension reforms were also implemented in tandem; for example, means-tested pension benefits, tax reductions or earnings-related subsidies to employers, employees or individuals.

The latecomer structural pension reform cluster (LSP) is uniquely composed of countries that had transitioned from centrally planned economies to widespread market-based economies at the inception of their original pension programs. Their transition to market based-economies was not smooth and this was reflected in their relatively slow economic growth. Structural changes are not the only facet that describe the struggles these countries have had during the CRP; demographic issues have also played an outsized role in their economies. Not only had their relative population aged, but at same time, there was a dramatic drop in their fertility rates. New social risks have been reflected in their rising proportion of service sector employment and the swift opening of their economies. This cluster turned to structural-based reforms as a countermeasure to the ballooning pension expenditures that ensued, because of these different macro-socio-economic hardships. In order to compensate disadvantaged groups and unpaid workers, various expansionary pension reforms were also implemented in tandem with contractionary reforms (ex. targeting reform), but recalibration reforms were not implemented.

The extensive retrenchment pension reform cluster (ERP), is composed of countries that demographically aged the most, and experienced the greatest long-term economic hardships because of economic crises during the CRP. Another critical issue was the decline of birth rates in these countries. New social risks have also added stress to their economic hardships with increases in atypical workers, women's labor participation rates, and serious issues with low employment rates. Under these increasing new social risks and problematic pension structures, the extensive retrenchment pension (ERP)

reform cluster retrenched inherited asymmetric pension systems through radical parametric reforms, then means-tested programs were additionally added to compensate low-income groups and impoverished elderly.

Each pension reform clusters' socio-economic backgrounds provide insight into the underlying indicators that are correlated with their adoption of different pension reform policies. Using these pension reform clusters as independent variables, this study demonstrates that different pension reforms have diversified the existing architecture of pension effort. According to the Linear Mixed Effect Model (LMM) results, the labor-activated pension reform (LAP) cluster statistically reduced pension expenditure relative to the reference pension reform cluster (extensive retrenchment pension reform cluster). The extended privatization pension (EPP) reform cluster significantly reduced pension generosity relative to the reference pension reform cluster (extensive retrenchment pension reform cluster). While the labor-activated pension (LAP) reform cluster maintained the highest standard pension retirement age and most restrictions on early retirement, the extended privatization pension (EPP) reform cluster created a more direct link between pension benefits and an individual's pension contributions, by shifting to mandatory enrollment in occupational or individual pension programs.

This study asserts that pension reforms are the key to understanding pension effort (pension expenditure and pension generosity), and that contractionary and expansionary pension reform policies should be studied together. In addition, existing comparative studies have often excluded East-Asian countries, in particular, China, Japan, and Korea. They should be included in comparative policy analysis that will allow researchers to determine if they are empirically different, and thus compensate or address those differences more effectively in future research. In comparative social policy research, from the new institutionalism perspective, policy

classifications should consider the process of policy change, from a dynamic perspective rather than static characteristics.

This study suggests that policymakers may need to be concerned about each pension reform's pros and cons in the context of pension expenditure and generosity when adopting a pension reform. In future pension reforms, policymakers need to explicitly design their policies around increasing new profiles who, if not considered more carefully, are at higher risk of poverty in this post-industrialized global economy. The most sensible means of doing this is if policymakers avoid reducing benefits for these groups when legislating future pension reforms. Take Korean pension reforms as an example. Korea adopted extensive parametric pension (ERP) reforms that may prove to be an effective way of curbing costs, while means-tested incentives provide more generous benefits to the growing population of at-risk individuals. However, extensive retrenchment pension (ERP) reforms have a high risk of providing inadequate pension benefits to at-risk groups without seriously resolving issues with program expenditure. Since extensive retrenchment pension (ERP) reforms do not sufficiently meet the needs of the Korean pension system, the next step is to look at alternative clusters to resolve these issues. Extended privatization pension reforms (EPP) generally supplement pension benefits by adopting a market-based pension component. However, adopting a reform from this cluster will also likely result in stagnated pension coverage, deteriorated pension benefits, and increased gender and income inequality. Adoption of a latecomer structural pension reform (LSP) (e.g. NDC) is also not realistic, because there are a large number of atypical workers in Korea (e.g. self-employed, part-time workers) who are unable to shoulder considerable financial burdens (double payment issues). This study suggests that adopting a labor-activated pension reform (LAP) may be the most effective pension strategy to strengthen Korean public pension

system security. This strategy takes into account new career profiles that were previous overlooked by the system; the goal of including these workers to the system would be reduce the occurrence of old age poverty.

Keywords:

Pension reform, Expansionary pension reform, Retrenchment pension reform, Pension reform cluster, Pension Effort, Pension Expenditure, Pension Generosity, Unsupervised clustering analysis, a Linear Mixed Effect Model

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LIST OF ABBREVIATIONS

DB	Defined Benefit
DC	Defined Contribution
MISSCO	Mutual Information System on Social Protection
NDC	Notional Defined Contribution
ISSA	International Social Security Association
ILO	International Labor Organization
OECD	Organization for Economic Cooperation and Development
PAYG	Pay-As-You-Go
WB	World Bank
CRP	Compound Reform Period
EPP	Extensive retrenchment pension reform
ERP	Extended privatization pension reform
LAP	Labor-activated pension reform
LSP	Latecomer structural pension reform
WRP	Welfare Retrenchment Period
WEP	Welfare Expansion Period

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Chapter One: Introduction

1.1 The Purpose of this Study

The purpose of this study is to analyze how both contractionary and expansionary pension reforms have affected pension expenditure and pension generosity from 1990 to 2015, using cluster analysis and linear Mixed Effect Models (LMMs). A new dynamic has emerged from the modern pension reform efforts of contemporary welfare states - the combined implementation of retrenchment and expansionary pension reforms - in response to old and new social risks. Due to pension structural and socio-economic differences between developed nations, the pension reforms adopted for a given country are far from homogeneous. Yet, the impact of these pension reforms has been quantitatively under-investigated, leaving a 'black box' over the true driving mechanism that defines changes to pension effort (e.g. pension expenditure and pension generosity).

Research into comparative welfare states development has often divided the post-war era into two periods, the first being the welfare state expansion period (WEP) from 1945 to the mid-1970s; where public welfare policies were rapidly adopted by most industrialized nations. This was followed by the welfare state retrenchment period (WRP) defined as period

starting from the mid-1970s to the present; where demographic changes and the oil crisis of the 1970's required countries to re-evaluate and reform welfare policies, mainly through a series of cutbacks (Pierson, 2000; Hemerijck, 2012). However, since the early to mid-1990s, new social risks have forced countries to transition, once again, to a new era of welfare policy reform¹. Like the previous era, this period is characterized primarily by retrenchment, but new expansionary reform policies are also being adopted alongside these cutbacks. It may be more suitable then to define the WRP until 1990 and, instead for this study, refer to the current era as the compound reform period (CRP) (1990-present).

The demographics of most nations with welfare policies significantly aged, enlarging the gap between contributions paid by workers and the benefits claimed by retirees during the CRP (1990-2015). Silja Häusermann stresses that, "Demographic aging induces precisely this kind of drift: the contributing generation becomes smaller, and the number of beneficiaries increase" (Häusermann, 2010, p. 39). Demographic changes of this kind have placed fiscal pressure on public pension systems' affordability and sustainability, particularly because the majority of these systems rely strongly

¹ The emergence of new social risks can be conceptualized in various ways. According to Bonoli (2007), when a country transitions to a post-industrialized economy the result is economic, demographic and social structure changes. New social risks can be defined to include increases in women's labor participation, service and atypical workers, long term unemployment, etc.

on earnings-based contributions and/or are financed with Pay-as-you-go (PAYG) provisions (Pierson, 1993, 1996; Schludi, 2005; 2019)².

On top of demographic changes, labor market transformations taking place around the world have exacerbated existing pitfalls in the current pension system. Post-industrial employment structures have required that pension systems provide support for a whole range of new social needs (Häusermann, 2010a). For instance, an increasing percentage of the workforce consists of service-based and/or atypical employment. These workers, under most current systems, would be excluded from benefits (European Commission, 2012; OECD, 2015). In addition, societal and demographic changes also bring an increase in the diversification of households: higher rates of divorce or family separation, single parent households, or non-traditional family units. These households challenge the existing pension infrastructure that was initially planned around male breadwinners or the derived rights of spouses, traditional parts of the nuclear family structure.

These challenges have translated into a plethora of pension reforms since the end of the 1990s. Many countries have carried out wide-ranging parametric reforms to contain the future costs of their public pension systems, such as increasing the retirement age, cutting pension benefits, raising

² Pay-as-you-go (PAYG) pension systems are systems that use the contributions of currently employed individuals to pay for the pension benefits of currently retired individuals.

contribution levels, etc. For example, Greece raised the retirement age from 65 to 67 for men and gradually raised women's retirement age from 60 to 65 between 2008 and 2015. Similarly, the US has also set a higher retirement age, 66 for men and 65 for women starting in 2012. Such pension reforms have gained momentum since the 1990s (Pierson, 2006). The World Bank publication "Averting the Old Age Crisis: Policies to protect the old and promote growth" (1994) has had notable influence on reform, and following its lead, an increasing number of governments around the world have chosen to privatize their systems or add mandatory or voluntary funded programs to their public pension systems³. For instance, Poland, Sweden, China and Italy have shifted their systems from PAYG to Notional Defined Contribution (NDC). Some countries made a similar transition by adding an extra privatized pillar of mandatory or voluntary occupational pensions onto their existing systems. Other countries like the United States introduced a privatized market-

³ The recommendations outlined by the World Bank included a suggestion for countries to consider reforming their pension system structures into multi-pillar systems. Specifically, the World Bank suggests a three-pillar model that intended on distributing the risks and functions of social protection, rather than solely relying on either a public or private program. Where first pillar programs are mandatory existing public pension plans but are more redistributive (James, 1995; Holzmann, 2000). These programs provide a social safety net for the elderly through tax-based revenues. In the UK a mandatory means-tested benefit, or a flat benefit program was developed for this purpose. Second pillar programs are also mandatory and consist primarily of privately-provided pension income. This income is earned either through individual or occupational defined-benefit (DB) pension plans or defined-contribution (DC) retirement savings accounts. Benefits here are fully-funded, based on the amount of funds accumulated in an individual's account (World Bank, 1994). Third pillar programs are voluntary provisions funded through other forms of retirement savings. These are typically DC plans, that motivate participation through tax incentive provisions.

based system like the 401k, and Germany introduced a state-subsidized, voluntary private pension (Oksanen & Virtanen, 2012; Natali & Rhodes, 2004).

While privatization was intended to enhance existing benefits, similar to previous programs, it insufficiently addresses the needs of at-risk populations. Since most pension systems still derive from an archaic socio-economic model, originally from the WEP, benefits are typically awarded based on full-time-employment contributions only. At-risk populations are more likely to experience career interruptions that result in an inability to qualify for benefits (Bonoli & Shinkawa, 2005; Häusermann, 2010; Joubert & Todd, 2011; OECD, 2015). To meet the challenges of the world's changing demographics and social-economies, a variety of expansionary pension reforms have attempted to include these new groups (Häusermann, 2010, p34, Bonoli & Natali, 2013). Extra pension credits are an example of one method that these expansionary reforms are using, which add some flexibility to the eligibility requirements of existing systems. Means-tested pensions may also directly supplement retirement income. The overall motivation of such programs has been to focus on providing adequate pension benefits for those populations at risk of falling into poverty.

Since the CRP (1990-2015), the strategies that have been implemented to reform pension systems have begun to mature, indicated by the transition to a combination of retrenchment and expansionary reforms. These policy

instruments are composed of four different reform types – insurance, capitalization, targeting and recalibration (Häusermann & Kriesi, 2015; Häusermann, 2010, 2012). Yet there is still a distinct trend toward retrenchment policies, that has sparked growing concern that the goal of curtailing pension expenditures will eclipse the reasons pensions were originally adopted. Concerns about this trend focus on the potential danger retrenchment poses to the generosity of pension-based retirement incomes, which is commonly measured by looking at the ratio of post-retirement to pre-retirement income. Therefore, behind these concerns about pension sustainability, critical questions are left unanswered. One of the most important of these questions is: how have these diverse pension reforms affected pension effort? Pension effort is defined as both pension expenditure and pension generosity. Previous studies have primarily investigated the large-scale effects of socio-economic factors, political factors, or institutional factors on pension effort, but little is known about how the traits of pension effort are shaped by the dimensions of pension reform (Esping-Andersen, 1990; Esping-Andersen, 2017; Pierson, 2001; Scruggs & James, 2006). Furthermore, the performance of a pension system is initially characterized by the cost to operate the system (expenditure) and the benefits that are awarded to participants in the system (generosity). Yet, pension expenditure has served as the only representative dependent variable. In order to fill this research gap,

the aim of this study is to supplement existing pension reform research by first classifying pension reforms into reform types, and then examine how pension expenditure and generosity respond when these reform types are implemented and or manipulated. This work is focused on reforms implemented in 15 countries during the CRP between 1990 and 2015.

1.2 Limitations of Contemporary Literature

There has been a level of dynamism to the reforms implemented during the CRP that was not previously seen. The dynamics are defined by the relationship between changes to reform strategies, i.e., changes to a reform type, and the resulting generosity and expenditure of reformed systems. In simpler terms, reform strategies matter because of their direct consequences on not only pension expenditure, but also pension generosity for a given economy. That leads to another question. How are generosity and expenditure each uniquely impacted by pension reforms? Nevertheless, even though pension systems undergo a plethora of reforms, pension expenditure may remain unchanged, or even increase due to an increasing number of beneficiaries. However, this does not mean that pension generosity remains unchanged; rather, it often decreases. It should be noted that reducing pension generosity can positively contribute to pension sustainability, but it has an adverse effect on pension adequacy, which is highly correlated with old-age

poverty. In other words, pension reform should not merely focus on pension financial stability, but also on income security (Esser & Palme, 2010). Yet, how reforms impact pension generosity has been quantitatively under-investigated. Pension reform is the political instrument necessary to restructure a given country's existing pension policy output architecture. It is known that various factors (socio-economic, political, institutional, etc.) affect the pension policy, and in the end pension effort. Key changes to pension output, on the other hand, lie in the instrument, pension reform, specifically crafted to counter financial instabilities or other drawbacks. Thus, the reform strategy chosen and ultimately implemented, and its relationship to pension spending and pension generosity, cannot be overlooked. The goal of this section, discussed in more detail in Chapter Two, is to provide a greater understanding of pension reform and pension output, the factors that impact them, and how previous literature has yet to tackle the intricate relationship between them.

Scholars of the WEP (before the mid-1970's) were determined to explain the ongoing trends of pension effort; their desire was to understand how pensions developed and why the systems implemented by different countries yielded such starkly different outcomes. Thus, the first attempt at modeling these trends was through an examination of identifiable economic elements. From an economic perspective, published literature highlighted

pension spending's upward trajectory as a function of rapid economic development (Pampel & Williamson, 1985; Pampel & Williamson, 2010; Wilensky, 1976; Myles & Quadagno, 2002). A second attempt at understanding pension policies employed the Power Resource Theory (PRT), which identified how the WEP had been distinctively marked by the successful lobbying of leftist parties, strong trade unions, and working-class constituents using political pressure (Stephens, 1995,1979; Castles, 2004; Korpi, 2000). Their desire for a strong social safety net in turn fueled increases in pension effort. Nevertheless, both perspectives were severely criticized. Political scientists pointed out that drawing conclusions after applying only an economic model ineffectively explained previously observed cross-national variations in pension spending. Additionally, these models relied on the assumption that economic development was directly correlated to pension spending. However, as time went on political scholars too began to criticize previously held political perspectives, claiming that institutional legacy and the power of the state are highly correlated to pension spending levels (Hochschild & Skocpol, 1996; Skocpol, 1995; Huber, Ragin, & Stephens, 1993). Accordingly, a third attempt highlighted these institutional matters, and claimed that existing policies have had a substantial impact on current pension spending, from the old perspective of institutionalism. By the end of the WEP

three distinct interpretations of pension spending, and what had driven its rise, had been established.

The mid-1970s birthed a new, radical perspective on pension spending that led to dramatic cuts, the WRP (the mid-1970s to the early 1990s). Yet, the institutions that had been previously established during the WEP could not be so easily dismantled. Gosta Esping-Andersen's work points out that the difficulty in dismantling a welfare state is in part due to the class-structures of society at-large, and the power and ease-of-mobilization that had been previously demonstrated by the working class. Validating his argument through further implementation of the Power Resource Theory. He concluded that through all the hardships that countries suffered due to the 1970s' oil shock and increasing demographic aging, welfare programs remained mainly unchanged (Esping-Andersen, 1999). While welfare programs may have been resistant to retrenchment policies, Esping-Andersen had constructed his theory on the idea that political actors were the pivotal component to this resilience. Paul Pierson (1994 & 1996) reshuffled these conventional theories. He argued that "old politics" are not the reason for the resilience of welfare programs, but rather, pension reform and the "new politics" of retrenchment fell victim to unpopularity, and that the real driver was "blame avoidance" on the part of the political actors involved.

The insight gained from socio-economic, political and institutional discourse has influenced pension policy in a useful manner, but it hasn't clearly shone a light onto the dynamics of pension system change (Häusermann, 2010). The analysis so far has been relatively one-directional; discourse has been limited to a scope where welfare programs have either remained untouched, are totally dismantled, or are on their way to being dismantled. Since the beginning of the CRP (mid-1990s to the present), pension reform has become increasingly dynamic. Instead of moving only toward retrenchment, expansionary reforms have also been implemented. Thus, the arguments that were previously introduced only explain part of the actual ongoing dynamics that are changing institutions. The interconnectivity of both retrenchment and expansionary reforms are key to considering the whole picture. In fact, pension systems have been dynamically reformed through the implementation of various parametric and structural reforms in different countries over time (Bonoli & Palier, 2007; Bonoli, 2000, 2007; Häusermann, 2010). In the last decade, new institutionalism has become the accepted theory to account for the dynamics of pension reform, emphasizing that pension changes are built on both actors and institutions. Instead of considering only institutional constraints, related literature has acknowledged that "institutions may not only influence actors' preferences but they may even create actors and actors' interests" (Häusermann, 2010, p15). Due to the

differences in how benefits are distributed, institutions may produce winners or losers, insiders or outsiders, who then may then rise from their positions to become influential rallying points for reform (Mahoney & Thelen, 2010). Based on this new institutionalism, Häusermann (2010) not only demonstrated how reforms implemented in France, Sweden and Switzerland have been diverse, but also argued that the macro-level societal and economic changes that occurred as a result, created increasing inequality in the distribution of public pensions. This inequality has the potential to create new conflicts between institutional actors, who may then mobilize to demand changes that aim to balance the system.

As previously stated, not enough attention has been paid to the dynamics of pension system change. Although some studies have examined pension spending and pension generosity's relationship with pension reform, to this day, this relationship has been only narrowly investigated within the scope of a couple reform types. Pension reforms have been implemented in a dynamic manner. Therefore, robust research into the dynamics and underlying relationships between pension reforms is critical. To fill this gap, this study will apply a comprehensive framework to classify pension reforms into expansionary and retrenchment policies. Then, these groups will be statistically analyzed to find the representative effect that each reform type has had on the nature of pension policy output in the CRP (1990-2015).

1.3 Identifying Dynamic Pension Reform and Pension Effort

Under both fiscal and functional pressures during the CRP, pension reforms have been implemented in both contractionary and expansionary manners. To robustly evaluate the impacts of pension reform, this study utilizes a comprehensive framework for characterizing dynamic pension reforms that will rigorously investigate pension spending and pension generosity. This study uses Silja Häusermann's four reform types from the book *The Politics of Welfare State Reform in Continental Europe* (2010). Häusermann defined pension reform as the dynamic restructuring of a pension system through the implementation of both retrenchment and expansionary policies during the CRP. Häusermann's definition of pension reform is broken down into four constituent reform types: (1) Insurance – the distributional politics of cost containment; (2) Capitalization – redefining solidarity in financing mechanisms; (3) Targeting – tailoring old-age coverage for vulnerable groups; and (4) Recalibration - the adaptation of welfare states to new social needs. These reform types capture the main features of both contractionary and expansionary reform policies that have been enacted since the 1990s. What makes this classification system unique are the targeting and recalibration reform types, since they are specifically designed to address emerging social risks. By aggregating, organizing, and evaluating pension reform data, this study enhances the overall understanding of pension reforms

in the context of institutional factors and their impact on pension policy outputs – pension effort - during the CRP.

Pension effort is defined as the combination of both pension expenditure and pension generosity. Recall the definition and the purpose of pension reform: the resources necessary to sustain the spending and generosity of a given pension system, or simply pension effort (OECD, 2015). During the CRP both contractionary and expansionary reforms have been implemented. As previously discussed, contractionary policies have been the focus of research into pension reforms. For instance, existing studies on pension reform mainly examine the relationship between socio-influential factors (socio-economic, political, institutional, etc.) and pension spending, but fine-grained factors like pension generosity are ignored (Scruggs & James, 2006). This narrow focus on pension spending resulted in a narrowed interpretation of pension reform, which assumes that the focus of reform is to control spending, justified by the overall need to stabilize the sustainability of the system (A. G. Grech, 2017). Curtailing pension expenditure does not fall in line with the overall definition of pension reform policy, and by association, pension effort. The effectiveness of pension reform research is thus dependent upon a detailed investigation into both spending and generosity. The rigor of this approach will in turn lead to improved pension reform identification and, ergo,

comprehensive reforms that affect recipient benefit levels and systemic spending more effectively.

1.4 Research Scope and Research Questions

This study assumes that pension effort is affected by varying types of pension reforms. Using Häusermann's framework, this study applies cluster analysis and a linear mixed-effect model to quantitatively analyze pension reform data collected from 15 countries in and out of the OECD. The following countries are: China, the Czech Republic, Denmark, France, Germany, Greece, Italy, Japan, the Republic of Korea, the Netherlands, Poland, Sweden, Switzerland, the United Kingdom, and the United States. OECD countries are the go-to for pension policy analysis because data is easily obtained, and the countries within the OECD are structurally similar. Specifically, with regard to pension systems, these countries were all well represented by Bismarckian and Beveridgean pension system types. This study differs from preceding research because of its inclusion of China, Japan, and Korea into its analysis. While Japan and Korea are in fact OECD countries they are not generally included in comparative welfare studies. This study included Japan and Korea, as well as China, because the same socio-economic transformations that have preceded challenges to pension reforms in western countries have been recently observed in these three East Asian countries. The

dominant transformation that China, Japan, and Korea face is an unprecedented rate of aging. For example, it took 156 years for the elderly (over 65) population of France to increase from 7% to 20% and 86 years in the United States; for Japan, it has taken only 36 years (UN, 2009, 2019). China has a significantly different economy and political structure from OECD countries. However, since China has become the second world's largest economy over the last decade, its political structure should not justify exclusion from this study. Inclusion into this study will allow researchers to determine if it is empirically different, and thus compensate or address those differences more effectively in future research. Overall, it is prudent to include these three East Asian countries into this study.

This study employed a combination of statistical examination; the overall methodology can be broken into two parts: the first part employs cluster analysis to classify pension reform variables into pension reform clusters; the next part, a Linear Mixed-Effect Model (LMM) is employed to examine the causal relationship between a given pension cluster and pension effort. Specifically, reform variables are clustered based on their characteristic similarities. After sorting pension reforms into clusters, a Linear Mixed-Effects Model (LMM) evaluates the effect a particular cluster has on either pension expenditure or pension generosity. A cluster's effect is measured by its statistical significance to either of these factors. To evaluate the impact of

pension reform on pension effort, research questions were designed to guide researchers through each part of the research methodology.

RQ1. How are pension reform variables clustered into different groups?

RQ2. How have different pension reform clusters affected pension expenditure and pension generosity?

Chapter Two: Theoretical Framework and Literature Review

Chapter Two is a detailed investigation into theories that have attempted to explain the trajectory of enacted pension reforms for 15 different countries during the compound reform period (CRP, 1990-2015). Initially, discussion will focus on the mechanisms that have driven the rise of pension reforms over the last quarter century, with the discussion pertaining mostly to the demographic and socio-economic transitions that have forced countries to amend their pension systems. The discussion then transitions to pension reform trends of the CRP and their complexities, it then proceeds to introduce the influential factors (economic, political, and institutional) that are at play when pension reform is crafted, and how modern literature has tried to explain their influence on pension effort. Chapter Two then presents the impact of various policy instruments on pension effort and sorts the complexities of pension reform trends into qualitative categories. The chapter wraps up with a review of influential contemporary works in this field, and a critique that highlights limitations that still exist. Then, an alternative analytical framework is presented that attempts to address some of the limitations of preceding literature.

1.1 Pension Reform Background

Pension spending has increased from an average of 6.1 percent of GDP to 8.2 percent between 2000 and 2013 (OECD, 2017). This expenditure often represents the largest portion of social expenditure in many countries. The mechanisms that have driven pension financial instability can be sorted in one of two ways: demographic transitions and or macroeconomic transitions (Holzmann & Palmer, 2012; Pierson, 1998, Häusermann, 2010). The rapid pace and intensity of these transitions has tested the structural integrity of existing pension systems in unprecedented ways, leaving countries grappling for solutions. This section will be devoted to this phenomenon in the context of the CRP, introducing the adverse impacts it has had on pension system sustainability. Modern pension reform trends will then be discussed to investigate how countries have responded to this phenomenon.

1.1.1 Demographic Pressures

Population aging poses a direct threat to the long-term sustainability of inherited public pension systems. Public pension systems are predominantly financed using a PAYG structure, where beneficiaries are strongly reliant on the wage-based contributions of the working-age population. Initially, most countries establish an earnings-related replacement rate with relatively

generous defined benefits (DB) in most countries. For example, in Bismarckian type countries that are based on the social insurance principle and DB, an average income replacement rate was set to about 80 to 90 percent of previous earnings. In Beveridgean type countries that typically provide either universal flat-rate or means-tested benefits, additional contributory pensions were established (Schludi, 2005). Thus, most countries rely on wage-based PAYG pension systems to some degree. This means that most countries also share similar prerequisites for pension system sustainability – a growing population and a growing economy (Bonoli & Palier, 2007). However, once the ‘baby boom’ generation began to reach retirement age, the impact of an increasing number of beneficiaries and decreasing number of citizens entering the labor market placed a heavy financial burden on public pension systems’ affordability and sustainability (Pierson, 1994, Schludi, 2005).

Population aging is commonly characterized as the ratio between birthrate and mortality rate. As families live longer and the number of children they have decreases, the relative size of the workforce decreases compared to the number of system-dependent elderly - the old-age dependency ratio. Figure A (Appendix) depicts the decreasing size of the workforce relative to the number of system-dependent elderly. Japan reached an old-age dependency ratio of 27.3 percent in 2000, and it is expected to rise to 77.8

percent by 2050. By 2050 the number of pensioners in Japan will have more than doubled relative to the workforce (table 1).

Table 1. Demographic old-age dependency ratios: Historical and projected values, 1950-2075

	1950	1975	2000	2015	2025	2050
China	8.5	8.8	11.4	14.5	22.3	47.9
Czech Republic	13.9	22.7	21.9	28.8	37.1	58.9
Denmark	15.6	23.7	24.2	33.0	37.7	45.3
France	19.5	24.5	27.3	33.3	40.9	52.3
Germany	16.2	26.5	26.5	34.8	41.4	59.2
Greece	12.4	20.9	26.7	33.0	39.2	73.4
Italy	14.3	21.6	29.2	37.8	45.6	72.4
Japan	9.9	12.7	27.3	46.2	54.4	77.8
Korea	6.3	8.2	11.2	19.4	31.7	72.4
Netherlands	13.9	19.3	21.9	30.2	39.0	53.0
Poland	9.4	17.1	20.1	24.3	36.4	60.8
Sweden	16.8	26.3	29.5	33.8	38.2	45.5
Switzerland	15.8	21.5	24.9	29.0	35.4	54.6
United Kingdom	17.9	25.5	27.0	31.0	35.9	48.0
United States	14.2	19.7	20.9	24.6	32.9	40.3

*Note: The demographic old-age dependency ratio is defined as the number of individuals aged 65 and over per 100 people of working age (those aged between 20 and 64).
Source: United Nations, World Population Prospects 2017 Revision.*

For most European countries, the old-age dependency ratio is projected to increase to 49 percent by 2045 (OECD, 2017). When public pension systems were initially introduced, the average global life-expectancy was about 50+ years old, but thanks to modern medicine and other quality-of-life improvements this number is approaching 80+ years old (Auer Mariangels, 2000). As global life expectancy dramatically increases, the number of

pensioners relying on the system increases (Clark & Munzenmaier, 2001). At the same time, birthrates are shrinking worldwide. Lower fertility rates lead to potential shortages in the number of workers available to contribute to a given economy; lack of workforce contribution leads to reduced pension contributions and workforce productivity (Gonyea, 2007). In particular, Mariacristina Nardi and Larry Jones (2005) point out that a reduction in the total fertility rate of women, from 1.6 to 0.7 children, can increase social security costs by up to 10 percent (GDP) (Boldrin, De Nardi, & Jones, 2015). Empirically, Miroslave and Spruk (2014) reported that increases in either life expectancy or birth rate result in increases to old-age expenditure. Alessandro Cigno (2007) backs up this idea, writing, “Whereas both funded and PAYG systems are vulnerable to increased longevity, PAYG pension schemes are especially vulnerable to lower fertility because they rely on the human capital of the young to finance the pensions of older generations” (p. 37). Simply, the ratio of contributors to pensioners has become smaller, which enlarges the fiscal deficit between pension revenue and benefits. Equation (1) highlights the problematic features of PAYG systems.

$$s = \left(\frac{p}{w}\right) / \left(\frac{L}{R}\right) \quad \text{Equation (1)}$$

Where p is the average pension, R is the number of pensioners, L is the number of contributing workers, and w is the average income. A PAYG

system is sustainable when the ratio of contributors to pensioners, L/R of a system, is greater than 1. Fritz Scharpf (1997) and Martin Schludi (2005) both acknowledge the inherent problems with the PAYG structure; as the ratio between contributors and beneficiaries declines, PAYG systems will experience financial strain. Thus, PAYG public pension systems are highly sensitive to fluctuations in the number of contributors participating in the system. This fiscal burden is exacerbated by massive population aging expected to begin from 2020 onward (UN, 2015).

Systems were initially designed with little thought for the demographic changes that would come to pass in future decades; this lack of foresight only made it easier for policymakers of the time to introduce generous pension benefits coupled with low pensionable ages (Schludi, 2005). In the context of reforming PAYG systems, there is a desire to limit the future working generation's level of exposure to increasing public pension costs, and at the same time, ensure pension sustainability. As a consequence, many countries have raised their retirement age eligibility requirements, cut the size of pension benefits, etc. Unfortunately, this is not the only factor that is a cause for alarm, and actively endangering the sustainability of pension systems.

1.1.2 Macro-economic Pressures

For the last few decades, shifts in the makeup of world demographics have been coupled with dramatic shifts in the composition of the world's labor force. Traditionally, employment was defined as a 40 year or more career that provided retirement benefits to employees who devoted themselves long term to their employer. The shift away from this type of benefit system over the last couple decades has forced retiring employees to, rather, become system-dependent on public pension programs. Employers attempting to manage affordability challenges and increasing turnover rates, coupled with accelerating technological innovations, have left the modern employment landscape unrecognizable (Häusermann & Palier, 2008). Therefore, a whole new range of career profiles have emerged. Atypical employment, episodic employment, female employment and more, have given rise to new social burdens, that have been squarely placed upon existing pension systems (Häusermann, 2010). The structures of traditional systems are ill-suited to these shifts. Figure 1 shows a substantially increasing rate of service-sector-based employment and also a high rate of female labor participation.

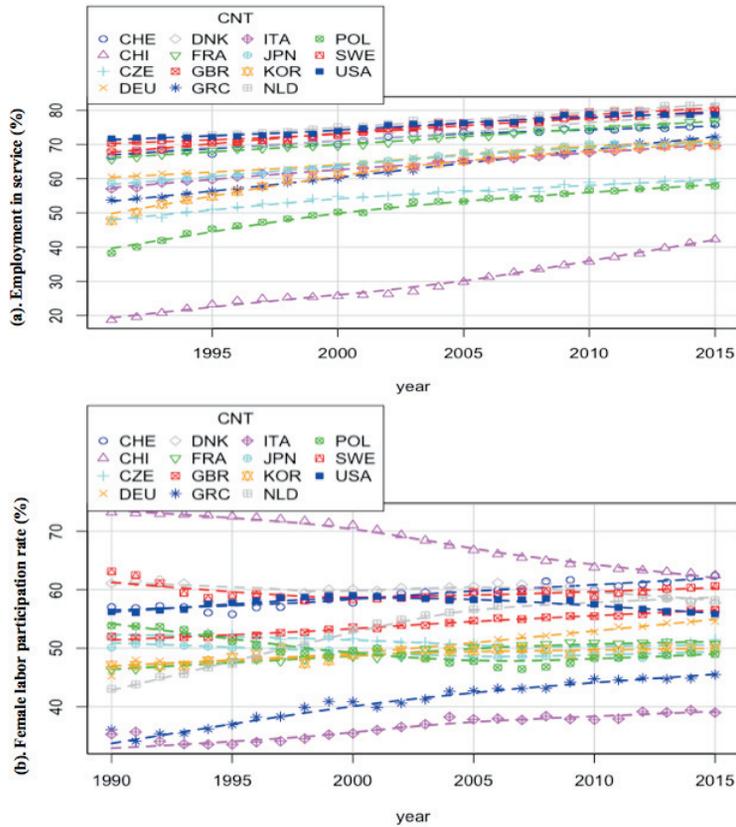


Figure 1. (a) Employment in service; (b) Female labor participation during the CRP.

Existing public pension systems were designed for lifelong employment, with strict eligibility requirements and benefit payouts linked to previous contribution records. Therefore, newer and different definitions of employment tend to be excluded from public systems, or employees of this type are unable to adequately contribute for long, consistent periods of time. All problems that are embedded in inherited pension systems. Their inability to benefit from traditionally structured public systems is often because these workers are paid less and, concurrently, experience high levels of career

interruption (van Kersbergen, Vis, & Hemerijck, 2014). Until recently the barriers to entry for women into the workforce also meant that existing pension systems defined the typical employee as a male-breadwinner with stable employment. Therefore, it is not uncommon for many countries to have instituted pension rights for women that are based on a working spouse (Bonoli, 2006). Consequently, women's increasing participation in the labor force, and rising divorce rates are highly associated with a desire for women to acquire their own pension rights. Moreover, a byproduct of new career profiles (employment type & gender alike) is their enlarging effect on pension deficits, as the margin between revenues and expenditures negatively expands. Thus, employment transitions are increasingly endangering the public pension system in hand with demographic transitions - with new social demands on the rise. New pension reforms will presumably have to address a distinct set of demographic and employment-based issues that were absent during the WEP and WRP (Bonoli & Natali, 2013a, Bonoli & Natali, 2013c; Vis, 2012). The following section will briefly outline how countries have reformed their pension systems in response to pension financial instability.

2.1 Pension Reforms Trends and Pension Structures

As outlined in the preceding section, unfavorable demographic and socio-economic pressures have challenged existing pension systems' financial sustainability. While the nature of these modern pressures is unique; for more than a century, countries have attempted to use welfare policy to address pension concerns. Original pension systems were broadly designed with either Bismarckian or Beveridgean pension structures. Bismarckian systems are contribution-based social insurance schemes financed on a PAYG basis, that use an earnings-related defined benefits (DB) structure. Beveridgean systems consist of tax-financed basic pension schemes that provide flat benefits. However, since the inception of these systems the world's economies have drastically transformed, and forced pension systems along with them to change. Two broad pension reform trends can be distinguished: the convergence of Bismarckian and Beveridgean pensions and the retrenchment of the inherited pension systems. This section explores how countries have reacted to fiscal pressures on their pension systems. This starts by asking: how have the countries with Bismarckian and Beveridgean systems reformed their programs? In order to answer this question, this section first identifies the reform trajectories in these countries. Then, it explores specific countries' pension structures and their reform profiles during the CRP.

2.1.1 Trend 1: Convergence between Bismarckian and Beveridgean Structures

All countries originally began by implementing either a Bismarckian or a Beveridgean pension system. The original policy aims of Bismarckian and Beveridgean systems are different: Bismarckian systems originate from contribution-based social insurance programs for old-age income security depending on employment status; Beveridgean systems originate from tax-based universal or flat-rate benefits with the objective of preventing poverty.⁴ Over time, both of these systems have undergone an abundant number of reforms in response to economic crises of varying degree, and a series of dramatic labor market changes since the beginning of the 20th century. Both old and new social risks have forced pension systems to choose between financial stability and pension generosity. For example, the economic crisis of the 1970s forced some countries with Beveridgean systems to adopt Bismarckian pension structures, by adding second pillar programs that created contribution-based supplementary pensions. As a consequence, countries originally with Beveridgean structures have come to adopt systems that are a mix of both Beveridgean and Bismarckian pension arrangements. In countries with Bismarckian structures, new social risks have excluded certain at-risk

⁴ More specifically, Bismarckian countries' central pillar is designed for delivering earnings replacement for old-age income benefits; whereas Beveridgean systems' central pillar is designed for preventing poverty alleviation through universal flat-rate taxed financed benefits.

individuals from these systems; therefore, Beveridgean pension components were added over time to support these groups by establishing tax-financed minimum protections (Bonoli, 2007). A large body of comparative studies have identified the consequences of the pension reforms that have begun blurring the boundaries between Bismarckian and Beveridgean pension systems (Hinrichs, 2000; Palier, 2012; Knill, 2005; Schmitt & Starke, 2011). Countries that originally implemented Bismarckian and Beveridgean systems now display a number of common pension elements: (quasi) earnings-related pensions programs and tax-financed minimum (basic) pensions (See table 2).

Table 2. Convergence of Bismarckian and Beveridgean Reforms

Countries	Initial typology	Year of First Law	Convergence Reforms	Tax-financed?	Earnings-related Component
CHI	Bismarckian	1951	<p>Non-contributory pension program and NDC reforms</p> <ul style="list-style-type: none"> - Implemented NDC in 1997. - A partial-contributory pension for rural and non-salaried urban residents were implemented in 2009 (state subsidized). 	✓	NDC
CZE	Bismarckian	1906	<p>Universal minimum pension reform</p> <ul style="list-style-type: none"> - Implemented a guaranteed basic pension at the end of the 1980s, independent of contributor income. 	✓	DB
USA	Bismarckian	1935	<p>Non-contributory pension reform</p> <ul style="list-style-type: none"> - A means-tested pension system (Supplemental Security Income) that is available for low-income pensioners in 1974. 	✓	DB
FRA	Bismarckian	1910	<p>Tax-financed and funded system reforms</p> <ul style="list-style-type: none"> - Reforms during the 1990s created tax-exemptions for self-funded pensions and savings. - A non-contributory income assistance program for the elderly was created in 1995 and 2007 – flat-rate minimum benefit (Bonoli & Palier, 1996). 	✓	DB +Points

	Tax-financed and funded reforms				
DEU	Bismarckian	1889	- The <i>Basic Security Benefit</i> program was implemented in 2003 to reduce old age poverty. - The <i>Riester-Rente</i> funded pension program was implemented in 2001, it provided incentives through tax-advantages or subsidies.	✓	Points
	Non-contributory pension reform				
GRC	Bismarckian	1934	- The State budget pension reform program was implemented in early 1981 that provided residency-based special non-contributory pensions financed directly from the state budget.	✓	DB
	Non-contributory and NDC reforms				
ITA	Bismarckian	1919	- Social check (<i>assegno sociale</i>) means-tested pension program is granted to residents of Italy starting in 1983, who are older than 65 and have no sufficient public pension. - Introduced a notional defined contribution (NDC) system in 1995.	✓	NDC
	Non-contributory pension reforms				
JPN	Bismarckian	1941	- A reform for low-income individuals that exempted 50% of their contribution requirements to the National Pension Scheme was created in 2003.	✓	DB
	Tax-financed quasi-basic old-age pension reform				
KOR	Bismarckian	1986	- A tax-financed quasi-basic old-age pension was implemented in 2008 in order to supplement social security benefits.	✓	DB
	Non-contributory and NDC reforms				
POL	Bismarckian	1927	- NDC and means-tested benefits programs were introduced during the 1990s. - Additional means-tested and pension-tested non-contributory pension programs were added in 2013.	✓	DNC
	Contribution-based and earnings-related reforms				
NLD	Beveridgean	1901	-The General Old-age pension Act (AOW) implemented a contribution-based universal benefits program for persons over 65 beginning in the 1950s. - Earnings-related pensions were added through occupational social insurance provisions, financed through earmarked employers and employees' contributions during the 1990s.	✓	*DB
	Non-contributory and NDC reforms				
SWE	Beveridgean	1913	- In 1959 the salary-based pension plan Allmän Tilläggs pension (APT) was introduced and was composed of residential pension and salary-based pension plans. - In 1994, they adopted an NDC program. - A tax-financed guaranteed pension (garantipension) was implemented in 1998.	✓	NDC

Earnings-related occupational reforms					
CHE	Beveridgean	1946	- Since 1985 the Swiss government began implementing a number of earnings-related occupational pension schemes.	✓	DB
Contribution-based and earnings-related reforms					
DNK	Beveridgean	1891	- Earnings-related pension reforms were implemented in the early 1990s. - New contributory pension systems were implemented in 2003: <i>Special Pension</i> .	✓	*DC
Earnings-related reforms					
GRB ⁵	Beveridgean	1908	- In 1976, the British government introduced SERPS (the State Earnings Related Pension Scheme) to supplement the Basic State Pension. - In 1999, increased means-tested benefits and also introduced Stakeholder Pensions.	✓	DB

Source: Hinrichs, 2000; Palier, 2010; Knill, 2005; Schmitt & Starke, 2011; ISSA 1990-2015; OECD 2005, 2007, 2009, 2011, 2013, 2015, 2017. MISSOC 2004-2014.

DB = Defined benefits; DC = Defined contribution; NDC = Notional accounts

Note: The Czech Republic and the Netherlands contain universal basic pensions: paid at a flat rate and conditioned on residency. Basic pensions depend on career length in Japan and the UK. Denmark and Korea are tested against other income.

As table 2 illustrated, Germany, Italy, France, Japan, Korea, China, the Czech Republic, Poland, and the US are considered countries with Bismarckian systems⁶. Since the inception of their systems, these countries have added non-contributory tax-financed redistribution components to their

⁵ The UK has a history of Bismarckian pension reforms. The DB-based State Earnings-related Pension Scheme (SERPS) was legislated in 1975, and “contracting out” was only limited to employer-provided occupational pensions.

⁶ China initiated a contributory pension system (PAYG) in the early 1950s – their Labor Insurance Regulation program was designed to protect industrial workers in state-owned enterprises against illness, disability and old age. Since social and economic reform in 1978, existing pension systems in China were radically reshaped during the CRP: existing social pooling collapsed in addition to market privatization. Beginning in the 1990s, the Chinese government adopted a two-pillar pension system that provided nearly universal pension benefits. In the case of the US, the first piece of pension legislation was enacted in 1935 (Social Security Act). In the case of Czech Republic, it introduced its first law in 1906 covering only salaried employees, but expanded coverage through the Pension Insurance Act in 1995.

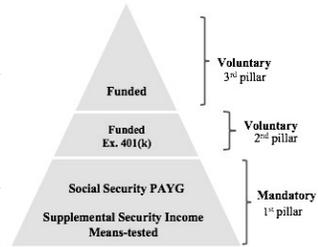
systems (Hinrichs, 2000; Karl & Lynch, 2010). Countries like Sweden, Denmark, the Netherlands, Switzerland and the UK were originally designed with Beveridgean pension structures (Hinrichs, 2000, Schludi, 2005). Each of these countries' addition of Bismarckian pension characteristics are unique and interesting. Sweden transitioned by adding an earnings-related pension scheme, and as this scheme matured, the provisional role of the existing basic pension system declined; As more time passed, Sweden's pension system continued to become more Bismarckian in nature. In the case of the Netherlands, Switzerland, and Denmark, mandated or collective agreements created additional earnings-related pension systems (via nearly universal occupational pensions) to protect the old-age income security of workers (Hinrichs, 2000). In the UK, employer-provided pensions transitioned UK pension systems to a mixed pension structure (Hinrichs, 2000). Specifically, the State-Earnings-Related Pension Scheme (SERPS) was introduced in 1978; and in 1995, SERPS's "Contracting Out" programs began using tax-incentives to further encourage participation. Table 3 provides each country's pension system profiles which provides a clear picture that countries tend to obtain both Beveridgean and Bismarckian pension components.

Table 3. Country Profiles: Pension Structure and Pension Reforms

Countries	Country profiles (pension structures and pension reforms)	Figure of Main Pillar
CHI	<p>China implemented their first pension system in the early 1950s using a Bismarckian scheme. However, it was highly fragmented and only the workers of State-owned Enterprises were covered. The system used a single pillar contribution-based PAYG program. By the end of the 1970s this system underwent radical changes due to economic reforms, as China shifted to a market-oriented system. By the 1990s, economic reforms, the dramatic aging of China's population and other demographic transitions, as a consequence in part because of the One-Child policy, began to seriously endanger their pension system. This forced the government to undertake structural pension reforms even at the consequence of considerable transition costs. With the help from pension reform recommendations by the World Bank, structural pension reforms and a series of expansionary pension reforms were adopted. The consequence of a 1998 structural pension reform turned China's pension system into a multi-pillar pension system: a basic pension program on the first pillar and a mandatory employee contribution program on the second pillar. The total contribution rate paid by both employees (8%) and employers are indexed using a mix of wage-based and CPI-based indexing. The main pillars in the Chinese pension systems are: a National Social Security Fund, a PAYG program, and an NDC individual account system on the first pillar; on the second pillar, an enterprise annuity funded pension system; and on the third pillar, a voluntary private pension program.</p>	<p>The diagram for China is a pyramid with three levels. The bottom level is labeled 'Mandatory 1st pillar' and contains 'National Social Security Fund' and 'Social pool PAYG (NDC)'. The middle level is labeled 'Voluntary 2nd pillar' and contains 'Funded'. The top level is labeled 'Voluntary 3rd pillar' and contains 'Funded'.</p>
CZE	<p>The Czech Republic introduced a PAYG pension system in 1995, but its rapid transformation into a market-based economy, shortly after the peaceful dissolution of Czechoslovakia in 1993, opened it to dramatic privatization. By 1997 privatization of SOEs had reached upwards of 70 to 80 percent. With increasing privatization, the government intended to reduce state responsibility by implementing supplementary private pension systems, and also reduced minimum government subsidies. The Czech government introduced a funded scheme of a State-contributory Supplementary Pension program in early 1994, and enacted a mandatory funded pension system in January of 2013. After this series of pension reforms, the Czech pension system consisted of public pension schemes and a mandatory funded private pension system. The public pension system had a basic pension element and an earnings-related PAYG system. Retirement age increased from 60 in 1990 to 63.2 years (men) in 2015. It was possible to retire three years earlier than the standard retirement age, but a penalty of 5.6 percent was imposed on each year's benefits (in the case of full-career workers).</p>	<p>The diagram for the Czech Republic is a pyramid with three levels. The bottom level is labeled 'Mandatory 1st pillar' and contains 'Basic and Minimum' and 'PAYG'. The middle level is labeled 'Mandatory 2nd pillar' and contains 'Funded State-contributory Supplementary Pension'. The top level is labeled 'Voluntary 3rd pillar' and contains 'Funded'.</p>

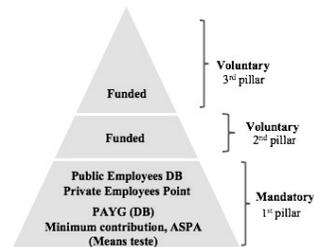
USA

The first pension system in the United States, Social Security, was introduced in 1935 and is characterized as a social insurance system. Public pension systems in the US broadly consisted of earnings-related pensions and means-tested pension systems (Supplemental Security Income) that were available for low-income pensioners. Both public pensions systems used CPI-based indexation for their benefits. The standard retirement age was 65 in 1990 and was increased to 66 in 2012. The US began to gradually increase their retirement age, from 65 to 66 years old in 2006, and will again to 67 years old in 2022. Early retirement was possible from 62 years old, but yearly benefits were penalized by 6 percent. In addition to publicly provided pension benefits, privately managed occupational pensions (ex. 401(k) plans) allowed employees to contribute pre-tax earned-income to their funds.



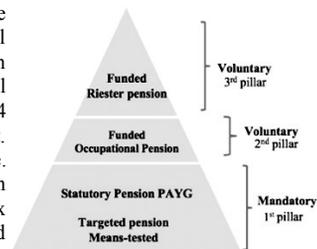
FRA

The French pension system is very reflective of traditionally Bismarckian social insurance policies. However French pension systems are highly fragmented, and provide benefits according to employment status. A fragmented pension system creates unequal qualifying conditions for pension coverage, and reduces the ability of sub-systems to coordinate with each other. The average replacement rate for the pensioners in France is approximately 60 percent, much higher than other European countries. Early in France's pension history high economic growth sustained their high benefits system, this was additionally bolstered by high employment rates and social insurance transfers. The legal retirement age was 60 years old before the 1990s. System contributions were supported by both employers and employees (with contribution rates of 8.2 percent and 6.4 percent respectively), with a 37.5 year-long contribution period, and benefits indexed on a 10-best-years basis. However, the demographic changes and rising unemployment rates in the CRP enlarged the gap between revenues and expenditures. Over the past 26 years, France frequently reformed their pension systems, with some notable reforms in 1993, 2003, 2006, 2007, 2010 and 2014. These reforms raised the contribution rate, retirement age and reduced pension benefits. In 2015, the French pension system consisted of a large PAYG financed public pension program and fragmented private funded pension programs. In 2001, the French government approved a new national benefits program designed to provide financial assistance to elderly individuals with low or moderate incomes. Structurally, France has a three pillared system: the first pillar consists of a minimum contributory means-tested (ASP) program and basic pension (PAYG) with DB; The second and third pillars consist of a voluntary funded and private pension system respectively.



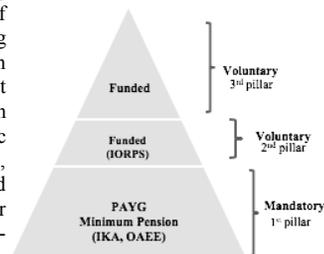
Germany had a traditional Bismarckian social insurance pension system (PAYG, first pillar) along with an occupational pension system (DC, second pillar). Germany is the result of the unification of West and East Germany in 1990, where two diametrically different economies merged together. West Germany was significantly more prosperous than East Germany, and therefore had a more developed labor market. This dichotomy was still present, especially in their pension coverage rates, even more than 10 years after reunification. In the early 2000s, occupational pensions provided by the private sector covered more than 34 percent of Germans in the West, while only 8 percent in the East. As a result, the German government extended private coverage. The Rister pension reform, the most representative privatization reform, was introduced in the early 2000s and consisted of tax deductions and state subsidies; with benefits targeted more toward low-income earners. After a series of reforms, by 2015 Germany's public pension system became a combination of a means-tested pension system and a DC funded pension systems. In 2003, the tax-financed basic security benefit was introduced to reduce poverty for poor persons older than age 65, and persons older than 18 with a permanent reduction in earning capacity.

DEU



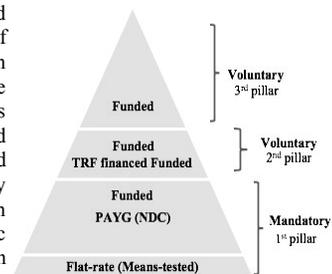
The Greek public pension system was introduced in 1934. The Greek government adopted extensive pension reforms due to a significant increase in the aging of the Greek population beginning in the early 1990s, and also the 2008 financial crisis. A plethora of parametric pension reforms emphasized rebalancing existing highly generous pension systems, by increasing contribution period and raising standard pension retirement age. However, but institutional fragmentation remained. In 2015, the Greek pension system consisted of three pillars: an earnings-related public pension and a series of minimum pensions, occupational schemes, and private pensions. The first pillar, Social Security, accounted for more than 90 percent of the entire pension system. This pillar operated as a DB and PAYG scheme, and it also included a means-tested scheme that covered the residents of Greece who had no or low income. The Occupational Scheme (IORPS) program was the second pillar, and the third pillar of private pensions was not widely adopted.

GRC



The pension system in Italy was introduced in early 1919. Italian pension systems before the 1990s were highly generous, with the mandatory PAYG public pension system providing benefits of with a replacement rate of approximately 72 percent (on average) to retirees. However, public pension benefits varied depending on employment status. Between the high degree of pension systems' fragmentation and generous benefits, the Italian government had to radically retrench their programs to curb the rising cost of pension systems. Some particularly notable reforms were passed in 1992, 1995, 1997, 2004, 2007, 2009, 2010 and 2014; these raised the contribution rate and retirement age, reduced pension benefits, and introduced an NDC program. In 2008 Italy radically transformed the structure of their pension program from a single pillar to a three-pillar pension system defined by: a public means-tested pension program, a compulsory public pension program (PAYG), and a compulsory private employee and self-employed (INPS) program (first pillar); a compulsory *Tfi* severance-pay program (mainly for regular workers before 2008) (second pillar); and a tax-incentivized individual pension plans through life insurance contracts (PIP) program (third pillar).

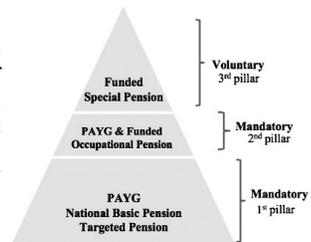
ITA



Attempts to stabilize pension costs increased the overall role of supplementary pension programs in Italy's pension system, in particular the government paid attention to the existing *Tfr* (*Trattamento di fine rapporto or Tfr*) program. The *Tfr* program provided lump sum payments to employees at the time when they retired or at the end of their contract; however, this was only limited to regular workers, as atypical workers were not entitled to these pension plans. In 2007 (Law 279/2007), a comprehensive reform of Italy's pension systems was passed that would introduce tax reductions to incentivize investment in private pension funds; additionally, in 2008, the government implemented the *Tfr* program as a compulsory DC supplementary system for workers who started after 1996. Along with the *Tfr* program, the Italian government introduced four additional prefunded supplementary pension programs: the pre-existing funding (PEF), the closed funded (CPF), the open funds (OPF), and the individual pension plans through life insurance contracts (PIP) program. Where PEF and CPF are second pillar programs and the OPF and PIP are third pillar programs. By the end of 2008, the CPF and OPF programs grew significantly, by 64 and 69 percent respectively (Ebbinghaus, 2011). Italy also implemented comprehensive public pension reforms in this same period to stabilize costs; with reforms passed in 2009, 2010 and 2012. This included gradual increases to the retirement age from 64 to 66.3 years old; the contribution rate from 32.7 to 33 percent; and to the required contribution period from 37 to 42.6 years by 2015.

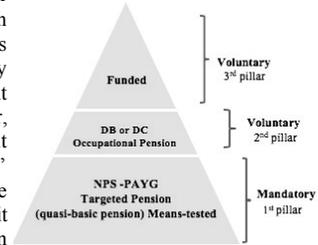
In the 1990s Japan faced extraordinary economic hardship, notoriously known as “the lost decade”, with an anticipated rapid aging of their population accompanied by rising unemployment. Thus, the Japanese government began to focus on the long-term financial sustainability of their pension system due to a shrinking labor force. The traditional Japanese pension system was comprised of two parts: a public pension system (first pillar and second pillar) and a private pension system (second pillar and third pillar). Within the public pension system there were two programs: the National Pension Insurance (NPI) program, a basic pension program introduced in 1985, and the Employees Pension Insurance (EPI) program, an income replacement program that covered both the public and private sectors. Since the EPI program covered private sector income, it is uniquely classified as a second-pillar public program. The private pension system consisted of three second-pillar programs: a DB program, a voluntary DC program, and the Employee Pension Fund (EPF); it also consisted of one third-pillar program, individual DC plans. Historically, early on in the post-World War II period, Japan had already implemented voluntary DB-based occupational pension programs. This included the Employee Pension Fund (EPF) program and the Tax-Qualified Pension Scheme (TQPS) program; where individuals were incentivized to join through tax exemptions. However, the CRP saw the rise of a series of economic hardships for the Japanese economy. The “lost decade” undermined the fiscal capabilities of the Japanese pension system, and coupled with the 1997 Asian financial crisis, the Japanese government responded by scheduling pension reforms once every five years in an attempt to ensure the long-term financial sustainability of their system. One particular way the government tried to bolster Japanese financial markets was by extending private pension programs. During these economic crises existing DB pension systems forced companies to pay benefits they could not afford. Therefore, in 2001, the government took steps with sponsored companies to transition them from DB programs instead over to newly established DC pension plans. Starting in 2004, these DC plans were expanded to cover private sector employees, private sector employees without corporate pension programs, and self-employed workers. In 2006 Japan’s baby-boomers began to retire *en masse*, putting more strain on the public pension system. Therefore, DC plans were further expanded and incentivized through the introduction of employer-based non-taxable contributions. By the following year, DC plan coverage had increased by 51 percent. Over this period of time, in tandem with the expansion of DC programs, Japan implemented comprehensive public pension reforms to stabilize costs. This included gradual increases to the required contribution rate from 13.6 to 18.3 percent between 2005 and 2017. In addition, pension indexation was changed from wage-based indexation to CPI-based indexation. In 2015, the main pillars in the Japanese pension system were: the first pillar consisted of a basic pension NPI and a basic means-tested pension program, the second pillar consisted of both DB and DC occupational pension programs and the third pillar consisted of a voluntary private pension.

JPN



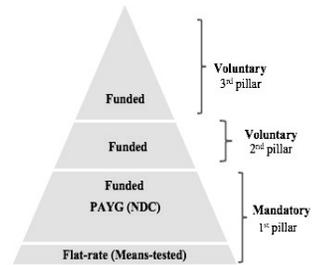
KOR

The Korean public pension system composed of an earnings-related NPS (National Public Scheme) program implemented in 1988, and a quasi-basic pension system introduced in 2007. The late adoption of their pension program is important because, fundamentally, structured similarly to other pension programs that were implemented much earlier than Korea's. By 1988, similar programs were already beginning to face problems with sustainability and non-universal coverage; nevertheless, this structure was still adopted. In 1988, the NPS originally only provided coverage for companies with 10 or more employees, but expanded this program to nearly universal coverage. However, some individuals were still excluded due to insufficient contributions. Pension benefits were based on both the employers' and employees' contributions. Standard pension benefits were provided to individuals aged 60 and older, but starting 2013 it increased to 61 years old. Originally the Basic Old Age Pension program provided for 70% of those aged 65 and over and was received through means-tested programs. However, in 2014, the Basic Pension program replaced the existing Basic Old Age Pension program. The second pillar of this new program implemented privately managed pension systems, but they only covered a limited number of insured individuals.



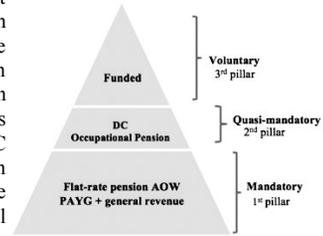
POL

Poland introduced their pension system in 1927, and post-World War II, had a very centralized government shaped largely by Soviet influence. Their pension system thus was highly generous but also very non-egalitarian; boasting a retirement age of 60 and an employer-only contribution system. The existing Polish pension system only covered state sector employees. After shifting to a market-based economy in the early 1990s, pension systems began to experience extreme financial challenges. One serious challenge was spiking double-digit unemployment in the late 1990s and early-to-mid 2000s, reducing the number of contributors to the pension system. In 1999, following the guidance of the World Bank, the Polish government restructured their existing PAYG system into a two pillared program (often labeled as NDC): PAYG, and a privatized mandatory employer and employee contribution system that established individual-defined contribution accounts. The proportion of total contributions split between the first and second pillar was 12.2 and 7.3 percent respectively. In 2015, the Polish pension system's main pillars were: a first pillar social assistance program, a flat rate means-tested pension program, and a NDC PAYG system; a second pillar mandatory funded pension system and a third pillar voluntary funded pension system.



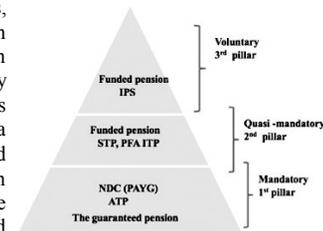
NLD

At the beginning of the CRP, the Dutch pension system had three established pillars: a flat-rate pension program (AOW), based on a required 50-years residential period, and a social assistance program (first pillar); a quasi-mandatory subsidized occupational pension (DC) program (second pillar); and a tax-subsidized voluntary private pension (third pillar). Where the combination of the first and second pillar programs created a pension system with both Beveridgean and Bismarckian roots respectively. The first pillar *Algemene Ouderdomswet* (AOW) public pension program provided flat pension benefits to all residents who have lived in the Netherlands based on their period of residency; with qualification for maximum benefits occurring if the individual had lived within the Netherlands for fifty years between the ages of 15 and 65 years old. Their second pillar occupational pension program was a DC program that covered nearly 90 percent of wage earners. Even though the Dutch pension system has maintained relatively stable public pension expenditure over the CRP, with a high rate of total occupational pension coverage, this system was still far from perfect. The Dutch occupational pension program - a wage-based pension program - was introduced in the early 1950s, and was originally based on breadwinner principles. The Netherlands pension program is a mix of both Beveridgean and Bismarckian structures. The Beveridgean component is the AOW program. This Bismarckian component is the combination of the second and third pillar programs.



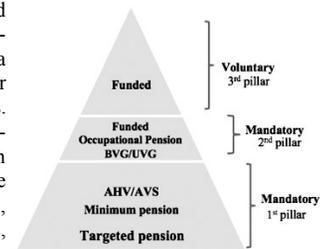
SWE

Existing Swedish pension systems at this time were highly generous, and were particularly designed to protect against risks associated with old age. This system combined both Beveridgean and Bismarckian features: a flat tax-financed basic pension (*folkpension*), that was not means-tested, and an earnings-related DB pension system. However, in the beginning of the 1990s, Sweden experienced a deep economic recession that resulted in high unemployment. Most notably, the existing basic pension systems were abolished and overhauled; being instead replaced by a minimum pension supplement program, that required various income tested supplements. In 1998, Sweden transitioned to a three-pillar pension structure: a flat rate pension (residential based – 40years and worked for 30 years) and an NDC PAYG system on the first pillar, a quasi-mandatory funded pension system on the second pillar, and a voluntary funded pension system on the third pillar. The first pillar minimum pension program was guaranteed by the state for all residents in Sweden. The public earnings-related program consisted of two parts: a PAYG scheme and a fully funded scheme. The contribution rate for the fully funded system was 2.5 percent, and 16 percent for the PAYG system.



CHE

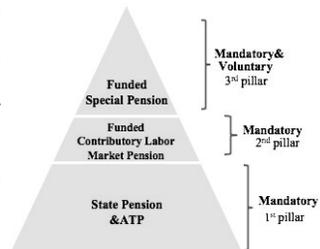
In 1963, Switzerland was the first country to establish a multi-pillar pension system, and has retained a well-established three-pillar pension system since. The first pillar (AHV/AVS) provided coverage for the basic needs of all retirees, and contained a means-tested pension supplement; the second pillar consisted of a mandatory occupational pension system; and the third pillar comprised of individual pensions incentivized with tax reductions. Prior to a 1985 reform that made participation in the occupational-based second pillar compulsory, one third of men and one fourth of high-skilled male and female workers, respectively, were covered. Within a decade after the passage of this legislation, second pillar coverage was at nearly 100 percent for male workers, but still, only 80 percent of female workers had coverage due to job instability and lower earnings. This is in part because full second pillar occupational pension benefits required employees to



have a contribution record of 40 years or more. However, as the labor market continued to change throughout the CRP, the number of atypical workers, for whom full coverage under these requirements was near impossible, began to climb. A labor market that women were a large proportion of. In response to these market changes, a reform designed to improve coverage of atypical workers by lowering the access threshold to compulsory coverage was passed in 2003; lowering the qualification threshold to CHF 18,990 per year. By reducing the qualification threshold, coverage among female atypical workers increased from 25 percent 38.7 percent by 2015. In order to balance pension costs associated with expanded coverage, the Swiss government then increased the required contribution period of their public pension from 42 to 45 years.

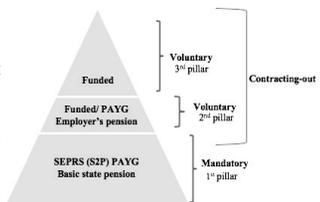
The existing public pension system in Denmark contained two pension programs: means-tested supplementary pension benefits and PAYG. Their PAYG system was a general budget revenue tax-financed system, called the residence-based national pension (*folkepension*). The original Danish pension system was a Beveridgean-typed multi-pillar system that had been gradually developed and reformed since WWII. A critical pension reform juncture took place in the early 1960s that introduced an earnings-related supplementary pension program (ATP). This was a flat-rate system where benefits were connected to the number of years an individual was employed. However, flat-rate characteristics could not satisfy the upper-middle and higher-income groups' needs for pension security; various occupational benefits were expanded. With the addition of these supplementary systems, the Danish government had the ability to cut public pensions. Restricting early retirement and requiring a full career of contributions for ATP benefits. Early retirements were a central reason for the sustainability issues facing the Danish government due to an increasing exodus of older workers. This forced the Danish government to reform their system by removing this early retirement benefit. The current Danish system was composed of a basic residential tax-financed public pension system, topped with contributory pension systems (ATP), and a compulsory occupational pension system which covered a large number of regular employees.

DNK



The UK pension system initially started as a Beveridgean-typed system, but the reforms that came with the Thatcher administration shifted the UK to a system with Bismarckian pension components. In 2015, the structure of the UK pension system is defined by: a tax-financed Basic State Pension with means-tested income support (first pillar), and a State Earnings-Related Pension (SERPS) or State Second Pension (since 2002) (S2P) (second pillar) that were provided by the state; employers and private sector financial systems. The UK pension system can be characterized by low public benefits with matured but fragmented, non-compulsory, occupational and private pensions. However, the State Earnings-Related Pension (SERPS), established in the early 1970s, and the State Second Pension did not consider self-employed and atypical workers. Therefore, qualified workers (e.g. large firms or skilled workers) tended to be broadly covered by both first and second pillar benefits while these atypical workers remained largely uncovered. Since a 2002 pension reform, the SERPS program was restructured into the State Second Pension (S2P). With this program workers had the option of contracting out of the public earnings-related scheme and into a private system instead. S2P was based on PAYG financing and replaced the older Graduated Retirement Pension system that was

GBR



contribution-based. Individual (third pillar) pensions were available, but they were based on an opt-in system. Thus, the fragmentation of the second, and optionality of the third pillar resulted in heavy dependence on means-tested pensions. Therefore, in order to close the coverage-benefit gap, the UK began incentivizing low-pay and middle-income workers to facilitate participation rates in occupational and private pension programs. Starting in 2012, employers were required to enroll all their employees into the occupational auto-enrollment (AE) pension program, where before 2012, enrollment typically depended upon company size. To facilitate the continued stable management of public system costs, parametric reforms were then implemented through increases to retirement age, and an increase in the pre-conditions to qualify for means-tested benefits. In 2015, the current UK pension system was a three-pillar system: a first pillar was composed of flat-rate benefits, the State Basic Pension, and the State Second Pension (S2P); employers' pensions and individual pensions were the second and third pillar respectively.

Source: Hinrichs, 2000; Palier, 2010; Knill, 2005; Schmitt & Starke, 2011; ISSA 1990-2015; OECD 2005, 2007, 2009, 2011, 2013, 2015, 2017. MISSOC 2004-2014.

2.1.2 Trend 2: Retrenchment of Inherited Pension Systems

The socio-economics of the world are changing, and in two particular ways: the emergence of new career profiles as developed nations transition to post-industrial labor markets, and an aging population. These two changes have exerted pressures that are increasingly threatening the fiscal sustainability of inherited pension systems. The future of the global economy is pointing toward further aging and shifts toward new career profiles; it is reasonable to expect that the stress on inherited systems will only increase without reforms. To this point the majority of reforms that have responded to these pressures have continuously been contractionary in nature and are broadly classified in two ways: structural and parametric reforms. Structural pension reforms change the nature of the system itself. The 1994 World Bank

publication *Averting the Old Age Crisis* suggested shifting from publicly managed PAYG and DB systems to privately managed, funded, and DC pension systems (WB, 1994; James & Brooks, 2001). For example, a shift from a PAYG to NDC (Notional Defined Scheme) program creates a two-pillar public program where the first pillar is scaled down and a second pillar DC pension scheme is added; this second pillar requires individuals to finance their own retirement benefits by saving during their working years (WB, 1994; 2005; Wachsen & Blind, 2016; Hinrichs & Jessoula, 2012). Countries like Sweden, Italy, Poland and China have implemented NDC programs. Alternatively, a number of countries have changed their systems by shifting from a public single-pillar program to a multi-pillar scheme that adds a fully funded private DC program; this downsizes the role of the publicly managed pension system and supplements pension resources instead together with the funded program. The Czech Republic, Denmark, Switzerland, and the UK introduced a compulsory second pillar to supplement resources available to retirees (OECD, 2011).

An alternative to structural pension reforms are parametric reforms that instead change the parameters of an existing pension structure⁷.

⁷ Pension at a Glance (2007) covers reform trends between 1990 and the end of 2003. Pension at a Glance (2013) sets out reform trend between 2004 and the end of 2008; Pension at a Glance (2013) sets out reform trend between 2009 and 2013; Pension at a Glance (2015) sets out the most important reform trend between September 2013 and September 2015. OECD Pension Outlook (2012) sets out reform trends over 2007-2011.

Parametric reform strategies include: raising the retirement age, increasing restrictions on early retirement, changing benefits formulas or qualifying conditions, modifying contribution rates, indexation etc. For instance, Korea increased the contribution rate from six to nine percent and also raised the retirement age by one year, every five years, from 60 to 65 beginning in 2013. Contractionary reform efforts are driven by the widespread need for fiscal consolidation (OECD, 2015). These reforms have taken shape in one of two ways, either as structural changes to pension systems or as parametric changes to pension systems, and because of socio-economic headwinds the continued adoption of these retrenchment reforms can be expected.

2.1.3 Summary

The evolution of pension reform policy can be broadly characterized by two trends: the convergence of Bismarckian and Beveridgean systems and the retrenchment of inherited pension systems. Retrenchment was commonly implemented to deal with pension financial sustainability via both structural and parametric pension reforms. Retrenchment policies downsize inherited publicly managed pensions and supplement these systems with funded pension programs. However, the nature of old and new social risks has endangered not only pension fiscal sustainability, but also pension benefits and who qualifies. Therefore, the reality is that pension reform policies are not

only austerity-oriented reforms, rather they are a mix of contractionary and expansionary reforms; this combination of reforms is especially noticeable during the CRP. Both inherited Bismarckian and Beveridgean systems originated in favorable socio-economic conditions so the contrast between these two systems was not highlighted. However, proceeding unfavorable macro-socio-economic transitions have revealed the advantages and disadvantages each system has in a changing world economy. As time has passed these systems have converged into a more uniform set of policies. The convergence of these two systems is defined by their effort to take the advantages of the other's systems to deal with the insufficiencies of their own. Therefore, the consequence of decades of pension reforms is that Bismarckian and Beveridgean systems no longer exist in their original form, and instead represent a range of policies with similar structures. Countries with Bismarckian systems have added tax-financed pensions to include previously excluded at-risk populations into inherited social insurance pension programs. Countries with Beveridgean systems have augmented their systems with earnings-related pension systems that supplement employees' pension benefits, beyond the original policy aim of poverty prevention among the elderly. Therefore, during analysis of pension schemes, it is necessary to examine all the pension systems that lie upon this new policy spectrum. These

commonalities justify the inclusion of countries with both types of systems into this study.

3.1 What Influences Changes in Pension Effort? Existing Arguments

The traditional retrenchment-focused approach to pension policy research is rooted largely in inherited theories of macro-socio-economics, that are not reflective of the recent post-industrial shifts occurring in the world. As mentioned in section 2.1, pension systems comprise of two interconnected components, retrenchment and expansionary reforms. Pension systems represent the largest proportion of welfare spending in most countries. Research has focused on its macro effect, welfare effort, to explain the nuances of pension policy in broad terms. The broadness of this approach, however, is partially why expansionary reforms have been overlooked. From this perspective, welfare effort has been commonly broken into three socio-influential factors: socio-economic, political and institutional factors. During the WEP period, due to the dramatic adoption of welfare policies across the globe, policy experts desired a method to characterize the design of these systems for different countries. Ultimately, these researchers settled on the idea that socio-influential factors could explain the nuances of welfare effort within a diverse pool of welfare systems. As the economies of the world further modernized, the initial architecture that welfare systems were designed

with could not withstand the test of time; sustainability began to falter. To counter the growing instability of global welfare systems, the same methods that were used to study and understand them became a tool to cut and “rebalance”, what is now generally referred to as retrenchment policy. Therefore, the scope of this section is to investigate how socio-influential factors have been conventionally used to address sustainability and, more specific to this study, impact pension effort.

3.1.1 Socio-economic Factors

There are a range of socio-economic factors that have affected the long-term prospects of welfare programs. As the world has changed since their inception, these factors have highlighted the structural flaws inherent to these systems. Two particularly significant factors that challenge long-term sustainability have been the evolution of the world’s labor market and demographics.

During the Welfare Expansion Period (WEP) period, conventional “industrialist” thinking stressed the idea that economic growth not only created the need for welfare state support, but also the resources needed to sustain it (Wilensky 1974; Myles & Quadagno, 2002). This thought process was encouraged by the economic surge of world economies; it appeared that the world could just “keep growing”. By the 1970s however, globalization,

demographic changes, and an oil crisis forced countries to re-evaluate “industrialism” and reform their welfare policies, mainly through a series of cutbacks (Pierson, 2002; (Van Kersbergen & Hemerijck, 2012). This spurred the ascendance of Right-wing Neoliberalism ideology, that saw the birth of new retrenchment-based policies aimed at bringing order to unsustainable systems (Orloff, Myles, & Quadagno, 1993; Swank, 2003). Sparked by two notable figures of this movement, Margaret Thatcher and Ronald Reagan; both of whom pushed for radical cutbacks to welfare benefits, arguing they were the only way to resolve the hyperinflating deficits of the 1980s (Castells, 1996; Huber and Stephens, 2001; Schumacher, Vis, & Van Kersbergen, 2013; Starke, 2006). Right-wing Neoliberalism became the predominant ideology of this era, with its flag-bearers in government pushing for cutbacks to social benefits and reforms that would rein in the globalist policies of the WEP period.

This ideology sparked one of the main themes adopted by comparative social policy research in the 1980s, the ‘Welfare State Crisis’ (O’Connor, 2003; Schwartz, 1994; Hicks, 1999). The Welfare State Crisis theorizes that what drives reductions in welfare benefits is a combination of global and domestic issues, that directly jeopardize the sustainability of welfare systems (O’Connor, 1973; Schwartz, 1994; Hicks, 1999; Maurizio Ferrera, Ferrera, Hemerijck, Rhodes, & Giddens, 2001; Hemerijck, 2006). Burgeoning domestic issues included population aging, long-term unemployment, and rapid automation of

the labor market (Schwartz & Seabrooke, 2008); global issues were the mobilization of the international labor market and an increase in free trade. Domestically, countries were panicked that there was little means to control the ballooning deficits and unemployment spurred by the aftermath of a global economic crisis (1970's stagflation), increasing life-expectancy, a technological revolution, and most importantly the rising cost of welfare (Huber et al., 1993; Huber, Mustillo, & Stephens, 2008). At the same time rapid globalization provided little comfort to countries grappling with issues at home. However, the effects of globalization were hotly debated between scholars. One side argued that globalization has negative effects on social expenditure, because economic openness causes increased dependency on the global market and reduces the government's spending capacity (e.g. Castells, 1996; Garrett & Mitchell, 2001). In contrast, others argued that the relationship between globalization and social expenditure was positive, they believed in the validity of the 'Compensation Hypothesis'; that governments would increase social spending to stimulate worker productivity, and therefore boost their ability to compete in the international marketplace (Rudra et al., 2000; Dreher et al., 2007; de Cos, Jimeno, & Ramos, 2017).

Scholars have attempted to extrapolate this discourse to changes in individual welfare programs, of particular interest to this study is pension systems. Globally, pension systems are the largest source of welfare spending.

It has been highlighted that the effects of globalization, labor market transitions, and an increasing aging population have been central motivations for pension policy reform, and are often cited as reasons to curb ballooning deficits (Pierson, 2001; Bonoli, 2007; Herbersson and Orszag, 2001). Tepe & Vanhuyse (2010) used a Fixed Effects (FE) model to examine the effects of population aging, the rate of female employment, and an increasing percentage of service sector employment specifically on pension spending; they reported that these factors, in fact, increased pension spending (M. Tepe & Vanhuyse, 2010b).

In short, the socio-economic perspectives that arose in the 1970s and 80s drove retrenchment and dismantlement policies that stripped much of the original power from welfare programs, but more importantly, set a powerful precedent that has continued into the present (Disney & Johnson, 2001; CLARK, 2003; McDonald, Kippen, & Temple, 2006). Despite the continued evolution of domestic and global economies, welfare systems have managed to survive - to the point that globalism has negatively affected welfare - this is even more intriguing. Socio-economists assume that governments automatically adapt to socio-economic changes. Political scientists argue that this assumption does not account for cross-national variations in pension policy reform. The “zero-sum-game” logic disregards political, institutional and other various factors that differ between nations. This study argues that,

more importantly, this socio-economic perspective sees only one path for welfare reform - further retrenchment and radical dismantling. This socio-economic perspective is anchored to economic trauma experienced in the 1970s and 80s; thus, it disregards the economic paradigm shift that has occurred in the following decades, requiring a combination of contractionary and expansionary reforms - the Compound Reform Period (CRP).

3.1.2 Institutional Factors

Traditionally institutionalism argues that the existing precedents that any given institution is comprised of provides resistance to dramatic policy changes, and a core theory adopted among institutionalists is path-dependency. Path dependency argues that “history matters”. In essence, policies become self-reinforcing (increasing returns) and are unresponsive to immediate changes as a consequence of their historical embeddedness (precedent) (Benhabib & Farmer, 1994; Mahoney & Thelen, 2009; Thelen, 2012). There are numerous ways to frame institutionalism; these frames provide further context and understanding of their reach and its associated effects on the establishment of new policy. Traditionally within institutionalism, the scope of their theories is narrower to the structures of the institutions themselves. This is highlighted by Skocpol and Amenta’s (1986) use of the term “policy feedbacks,” where once a social policy is enacted and implemented, the policy

itself transforms the structure and politics of that institution, substantially impacting the current and future development of social policies. The institutional perspective comes in direct conflict with theories like the Welfare State Crisis Theory. Path dependency argues that when a crisis occurs, underlying institutions are not immediately responsive, and change comes slowly. More directly, welfare states are persistent. The persistence of existing policy, and the nature of institutionalism and path dependency has been perceived and characterized using different approaches. Esping-Andersen (1999) demonstrated the power of path dependency by dividing welfare systems into three regimes (liberal, conservative, or democratic) and evaluated their historical longevity. He concluded that the institutional legacy of past welfare policy highly constrains future welfare policies to a similar paradigm. Some studies used the pension systems of particular countries to create pension typologies that could explain the nuances of these systems. For instance, Bismarckian and Beveridgean systems are defined by different levels of pension expenditure based on the influence of their institutional legacies (Kim & Beck, 2010; Bonoli, 2005). Alternatively, Pierson (1993) examined the dynamics of actors within different institutions. He concluded that actors rarely behave in ways that deviate from the existing constraints of their institution, they are “locked-in”. Typically, an actor is constrained in two ways, either the actor is in a position with the authority to significantly change the

institution but does not due to lack of incentive; or they are constrained by the institutional inertia of a policy. Where despite better alternatives, actors will not change an existing welfare policy due to the political risk associated with the “increasing-return” of that policy (Pierson, 2002). While each of these scholars may frame institutionalism from a different perspective, their views are ultimately rooted in the “vitality” of institutions. Path-dependency, regardless of its origins, prevents radical or sudden departure from the policies that presently constitute any given institution. Specific to pension reform, institutionalism considers institutions as an independent variable when examining how these policies are reformed. The legacy of past pension policy potentially constrains the future path of pension reform (Pierson, 1999; Bonoli, 2004, Schludi, 2005; Kangas, Lundberg, & Ploug, 2010). Institutionalism can be summarized to some extent as less concerned with how much a welfare state changes, but rather how the underlying institution itself resists future changes to the nature of welfare policy.

3.1.3 Political Factors

Until this point, this section has explored how socio-economists and institutionalists have tried to explain the development and evolution of welfare policies between the WEP and the present. However, there is a third, political, perspective, that claims the evolution of welfare policy has been influenced by

the actions of political actors within an institution. More simply, ‘politics matters’. From the political scientist’s perspective, the functional nature of socio-economics does not fully explain the diverse set of welfare policies that have been enacted across different countries. Rather, it relies on the assumption that policies are reactionary to the current economic conditions of a state. Institutionalists on the other hand overemphasize the weight of historical or political precedent, and underestimate the value of the actions of the political actors within that institution. The political perspective provides an approach that considers the socio-economic and institutional setting, and additionally, the impact of the actors within this setting.

The WEP is defined by a time of socio-economic expansion among democratic-socialistic institutions. This gave rise to left-wing political actors with a preference for increased welfare benefits spending, in order to cater to working-class voters. This came to be known as power resource theory (PRT). PRT emphasizes the power of the voter and their ability to organize. Typically, this manifests itself in strong labor unions and other left-wing organizations that push for welfare policies that benefit their members. Previous empirical studies that have examined this phenomenon support this theory (Myles, 1984; Pampel and Williamson, 1985; Esping-Andersen, 1990; Van Kersbergen, 1997; Hicks, 1999). Particularly, Myles (1984) discovered a high correlation between pension quality and the power of left-wing political

actors; Pampel and Williamson (1985) similarly demonstrated that social-democratic parties are the dominant political influence on pension expenditure during this period. It is important to highlight the high level of agreement among political scientists that have examined this period. Their high level of agreement may be explained by the general economic and political stability of western countries during the WEP, reducing the required complexity of empirical research.

Since political factors focus on how political actors operate within a particular socio-economic and institutional setting; when the setting changes it should be expected that the response by those actors also changes. The WEP abruptly came to an end in the 1970s when an economic crisis hit. Stagflation, continually rising unemployment, an aging population, etc. forced welfare states to reconsider the structure of their social policies in reaction to rapidly inflating welfare costs - 'permanent austerity' (Pierson 1994; Hausmann, 2010). Between the late-1970s and the early 1990s extreme measures of austerity were taken, effectively dismantling welfare systems, the Welfare Retrenchment Period (WRP). This change in setting led scholars to investigate if the way actors navigated this crisis had changed from the traditional political perspective of PRT. With regard to welfare policy changes, Pierson (1996, 2002) pointed out that classical PRT is not applicable to this timeframe, because retrenchment policies that were enacted carry with them a high

political cost. Rather, this political cost incentivized political actors to operate in ways that either protected their incumbency (blame avoidance), or leverage the political unpopularity of retrenchment policies enacted by their opponents in order to gain power. This new dichotomy around retrenchment-based politics laid the groundwork for an era of new politics. A phenomenon that results from the ‘blame avoidance’ hypothesis is the resiliency of welfare states; blame avoidance increases the likelihood that political actors will significantly retrench a welfare policy (Huber & Stephens, 2001; Potrafke, 2009; Tepe & Vanhuyse, 2009; Kwon & Pontusson, 2010; (Keman & Pennings, 2006). A “blame avoidance” mechanism typically employed by politicians when they push to reform existing welfare benefits is through blame sharing; where blame is shared among social actors (including the opposition parties, organized labor, etc.) involved with the negotiation of the new retrenchment reform (Myles & Quadagno, 2002). In contrast to the WEP though, while new politics is one way of explaining this new post-industrialized setting and the motivations of the political actors in this space, there is no clear consensus behind this theory among political scientists.

A popular criticism of “new politics” is that it does not consider the hyperpartisan state of politics in the WRP and the following Compound Reform Period (CRP). They argue that the political leanings of the actors in power at any given time provide a greater indication of their stance on welfare

policies, whether it be to retrench or not retrench. Typically ideological orientations are a main focus of political studies since legislative seats are usually a point of preference for both political actors and voters, therefore are more appropriate for translating the theoretical assumptions of scholars (Schmitt, 2016). Thus, these political leanings are a clear and significant indicator of expected welfare policy changes (Schmitt, 2016). For example, when a greater proportion of a government is controlled by left-wing members, the greater the likelihood that it will support the continuation of welfare spending. Allan & Scruggs (2004) also confirm this theory, that redistribution policies and the size of government spending are influenced by party ideology. Similarly, a number of studies have shown that as control over the reins of government shift between political parties, we can expect different welfare policy goals; right-wing administrations cut benefits to a greater degree than left-wing administrations because of their differences in political ideology (Palme, 2003; Jensen & Mortensen, 2014).

Since this work is focused on pension related welfare policies, the relevance of general political welfare policy theory is important to consider. Conveniently, since pension spending is often a large portion of total welfare spending, there is already a large body of existing research that has analyzed the effects of political factors on pension policy change. It is also important to note that a critical drawback of the modern political perspective, with respect

to pension policy, is its consideration only for retrenchment policies. Rather, a more holistic evaluation of pension policy would be to consider including analysis of other policy reform types, such as expansionary policy.

3.1.4 Summary

Section 2.2 presented a general overarching summary of the three most influential factors that are at the core of welfare state reform, and concordantly, pension policy reform. The socio-economic perspective treats the development of welfare states as an automatic response to macroeconomic trends - i.e. high economic growth during the WEP fostered welfare state expansion. During the economic downturn of the 1970s and 1980s, the WRP, socio-economists saw a direct relationship between demographic and economic slowing and the radical retrenchment of welfare states. Unlike the socio-economist however, institutionalists used institutional legacy, precedent, or path dependency to explain how policies are constrained, and will typically revert to a predetermined mean trajectory. Some institutionalists, neo-institutionalists, qualitatively introduced the theory of “critical junctures” and “incremental changes”; where regardless of if dramatic or small, there are noticeable changes in pension policy within an institution. However quantitatively, institutions are still studied from a static perspective. They use pension typologies to explain policy differences between institutions and how

they may explain pension policy output changes. Political scientists looked to build upon both the arguments of the socio-economist and the institutionalist, using the economy and the institution as a setting. Political scientists focused on how political actors within these constraints operate. When the economy turns for the worst, typically political actors will reluctantly retrench welfare policy (blame avoidance), and will attempt to mitigate the political cost (blame sharing). This is easily explained by the high unpopularity of social policy retrenchment legislation that is then associated with a high political cost. All three of these perspectives commonly highlight the relationship between a particular influential factor and its overall influence on welfare effort (change). However, previous empirical studies have not satisfactorily identified the core influential elements of welfare state reforms. One critical reason that may explain this is the one-dimensionality of pension policy reform research; i.e. research up to this point has been primarily focused on the implementation of retrenchment pension policy reforms. Note, that pension policies in the CRP are profoundly more diverse than they were during the WEP and WRP. This is in part because policy reform cannot only compensate for old risks (unemployment, aging population, etc.), but they also need to compensate for emerging social needs (atypical workers, women labor participation, etc.). Yet, the impact of reform on pension effort has been quantitatively under-investigated, leaving a “black box” over the true driving mechanism that

defines changes to pension spending and pension generosity. From the new institutional perspective, an understanding of pension systems requires analyzing pension policy from a dynamic perspective not a static perspective. Thus, this study aims to include pension policy reform legislation into an analytical framework because the interconnectivity of both retrenchment and expansionary reforms are key to social policy changes, that maintain the sustainability and generosity of pension systems.

4.1 Pension Reform Implementation - The Linchpin of Pension Effort

The discourse between scholars who study socio-economics, politics, and institutions has laid the groundwork necessary for this study to identify what it believes are critical factors that influence pension effort. However, all of these arguments were framed in the salient logic of the ‘welfare states crisis’. A popular view among socio-economists was that welfare effort would and should be cutback due to rising domestic and global issues that challenge fundamental economic stability. Institutional scholars have argued that welfare programs are resistant to reform due to their inherent path dependency; although recently, new institutionalists have posited that welfare programs may change, but it is incremental in nature. Political scholars agree that retrenchment occurs, but disagree as to the nature that it comes about. Radical reform is too politically costly, and therefore politicians avoid taking stances

on policy that would potentially endanger their positions. However, all of these viewpoints lack consensus on what drives and constitutes reform; particularly on the issue of the magnitude and direction of policy reform since the WRP. With respect to pension reform, the lion's share of studies have demonstrated that pension reform is neither purely contractionary or expansionary (Levy, 1999). Pierson (2001) himself points out that research into contemporary welfare states has suffered from 'concept stretching' because welfare reform data has been limited. This argument is no longer valid, with the dawn of the information age, data is readily available and typically open source. Additionally, this technological revolution has come at the same time that reforms have begun to economically establish themselves. This study has the means and the tools to measure changes between individual pension systems, domestically and cross-nationally.

The macro view of influential factors that has been used conventionally to characterize pension effort misses an important building block that has been overlooked within the reform process. Pension reform – the tool used to modify pension effort - is the linchpin that will ultimately define pension effort. This section elaborates on the significance of pension reform, and its impact on pension spending and pension generosity. Broadly, the pension reform process, and the construction of most policies can be broken down into four distinct stages. Figure 2 provides a visual of this process.

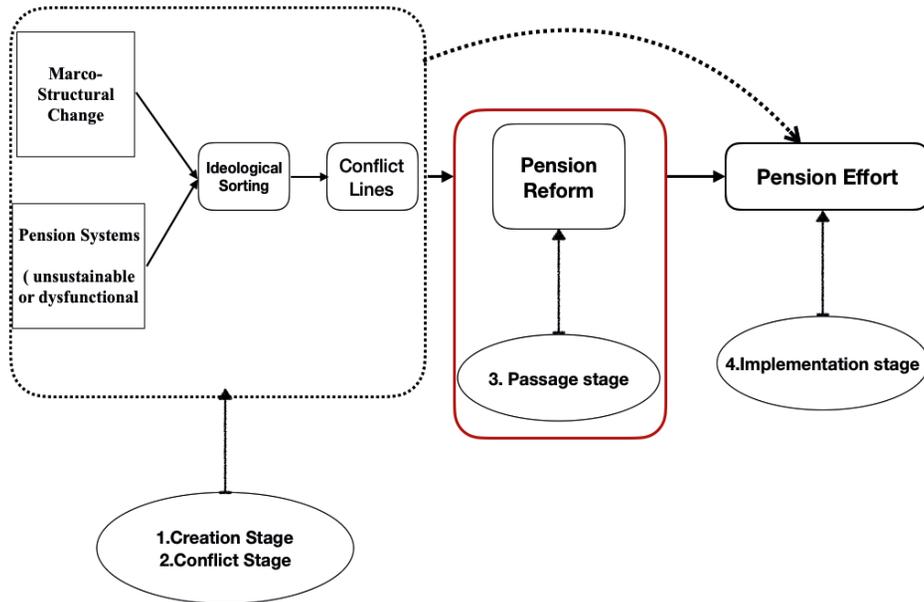


Figure 2 Pension Reform Process – Four Stages (1. Creation stage, 2. Conflict stage, 3. Passage state, 4. Implementation stage).

Note: created by author.

Macro-structural changes and economic unsustainability push lawmakers to enact reform policies that “rebalance” their role. The first stage, the creation stage, is defined by socio-economic, political and institutional factors. This is where ideas are generated and presented as potential reforms. For any given idea the natural ideological differences between members of a governmental body will create conflict, which signals a transition to the second stage of the process, the conflict stage. Conflict can be measured in many different ways, but most importantly to reform, the ideological differences between members can be aggregated and summed into a single desired policy outcome (Häusermann, 2010). The desired policy outcome is

the expected pension reform that would result if the expenditure and generosity goals of political leaders were directly translated into policy. Then, the chosen pension reform passes into the third stage, where after an iterative process of compromises, a reform policy is voted on and passed. This leads to the fourth and final stage, implementation, where the directives of a newly passed reform are carried out and enforced; where the actual policy outcomes, generally referred to in this work as pension effort, can be evaluated. Within the reform process, contemporary literature on this subject has primarily focused its attention on the relationship between the creation stage, the conflict stage and the implementation stage.

Yet interestingly, this is where the breakdown in logic occurs. A key step in the process was undervalued in comparative literature and, in its place, a black box has been placed over the stage that actually defines policy reform, the passage stage. The passage stage is defined by the product it creates, pension reform. Pension reform is the political instrument necessary to restructure the existing architecture of pension effort. Even though socio-influential factors (including socio-economic, political and institutional factors) are the driving forces for pension reform, desired policy output (or outcomes) and the proposed reforms that follow are almost always different from the actual reform that materializes. The key to changes in pension effort lies in the instrument that was chosen to make those changes. This instrument

is the reform policy that was chosen during the passage stage of the reform process (Weaver, 2010). However, the choice to analyze the relationship between what is desired by an institution, and the policy output from that institution, have instead produced conflicting interpretations of the welfare reform period by scholars. As a result, literature has narrowly attempted to link socio-influential factors, desired pension effort and the expenditure portion of pension effort into a coherent relationship. Yet the reform strategy chosen and ultimately implemented, and its relationship to policy output, have been underestimated. It hasn't been until of late, that some scholars have begun to pay attention to how pension reform has impacted pension effort. However, their focus has been narrowly set on retrenchment-based reform and pension expenditure; other studies have picked a singular pension reform related to a specific idea, rather than building a conclusion from a comprehensive compilation of pension reforms. Thus, to fill the gap, this study examines the impacts of pension reforms implemented during the compound reform period (CRP) (from 1990 - 2015) on pension effort.

5.1 Characterizing Pension Reform – Four Pension Reform Dimensions

Pension reform legislation is highly multidimensional, so modification of any single specific pension parameter can have cascading effects on a numerous set of pension policy outputs (Häusermann, Kurer, & Traber, 2019).

These impacts have the potential to affect the short, medium, and long-term prospects of Pension Effort. This makes for a very complex and dynamic problem - where the outcomes related to pension reform are a function of parametric changes, structural modifications and refinancing techniques. Parametric reform typically refers to modification of the major elements of pension systems, including changes to benefit levels and retirement age adjustments. Structural reform refers to changes to the financial mechanisms that underpin a pension system, like a shift from a defined benefit (DB) PAYG system to a defined contribution (DC) pension system⁸. Refinancing refers to the general fiscal policy goal of a given reform, whether the policy is in nature a retrenchment policy or an expansionary policy. However, a challenge has arisen when research tries to discern patterns between the modification of a given system parameter and the output characteristics that are used to define pension systems. Therefore, to better understand enacted reform policy, it is imperative that a robust classification model is designed and implemented to organize major pension reform variables, decode the complexity of the reform process, and identify meaningful connections between specific input and output parameters. A growing body of literature has attempted to model

⁸ DB programs are pension arrangements where retirement benefits are calculated based on an individual's highest earned salary, years of employment, retirement age etc. DC programs are a pension arrangement where each contributor possesses an individual account, and the retirement benefits are based on individual's contribution and investment return.

contemporary pension reform through the application of different classification methods (Weaver, 2003, 2011; Häusermann, 2010; Jensen, Arndt, Lee, & Wenzelburger, 2018). Table 4 summarizes three representative pieces of literature that have done just this.

Table 4. Pension Reform Classification

	Dimension	Pension Reforms
Häusermann (2010)	Insurance	<ul style="list-style-type: none"> • Cutting pension replacement rate • Raising retirement age • Modifying the indexation mechanism • Amending pension calculation period • Changing rules for early retirement • Tightening the link between contribution and benefits
	Capitalization	<ul style="list-style-type: none"> • Adding a pre-funded pension pillar • Implementing a DC pension scheme (voluntary)
	Targeting	<ul style="list-style-type: none"> • Providing benefits through means-tested pensions • Loosening the link between contribution and benefits for lower incomes
	Recalibration	<ul style="list-style-type: none"> • Providing pension credit for job interruptions • Dividing derived pension rights
Weaver (2003, 2011)	Retrenchment	<ul style="list-style-type: none"> • Increasing retirement age • Shifting indexation of benefits from wag-based to CPI-based • Targeting benefits cuts at upper-income recipients • Early retirement restrictions
	Refinancing	<ul style="list-style-type: none"> • Increasing or stabilizing contribution rates • Increasing the taxation of upper-income beneficiaries
	Restructuring	<ul style="list-style-type: none"> • Changing pension roles or adding more pension pillars
Jensen, et al, (2018)	Retrenchment	<ul style="list-style-type: none"> • Invisible instruments (i.e. blame avoidance strategies)
	Expansion	<ul style="list-style-type: none"> • Visible instruments (i.e. Taking credit)

R. Kent Weaver (2003, 2011) emphasized the necessity of classifying the underlying pension reform patterns for it to be possible to understand complex

pension reform. Weaver's model classifies pension reforms into three different types: retrenchment, refinancing, and restructuring reforms. However, all three of these reform types focus on retrenchment-based policies. Under each subsequent type there is a series of pension reform options. For instance, retrenchment refers to pension benefit cuts, changes to pension indexation, etc.; refinancing refers to increasing pension contribution rates or pension levels; and restructuring refers to structural changes like privatization. More recently, Jensen et al. (2018) refuted Paul Pierson's (1994, 1996) classic "new politics of the welfare state". Jensen suggests that models would be better to explore the characteristics associated with enacted welfare reform policy (with an emphasis on pension systems and unemployment systems). A key point that their work makes is the importance of modeling pension reforms not only in the context of retrenchment policy, but also from the vantage point of expansionary measures. Jensen argues that a stronger contrast between retrenchment and expansionary policy highlights whether or not a particular reform was designed to cut or expand citizens' social rights for old-age pensions. The work of Weaver and Jensen provide valuable clues to what variables are critical to the development of a robust classification model; the drawback of their work is their exclusion of some of the major elements that define pension reform. As outlined in section 2.1, pension reform is a combination of retrenchment and expansionary policy. Weaver provides

detailed metrics to classify reform, but mostly in the context of retrenchment. Jensen considers both retrenchment and expansionary policy, but their characterization is vague and requires a clearer definition of how a model should classify reform. Therefore, a model that comprehensively accounts for the parametric, structural, and refinancing characteristics of pension reform would be optimal.

Häusermann (2010) developed a comprehensive framework that accounts for the parametric, structural, and refinancing characteristics of contemporary pension reform. She noted that as time passes, the pre-existing institutions created during the WEP, designed for an entirely different demographic, increasingly struggle to address macro-level societal and economic changes; thus, the sustainability of these institutions is challenged, and the ability of the social protections implemented at that time to address newly arising social risks will continue to deteriorate. Reforms are necessary to readjust the system to address the compounding of old and new social risks. Häusermann concluded that, “both old social risks and new social risks, social policy instruments can be either cut back, expanded or other forms of reform, even though the difference among countries is wide” (Häusermann, 2012, p. 112). Yet resistance to reform by the beneficiaries of pre-existing pension systems provides a formidable challenge to new policies aimed at recalibration. Thus, Häusermann has adopted the new-institutionalism perspective, that the

institutional framework of constraints that resistance arises from also birth new actors. These actors contribute to the continued resistance to modifications to existing pension institutions (Mahoney and Thelen, 2010; Häusermann, 2010). Simply, the challenge behind reforming a pension system not only lies in addressing complex fiscal sustainability problems, but it must be designed to address the ever-growing demands by citizens that arise from new social risks. To account for the complex network of factors that the “pension reform process” is comprised of, it should first be organized the following way: modification of existing benefits and arrangements, funded-type pension supplementation to ease demographic pressures, eligibility enhancement and vulnerable group benefits, and pension credits and pension rights for non-labor participants. This organizational structure is in fact a detailed examination of the characteristics Häusermann uses to classify pension reform. Her classification process is comprised of four reform dimensions, regardless of their retrenchment and/or expansionary nature: Insurance, Capitalization, Targeting, and Recalibration.

These reform types will be introduced and explained one-by-one in the sub-sections below. Under each sub-section, the mechanism that defines that reform type and the pressure(s) that spur reforms of that nature are investigated in further detail. An aside to take particular note of is the nature of the pressures that catalyze reform. This work broadly classifies this in two ways -

as either fiscal pressure(s) or functional pressure(s). Fiscal pressure tends to drive retrenchment reform, whereas functional pressure may result in expansionary reform.

5.1.1 Insurance

Häusermann defines the Insurance reform type as the distributional politics of cost containment. In a simpler manner this can be thought of as major parametric reforms to contribution-based pension systems. Expanding on this concept, Insurance broadly refers to earnings-related social insurance systems. From the context of reform, the insurance reform type refers to restructuring existing social insurance conditions and insurance rights. The major reform elements that constitute insurance reforms include: lengthening the full pension contribution period, reference period extensions for pension benefits, indexation mechanism modifications, etc. The pressures that drive insurance type reforms are demographic shifts and existing generous social insurance programs. Insurance-based pressures are fiscal in nature, and the magnitude of their urgency can be measured by the gap between paid benefits and revenues; thus, these pressures drive retrenchment-based reforms. More specifically, Insurance-based pressures can be identified as demographic changes (e.g. the combination of low fertility, decreasing mortality, and the baby-boomer generation entering retirement) and existing social insurance programs that haven't been adjusted to the changing demographics of a given

country. It follows then that the Insurance-typed pension reforms, that most countries have attempted to implement, try to close the gap between pension revenues and benefits to achieve general economic and fiscal sustainability.

5.1.2 Capitalization

Häusermann defines the Capitalization reform type as a group of reforms that redefine the solidarity between contributors within a pension financing system - concerning the financing mechanisms of an existing pension system. These can be thought of as structural reforms, where a system changes its structure from a defined benefits (DB) system to a defined contribution (DC) system, or some combination of the two. This is independent of whether the system is public or private (e.g. shifts from a publicly managed PAYG DB system to a privately managed DC system). Typically, DB systems are particularly fragile to demographic shifts; in the case that the number of beneficiaries outnumbers the number of contributors, DB systems typically become unsustainable. To improve DB system sustainability, commonly countries have instituted pre-funded DC systems to water-down the fiscal challenges of DB system in the CRP. Thus, Capitalization-typed reforms are driven directly by demographic shifts that impose fiscal pressures on DB systems. They are targeted similarly to Insurance-based pressures with retrenchment-based reforms, and the two

typically complement each other. This reform can also be seen as a strategy that seeks to diminish collective responsibility for pension sustainability and transfer that to each individual participant.

5.1.3 Targeting

Häusermann defines the Targeting reform type as reforms that address issues with benefit eligibility for vulnerable occupational groups. This is executed by loosening the link between contributions and benefits, and rather, distributing those benefits according to the specific needs of those vulnerable occupational groups. Targeting-typed reforms often address eligibility issues by creating new benefit groups aimed at covering workers that weren't previously included within a given social safety net. Commonly implemented examples of this reform type are means-tested pension benefits; or additional insurance conditions for part-time workers whose income is low enough to make them ineligible for coverage. Pressures that trigger Targeting-based reforms are driven by existing pension systems where eligibility is tied to full-time employment status, therefore alienating irregular or episodic employment. More generally this kind of pressure on a pension system manifests when large changes to the nature of the overall makeup of the employment market occur. A pressure of this type is functional, and can be generally assumed to be independent of the fiscal state of a given pension system.

5.1.4 Recalibration

Häusermann defines the Recalibration reform type as the modification to the eligibility criteria of pension systems, to account for members of society who are not actively participating in the labor force. Since the advent of pension systems coincided with the most recent industrialization period, their policies are structured around full-time participation in the labor market. For instance, contribution-based pension systems link pension eligibility and pension benefits to previous work history and contribution records. For a series of reasons, a large group of prime-age workers find themselves unemployed, whether it's to care for a newborn, for retraining or educational purposes, etc.; governments have long looked for incentives to bring these workers back into the workforce. Thereby the eligibility of pension systems has been modified, where credits are provided to these workers in exchange for their re-entrance into the market. The pressure that drives this type of reform is simple, it is the desire of any country to optimize their labor force participation rates. Recalibration-based pressure like its very closely-related Targeting-based pressure, is functional. The benefit for countries to incentivize re-employment in the market is that the number of people contributing to the system increases; thereby possibly improving the sustainability of a wide-range of social programs.

6.1 Empirical Research Overview

In the last quarter century, scholars have made significant strides in identifying the underlying variables - the fourth stage of pension reform – that impact pension policy output. Yet, all previous literature assumes that pension reform occurs in the single direction of retrenchment. This study argues that previous empirical studies have not satisfactorily determined the causes of pension policy output because of two major issues: pension reform is examined without considering the phasing-in period of implementation and the employment of inadequate indicators to identify pension policy output.

Kown et al. (2018) examine the impacts of parametric pension reform on pension expenditure among OECD countries. Kown examined reforms including: pensionable age, benefits formula (1,0), change in benefit conditions (1,0), and changes to benefit intensity (1,0). By using latent profile and panel data analysis, this study found that modifying benefit formulas and pension indexation decreased pension expenditure. In addition to pension reform variables, the ratio of the elderly to the general population significantly increased pension expenditure. Kown's study provides valuable insight into the impacts of pension reform in a comparative context, but there are two significant drawbacks to this study: it considers only contractionary pension reform and it measures pension reform as binary variables. This singular direction (mostly retrenchment) not only causes a substantial loss of

information relative to the use of continuous dependent variables, but also results in a narrow interpretation of pension effort.

Verbič & Spruk (2014) investigated the determinants of public pension expenditure using a panel of 33 countries. The authors employed independent variables including net replacement rate and effective retirement age; and demographic control variables including the old-age dependency ratio, total fertility rate, life expectancy at birth and life expectancy at 65. The method used for the panel data model is the IV-2SLS fixed-effect estimator (Verbič & Spruk, 2014). The authors show the negative impact of an aging population on pension expenditure. Different from Kown's (2018) study, Verbič & Spruk (2014) examined pension reform with a few reform indicators, but they could not find a significant relationship between these variables and pension expenditure.

Fonseca & Sopraseuth, (2009; 2019) compared Italy and France after both of these countries adopted different reforms. France modified its pension benefits plan by altering a number of parameters including: increasing the required contribution years to 40, computing average wage by considering the 25 best years, and reducing benefits by five percent for pensioners with less than 40 contribution years. Italy switched from a defined benefits pension

plan⁹ to an NDC system. By using a calibrated life cycle model, they found that while the French reform only financed 20 percent of the expected deficit, the Italian reform financed all of their expected deficit by drastically cutting the generosity of their social security benefits. These studies share the common drawback of defining pension reform without consideration for expansionary policy. This study argues that this leads to inconsistent outcomes.

Another group of research evaluated potentially relevant variable effects on pension expenditure by examining a specific pension reform from a given country (e.g. modifications to pension indexation, changing retirement age). For instance, some studies argue that pension indexation reforms have been commonly practiced, because this type of reform is considered a powerful tool to curb the growth of pension expenditure (Schludi, 2005). This instrument is powerful because: 1) it can be employed in the short term to reduce pension spending; 2) once a less generous indexation mechanism is established, it can continually and substantially accumulate long-term savings; 3) this reform is much more technical and invisible, and therefore easier to implement (Schludi, 2005; Green-Pedersen et al., 2012; Jensen et al., 2018). Using the simulation model DESTINIE 2 INSEE¹⁰, Corinne Prost (2015) examined how changing

⁹ Italy shifted the PAYG system to NDC pension systems in 1997. So, each individual has an individual account and contribution for each year indexed to a five-year moving average of GDP.

¹⁰ This microsimulation tool DESTINIE 2 INSEE was utilized to isolate the effects of these two categories of measure, the ratio of pension benefits to GDP and the relative standard of living of pensioners (Prost, 2015).

indexation impacted pension expenditure in France, where the government switched their pension indexation method from wage to CPI indexation in 1993. According to Prost's simulation outcome, if GDP can grow one percent to two percent per year, the effect of this reform can vary, with the potential to save between 3.6 percent to 6.0 percent of GDP by 2060. Retirement age is a common variable that countries reform to reduce pension expenditure. Studies have argued that reforming retirement age has two fiscal effects on pension systems: 1) pension revenue increases because people work longer; 2) pension expenditure decreases because less people are eligible to draw upon their pension benefits. Etgeton (2018) focused on Germany, where the pensionable age gradually increased from 65 to 67 beginning in 2012. Etgeton points out that even though the German government raised the pensionable age from 65 to 67, beneficiaries only began to claim benefits 0.6 years later on average, while those who prolonged their employment status only did so for 0.7 years (Etgeton, 2018, p.157). Fehr et al. (2012) on the other hand, analyzed the same reform variable as Etgeton, but found that raising the pensionable age was effective at increasing the retirement age. These studies provide a useful template for analyzing pension reform at a micro-economic level. However, their analyses are limited in scope to one country. Taking this level of analysis and applying it to a wider range of countries and variables, is an essential next step.

Previous literature paid particular attention to pension spending, but recently pension adequacy (generosity) has come under increasing scrutiny (Patxot et al., 2017). G. Grech (2016) evaluates the impacts of pension reform on future living standards by measuring pension wealth in ten OECD countries¹¹. Pension reforms include the lengthening of contribution records and changing indexation. The results suggest that the average replacement rate from the 1990s through the 2000s has fallen. In addition, moves to link benefits and contributions have raised adequacy concerns for certain groups and strengthened the need for longer careers. Parallel to Grech's study, Fehr et al. (2012) found that increasing the retirement age negatively impacted poverty-vulnerable workers, who suffered the biggest losses relative to their previously earned pension benefits. Typically, low-skilled and low-paid employees are the biggest losers in this scenario because they are unable to adjust their finances to the new retirement policy. While these studies introduce analysis of pension generosity, it is limited in nature; only looking at one specific variable. One of the primary focuses of the research introduced in this paper is an expansion upon this preliminary analysis.

Previous literature has attempted to characterize the nuances of pension reform across the world so to better understand and design future reforms. At the beginning of this study the concept of Pension Effort was introduced.

¹¹ Austria, Germany, Finland, France, Hungary, Italy, Poland, Sweden, Slovakia and the UK.

Pension Effort is used to capture two critical performance metrics of a pension policy, expenditure and generosity. The purpose of this section is to investigate the perspectives of popular previous research with respect to pension effort; i.e. did they investigate only expenditure related reforms, generosity reforms, or a combination of both. This study has concluded that a significant amount of work has been dedicated to research on the topic of expenditure related pension reform. Furthermore, these works are part of a bigger trend of expenditure focused research and political opinion, that has then been used to justify retrenchment policies. This research presents the argument as to why it is important for researchers and policymakers to take a more comprehensive view of pensions; specifically, from a combined expenditure and generosity perspective. That views reforms dynamically as a combination of retrenchment and expansionary policies.

Although cutting-back pension benefits can enhance pension sustainability, maintaining adequate social security income is increasingly important. In particular, the post-industrial labor market has required that pension systems provide support for a wide range of new social needs (Häusermann, 2010). For instance, an increasing percentage of the workforce consists of service-based and or atypical employment. These workers, under most current systems, would be excluded from benefits (Irwin & Nilsen, 2018; Allmendinger e.al. 2013; OECD, 2015, p76). Since most pension systems still

derive from an archaic socio-economic model, originally from the WEP, benefits are typically awarded based only on full-time-employment contributions. Thus, expansionary reform is needed to provide adequate pension benefits for those populations at risk of falling into poverty. Considering the overall effects of pension reform, expansionary reform policy must be considered in order to comprehensively analyze the effects of pension effort.

The arguments that were previously introduced only explain part of the actual ongoing dynamics of pension reform that are changing institutions. The interconnectivity of both retrenchment and expansionary reforms are key to fully understanding the nuances of pension systems. Empirically, targeting and recalibration pension reforms have been omitted in the literature. These omitted variables not only underestimate overall pension reform impacts but also result in bias toward estimated effects. Therefore, robust research into the dynamics and underlying relationships between pension reforms is critical. This study applies a comprehensive framework to evaluate how pension reforms have impacted pension spending and pension generosity in the CRP (1990-2015).

7.1 Analytical Framework

This study presents a comprehensive analytical framework that will empirically examine how both pension spending and generosity have been affected by recent pension reforms. This study organizes pension reforms using four reform types: Insurance, Capitalization, Targeting and Recalibration. Pension reform data was collected from 15 different countries during the CRP (1990 - 2015) in the following way: through identification of the year a pension reform was implemented; interpretation and organization of the reform within a dataset based on its details and relevance. Figure 3 summarizes this framework, and in the following chapter (Chapter 3) it will be explained in further detail along with the specific measurement of dependent, independent, and control variables.

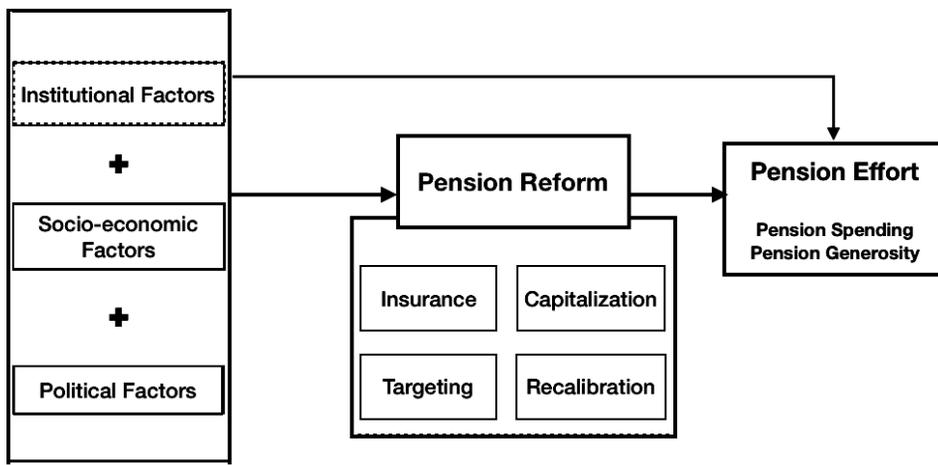


Figure 3 Analytical model

Chapter Three: Research Methodology

Chapter three is a comprehensive walkthrough of this study's methodology for acquiring, measuring and analyzing data. This study characterizes pension reforms enacted during the CRP (1990-2015) using a modified version of Häusermann's pension reform classification methodology. The purpose is to conceptualize how enacted pension reforms affected pension expenditure and generosity. It begins with introducing the scope, then how reform variables are measured and coded, and ends with a discussion of the analytical methodology.

1.1 Data and Scope

The analysis performed in this study was empirical and relies on cross-sectional panel data divided into two groups: macro and pension reform data. Macro data is collected from the OECD, the World Bank, the ILO, the UN, the Chinn-Ito Index, and the Comparative Political Data Set (CPDS). Pension reform data was mainly collected from the International Social Security Association (ISSA), Mutual Information System on Social Protection (MISSOC), the Social Security Administration (SSA), and the OECD.

A total of fifteen countries are covered in this study, namely China (CHI), the Czech Republic (CZE), Denmark (DNK), France (FRA), Germany (DEU), Greece (GRC), Italy (ITA), Japan (JPN), Korea (KOR), the Netherlands (NLD), Poland (POL), Sweden (SWE), Switzerland (CHE), the United Kingdom (GBR), and the United States (USA). As was conveyed in chapter one, this study included China, Japan, and Korea because they are experiencing the same socio-economic transformations that are shaping pension reform legislation in the western world. These three countries are aging at unprecedented rates (Ahn, 2005: 95; Kim, 2012, Choi, 2006). For example, it took 156 years for the elderly (over 65) population of France to increase from 7% to 20%, and 86 years in the United States; for Japan, it has taken only 36 years (UN, 2009). Thus, it is prudent to include these three East Asian countries into this study.

2.1 Operational Definition of Variables

The primary goal of this section is to examine how pension expenditure and generosity change depending on which pension reform type is being analyzed. In order to test the impacts of any given pension reform, two dependent variables will be measured in this analysis: pension expenditure and pension generosity. Generosity and expenditure will be modified by four independent variable sets: Insurance, Capitalization, Targeting, and

Recalibration. This study is constructed around pre-defined control variable sets: socio-economic factors (GDP per capita, economic openness, service employment as a percentage of total employment rate, women's labor participation rate, employment rate, fertility rate, and the aged 65+ population rate), and political factors (government ideology). The following section details the operational definition of each variable, and Table 5 summarizes the variables in a visual manner.

Table 5. Summary of independent and dependent variables used in this study.

Variables		Variable Description	Data Source
Dependent Variable	Pension Expenditure (PE)	National pension expenditure as a percentage of GDP (%)	OECD/ National Bureau of Statistics (China)
	Pension Generosity (PG)	Gross pension replacement rates (%)	
Reform Variables	Insurance	1). Male statutory retirement age 2). Number of contribution years 3). Total contribution rate (%) 4). The maximum allowed years an individual may retire early 5). Maximum reduction in benefits due to early retirement (%) 6). Number of years used to compute benefits 7). Method used to index benefits (based on wage growth=0, based CPI=1)	ISSA (country profiles)/ Social Security Administration/ MISSOC (comparative table)/ OECD/ World Bank
	Capitalization	Reform event from either a pay-as-you-go system or defined benefits system to a system that either partly or entirely based on notional defined contributions (no reform event=0, reform event=1)	
	Targeting	Reform event implements means-tested pensions and/or enhanced benefits for vulnerable occupational groups (no reform event=0, reform event=1)	

Independent Variables		Recalibration	Reform event awarding pension credits for time spent in work training programs or for non-labor participation groups (no reform event=0, reform event=1)	
	Socioeconomic Variables	GDP per capita (GDP)	GDP per capita (log)	OECD/ ILO/ IMF/ World Bank/ Chinn-Ito Index/ UN Population Division
		Economic Openness (Open)	Chinn-Ito index	
		Aged 65+ population (Age65)	The percentage of population aged 65 and above of total population (%)	
		Service Sector Employment (SER)	Service sector employment as a percentage of total employment (%)	
		Female labor participation (FLP)	Female labor participation rate (over-fifteen population) (%)	
		Employment Rate (ER)	The ratio of employed to the working-age population (%)	
	Total Fertility Rate (TFR)	The number of children who would be born per woman (%)		
Political Variables	Government Ideology (GOV)	A measure of government ideology derived from control of parliament by parties and/or coalitions with different ideological affinities.	Comparative Political Dataset/ Korean National Election Commission	

2.1.1 Dependent Variables

Pension systems need to be evaluated from two broad criteria: pension financial sustainability and pension generosity. The primary objective of pension reform is to deal with pension financial sustainability; these reforms attempt to balance pension spending and pension generosity in order to achieve this. To comprehensively evaluate the effectiveness of pension reform, both pension spending and pension generosity need to be examined. Spending

- pension expenditure - is broadly described as the cost to operate the system, and generosity is described as the level benefits paid and protection of the elderly from systemic poverty.

Pension expenditure: A measure of the cost for a given pension system, measured as a function of GDP. This consists of old-age public pension spending (including lump-sum payments), survivors' pensions and minimum social assistance pensions¹². Pension expenditure data was collected from the OECD Statistics dataset. This study too will measure expenditure as a ratio of a country's given GDP for any given period of time.

Pension Generosity: The level of pension benefits, often measured by using income replacement rate¹³. The aim of pension generosity is to protect the elderly from poverty and maintain a standard of living. Holzmann and Guven (2009) states that this indicator is useful for measuring pension

¹² Pension expenditure in this study is defined as the cash expenditures (including lump-sum payments) on elderly and survivors' pensions. Old-age cash benefits provide income for retired persons, or guarantees income when a person has reached a 'standard' pensionable age or has fulfilled the necessary contributory requirements. This category also includes early retirement pensions: pensions paid before the beneficiary has reached the 'standard' pensionable age relevant to the program. This indicator is measured as a percentage of GDP and is divided into two groups: public and private programs (OECD, 2015).

¹³ Pension generosity has two main objectives: poverty protection and consumption smoothing (OECD, 2015). The income replacement rate is the most common means of measuring the generosity of a pension system. However, this is not sufficient because income replacement rate solely represents benefits calculated from pre-retirement earnings, mainly referring to the working class. Chybalski & Marcinkiewicz (2016) argue that this indicator cannot comprehensively express both means of pension generosity: to reflect the level of income allocation over an individual's lifetime; to reflect the level of spending among pensioners or in their households. Since this study only uses the median income replacement rate to express pension generosity, it is limited in its ability to represent a country's pension generosity. However due to data unavailability, this indicator is still the best measure of pension generosity on individual level for cross-country analysis.

generosity because it indicates the degree of income that is replaced when workers retire. Since pension systems typically pay the participants of their systems as a function of their pre-retirement income, the pension generosity for any given individual will vary. This study will make use of the gross replacement rate – the ratio between gross pension entitlement upon retirement and gross pre-retirement earnings - as a means of measuring the overall generosity for a given country (Chybalski & Marcinkiewicz, 2016). Replacement Rate - the percentage of a worker's pre-retirement income that is paid out by a pension program upon retirement. This ratio is the gross pension replacement rate and is indicated in this study using three values 0.5, 1, and 1.5. Where 0.5 is denoted for low-income, 1 for middle-income, and 1.5 for high-income earners. This study used the average of the gross pension replacement rate. Pension generosity data was collected from the OECD's pension spending database. When a pension reform is enacted, pension expenditure and or pension generosity may or may not change, but their changes are not independent. For example, if a reform policy changes the minimum retirement age, it is expected that both expenditure and generosity will change. Conventionally, pension expenditure has been dominantly used alone to measure the performance of a pension system. As was just defined

though, generosity too represents pension performance¹⁴. Therefore, a more thorough evaluation of pension systems, and for this study pension reform, would evaluate how both variables change. Thus, a study is needed that can utilize replacement rate to measure the consequences of pension reform with respect to individual pension benefits, and this study does that.

2.1.2 Independent Variables

To measure potential ways that generosity and or expenditure are manipulatable this study has identified four independent sets of variables. The variable sets are Insurance, Capitalization, Targeting and Recalibration. The Insurance variable set consists of the following eight variables: retirement age (male), pension contribution years, contribution rate, reference years for full pension benefits, pension indexation, and eligibility of early retirement pension related formulations. There is one binary Capitalization variable; this variable either represents a system that has shifted from PAYG to NDC or shifted from DB to DC. The Targeting variable set consists of: implementation

¹⁴ The reason pension replacement rate is used as the primary metric for pension generosity, is due to lack of access to other metrics. This is the most widely used indicator of level pension benefits. In the future, other examples of metrics that would improve this work's ability to analyze pension generosity include income adequacy and consumption adequacy when data becomes accessible. In the case of Czech Republic, their replacement rate before the dissolution of Czechoslovakia (1993) was assumed to be the same as that of Slovakia (OECD, 2009; Müller, 2002).

of a means-tested pension and providing eligibility for vulnerable occupational groups. And the Recalibration variable set includes two variables, pension credit provision and pension eligibility for short-term unemployed groups provision variable. This study assumes for modeling purposes that these variables are entirely independent of each other. A glossary of the pension reform variables used in this study is provided at the end of this work (see table (A).); this is based on each country's legislation, law, and specific implementation year. The following subsection details each individual indicator.

1). Insurance

(1) Retirement Age

Retirement age is defined as the legal age people qualify to receive full pension benefits. Theoretically, raising the retirement age should increase the contribution period and reduce the benefits period (Schludi, 2005). Empirically, raising the retirement age has been found to prolong employment; these studies have found that prolonged employment strengthen pensions' financial stability, but at the same time, disadvantage low-paid workers (Börsch-Supan & Berkel, 2004; Berkel, Börsch-Supan, Ludwig, & Winter, 2004; Etgeton, 2018). To test the impact of retirement age on pension effort, this variable measures the retirement age of each country, as per enacted

legislation. Previous research argued that reforming retirement age has two fiscal effects on pension systems: 1) pension revenue increases because people work longer; 2) pension expenditure decreases because less people are eligible to draw upon their pension benefits (Schludi, 2005). The retirement age variable only considers men, some countries have different retirement ages based on sex, however there is a strong correlation between movement of gender-based retirement age¹⁵. When one gender's retirement age increases, the other gender follows a similar trend. The empirical definition of this variable is (Retirement age), and is measured by the eligibility age for full benefits. Data was collected from ISSA's country profiles and MISSOC's comparative table.

(2, 3, and 4) Contribution Rate, Period, and Reference Years

Countries attempting to reduce pension expenditure commonly adopt reform procedures that tighten the association between contributions and benefits. A system with increased contributor responsibility can be reformed

¹⁵ This indicator is coded with each country's standard retirement age. For example, the standard retirement age in Korea is currently being raised by one year every 5 years, from 60 to 65 years old (2013 to 2033). In the case of the Czech Republic, the retirement age was 60 years before 1995 (the Pension Insurance Act, Law No 155/1995). Since 1999, the statutory retirement age has been increased by two months per year. There are some exceptions, the retirement age can be lowered 1 to 3 years depending on the number of children an individual has. However, from a comparative perspective, this study did not account for such differences, instead coding the retirement age according to the general letter of the law without regard for those exceptions.

by governments in a number of ways to manage pension expenditure including: changes in pension formula (e.g. increasing contribution rate, contribution years and reference years for receiving full pension benefits) (Schludi, 2005; WB, 2005). From a mathematical standpoint, contribution dependent pension benefits (B - \$) can be theoretically determined as a function of three variables: the reference salary (Y - \$/year), the period of assessed contributions (T - years) and the accrual factor (C - unitless) (Schludi, 2005, p. 30); This relationship is proportional and can be expressed in the following way:

$$B = Y * T * C$$

Y is determined as the average pay over a defined period (often the required number of contribution years to reach a full pension). In addition, this reference salary typically varies between a number of “best” or last years and total career period. Commonly the highest five years of pay, or the majority period of an employee’s career are used. Thus, when the highest five years of pay is used when calculating a potential retirees’ benefits, it is typically higher, and more expensive for a pension system. Research has shown when a pension system’s assessed contribution period (T) is increased to match the full length of a contributor’s career, it forces the contributor to delay their exit from the labor market; thus, reducing pension expenditure (Disney, 2004; Schludi,

2005). Based on each country's legislative dataset, the set assessed contribution period and the average of the county's reference years for full benefits will be evaluated in this study. For modeling simplicity, analysis will assume that the accrual factor (C) is one. These variables will be labeled for this model's analysis: Contribution year¹⁶, Contribution rate¹⁷, and Reference years¹⁸. Data was collected from ISSA' country profiles and MISSOC's comparative table.

(5, 6) Early Retirement Year and Early Retirement Penalty

¹⁶The initially designed contribution period balanced a specified period of retirement with a specified period of years working in the labor force. Greece, reformed their required contribution period from 35 years to 45 years; France, from 37.5 years in 1990 to 41 years by 2015.

¹⁷Contribution rate refers to the proportion of an individual's income tax that is used to contribute toward the cost of retirement benefits. Often, this contribution rate is shared between employees and their employers. For Japan, the contribution rate increased on average 0.354 percent every year beginning in 2004, from 13.6 percent to 17.8 percent of an individual's income tax by 2015. In the case of Korea, the contribution rate increased from six to nine percent for both employers and employees after reform. However, before reform, self-employed individuals contributed only three percent. This was then increased to nine percent in 2008. This study didn't consider this difference, but rather coded it as six percent - the same as standard employees. In the case of the UK and Denmark this study coded their contribution rates as zero percent, according to the OECD and ISSA. Other sources that would have properly reported this information were not used because of the desire on behalf of this study to maintain a consistent source of data.

¹⁸Reference period is the assessment period used to calculate received benefits. For most countries, this reference period was initially defined as the highest paid five years of income. The consequence of higher life-expectancy is a longer period of benefits paid. For most workers, the shorter the reference period is, the higher the effective yearly benefits will be. Therefore, countries can reform the sustainability of their systems through increasing the reference period used when calculating benefits, effectively reducing their value. For some cases this was reformed to the highest paid 20 years, and in other cases a worker's entire working period is used in this assessment.

Early retirement is defined as retiring before the legally defined retirement age that would qualify a person for full benefits. Studies have identified early retirement as a significant contributor to increasing pension expenditure, because the number of contributors decreases and the period of received benefits increases (Engels, Geyer, & Haan, 2017; OECD, 2017; Staubli & Zweimüller, 2013). However, benefits claimed early are typically reduced. To test the impacts of early retirement reform on pension effort, this variable measures the number of allowable years before the “standard” retirement age that a person may retire for a given country. It also measures the penalty percentage on early collected benefits per year in the case a person retires at the earliest allowable age. Manipulating this variable provides a complex result that is too difficult to ascertain from general common sense, therefore this study does have the means to predict an outcome before detailed analysis. The variables in the model are referred to as (Early retirement years) and (Early Retirement penalty %)¹⁹. Data was collected from ISSA’s country profiles and MISSOC’s comparative table.

¹⁹ This variable measures the number of allowable years before the “standard” retirement age that a person may retire for a given country. For instance, in the case of Czech Republic, the standard retirement age was 60 in 1990 and was gradually raised to 63.2 by 2015. Originally the maximum number of allowable years an individual could retire before the standard retirement age was five, but was reduced to three years during the CRP. The penalty for early retirement is different per year. If an individual qualifies with 35 years of contributions, the early retirement penalty is 0.9 percent for every 90 days of the first 360 days of early retirement, 1.2 percent for each 90 days between 361 and 720 days, and 1.5 percent for each 90 days thereafter. This study only considers workers that have made life-long contributions, retire as early as allowed, and then averages the yearly early retirement penalty. According to the OECD and ISSA datasets, this was 2.4 percent per year in 1990, and increased to 5.6

(7) Pension Indexation

Pension indexation is a method of benefit adjustment that scales an individual's pension benefits to account for inflation. Pension indexation adjustments have been implemented in many countries since it is a very effective means of curbing the growth of pension benefits (Jaag, Keuschnigg, & Keuschnigg, 2010; Schludi, 2005). The most common method of indexation adjustment is to transition the growth of pension benefits from an average-wage-growth model to a CPI-based index-based model (or mixed wage/CPI indexing). Historically the growth of wages has outpaced inflation; by tying it to inflation it slows the growth of benefits (Schludi, 2005). Corinne Prost (2015) reported that indexation reforms have effectively curbed social spending regardless of their high sensitivity to macroeconomic conditions. Simply, it has been concluded that indexation reforms have generally, only

percent per year by 2015. In the case of Denmark, the early retirement age gradually decreased, and was abolished by 2015. The maximum number of allowable years an individual could retire before the standard retirement age was seven years, and was phased out by 2015. A penalty was phased in based on birth year, with a total average penalty for all individuals of 9.6 percent per year. For Korea, the maximum allowed number of years an individual may retire was five years before the standard retirement age. The early retirement penalty was five percent per year from 1988 to 2007. The penalty rate was increased from five percent to 6 percent per year. However, penalties were phased-in according to the maximum and the minimum retirement year. This study used Korea's first year penalty rate of 6 percent per year based on ISSA data. (Note: this study referenced data from ISSA. According to the Korean early retirement penalty reform laws implemented in 1998 and 2007, a penalty was phased in based on the number of early retirement years. This actual per year penalty is then calculated using a base penalty rate, and is then multiplied by the number of years an individual retired early. For example, if an individual retires early by one year, the early retirement penalty is 6 percent, 12 percent for two years, and 18 percent for three years (NPS, 2008).

decreased pension generosity. To test the impact that pension indexation reforms will have on pension effort, the pension indexation variable measures what index benefit growth is tied to (wage-based growth or inflation-based growth). This study concurs with the conclusions of previous works, and this study assumes that switching from a wage-based index to a CPI-based index would reduce both pension expenditure and generosity, since inflation grows slower than wages (Bonoli, 2005). This study refers to the indexation reform variable as (Pension indexation). Data was collected from ISSA's country profiles and MISSOC's comparative table²⁰.

2) Capitalization

²⁰ Since the growth of CPI is slower than average wage growth, countries have changed pension indexation from wage-based to CPI-based indexation. For instance, in the case of Japan, wages are expected to grow faster than the CPI by one percent annually. Accordingly, a shift from wage to CPI-based indexation may significantly reduce pension effort. Japan passed a law that shifted wage-based indexation to CPI-based indexation in April of 2000. However, some countries chose a mixed model indexing benefits based on both wages and CPI. For mixed systems, this study coded this indicator according to each country's political trends in order to choose which indexation is more heavily weighted. Switzerland uses a mixed model with a 50/50 distribution, but based on recent policy trends this study considers Switzerland as a wage indexation weighted country for data purposes. The Czech Republic adopted a 33 percent wage and 67 percent CPI-based indexations. The UK is unique, they imposed a triple indexation pension benefits rule (highest of CPI inflation, average earnings growth, or a 2.5% underpin). The government has the discretion to change their method of indexation, however triple indexation is not enshrined in law. This study treats the UK as a CPI-based indexing country, since the political trend has shifted toward less generous indexing options (E. Whitehouse, 2009). For instance, since 2011, state pensions need to be updated annually in line with CPI.

This study defines Capitalization (Capitalization) as a shift from PAYG to DC or NDC. According to literature, shifts from Pay-As-You-Go (PAYG) to a Defined Contribution (DC) or Notional Defined Contribution (NDC) system have been executed with the hope that they may reduce pension expenditure. Defined Contributions (DC) tie retirement earnings closely with contribution wages, Notional defined Contributions (NDC) are a pre-set benefit amount paid to retirees at the discretion of the government. Previous work has explored both of these reform variables, but have not come to any definitive conclusions as to whether or not it effectively reduces the cost of a pension system (Lundberg et al., 2008; Ebbinghaus, 2011) Accordingly, this variable is binarily measured. This study does not come to any initial conclusions as to how manipulating Capitalization will affect pension effort, due to a lack of previous analysis. Data was collected from ISSA's country profiles and MISSOC's comparative table²¹.

²¹Capitalization refers to pension policy shifts from a defined benefits (DB) program to a defined contributions (DC) or a notional defined contributions (NDC) program. This includes the addition of a mandatory and or a voluntary funded pension system. The capitalization reforms that have been implemented vary in many ways. This study considers if countries mandated the establishment of a privately managed system, funded pillars through structural pension reforms, and public-private mixed pension reforms: NDC reforms, shifting DB to DC, add a mandatory pre-funded pension, and also include incentives from other funded occupational pension reforms. For instance, Sweden, China, Poland and Italy implemented NDC reforms; Denmark introduced the Special Pension program in 1997. This included a compulsory savings clause, where an individual must contribute at least one percent of their earnings.

3) Targeting

Targeting type reforms address issues with benefit eligibility for vulnerable occupational groups and or the elderly. Accordingly, Targeting is meant to enhance decommodification by providing pension benefits based on means-testing and or reduced benefit dependency on contributions for careers that feature precarious or atypical employment (Häusermann, 2010). Previous research has not analyzed the effects of targeting reforms on pension effort. This study will introduce this analysis in a simple manner by measuring targeting as a singular binary variable (Targeting)²². If a country implemented a means-tested and or enhanced benefits system for vulnerable occupational groups, this variable is flagged with the value 1. This study expects that countries that have implemented a targeting type reform will have increased pension expenditure and pension generosity with respect to countries that have not. Data was collected from ISSA's country profiles and MISSOC's comparative table.

²² Targeting refers to expansionary pension reforms to benefits for elderly and vulnerable groups. These reforms typically implement flat pension benefits or means-tested pension benefits. This also includes rules that relax pension contribution requirements for these groups. Germany introduced a targeting reform in 2004 that created a minimum income to old age pensioners provision through a means-tested program. In 2008 Korea implemented a targeting-based reform. This supplemented the large number elderly individuals who were excluded from the NPS. The Korean government introduced the basic old age pension that covered 70 percent of the elderly population in 2008. These are non-contributory and means-tested benefits.

4) Recalibration

Recalibration reforms are modifications to the eligibility criteria of pension systems to account for members of society who are not actively participating in the labor market. A specific example of an eligibility criteria adjustment for a pension system would be, credits provided to workers to incentivize their re-entrance into the labor market. Countries benefit from these types of reform because they are an effective means of optimizing labor force participation rates. Previous research has not analyzed the effects of recalibration reforms on pension effort. Data will be sorted into two groups: 1) pension credits to those who cared for a child or an elder, or were attending an educational program; 2) contribution sharing and splitting between spouses in the case of marriage or divorce. This variable (Recalibration) is a singular binary variable that is flagged as 1, when either or both credit programs are provided by a country²³. This study expects that recalibration reforms will increase pension generosity, but the effects on expenditure are policy dependent and the net result will be determined in this model. Data was collected from ISSA's country profiles and MISSOC's comparative table.

²³ Pension credits are provided to individuals for time spent out of the workforce while caring for dependent children or elderly family members. The primary aim is to improve the adequacy of old-age benefits for women whose career interruptions typically lead to fewer contribution years.

2.1.3 Control Variables

This study employs the use of the following control variable sets: socio-economic, institutional, and political factors. The parameters within each set are used as control variables frequently in previous literature (Esping-Andersen, 1999; Steinmo, 1993; Huber & Stephens, 1998; Ebbinghaus, 2011). This study implements the following socio-economic controls: GDP per capita, economic openness, service employment as a percentage of total employment rate, women's labor participation rate, employment rate, fertility rate, and the aged 65+ population rate. The political control variable implemented in this study is government ideology.

1) Socio-Economic Factors

(1) GDP per capita

Industrialism argues that welfare effort is highly associated with increasing GDP (Esping-Andersen, 1999, Bonoli, 2005; Steinmo, 1993; Huber & Stephens, 1998; Ebbinghaus, 2011). Therefore, extending that logic to pension effort, it would also be reasonable to assume that GDP per capita is highly related. There are two possible explanations for this relationship: if GDP per capita increases and pension expenditure remains unchanged, then the relative share of total GDP expenditure must decrease; additionally, the

relative burden of pension contributions decreases due to an increase in expendable capital. This study uses its common logarithm in the analytical model. GDP per capita (USD), is a measure of a country's economic output as a function of a country's total population (Original source is the World Bank national accounts and OECD National Accounts data).

(2) Economic Openness

Economic openness, in political economy, is the degree to which non-domestic transactions (imports and exports) take place and affect the size and growth of a national economy. The degree of openness is measured by the actual size of registered imports and exports within a national economy (Encyclopedia Britannica). This variable, often measured by the Chinn-Ito index, has exacerbated the rise of retrenchment reform policy in contemporary welfare states (Castells, 1996; Swank, 2001). However economic openness is complex, in previous works it has been correlated to both increases and decreases in pension expenditure. The efficiency hypothesis poses a counter argument to the welfare compensation hypothesis. According to the efficiency hypothesis, governments cut back on social expenditure (mainly pension expenditure) and instead focus on increasing their international competitiveness through human capital (Rudra et al., 2000). Different from the efficiency hypothesis, competition in the marketplace also rises, due to

increased exposure to global supply. Countries increase their global competitiveness by cutting costs, where entitlement spending tends to be at the forefront. It is necessary to control economic openness because it has such a large impact on pension policy, and is not driven domestically. Therefore, this study adopted the Chinn-Ito index.

(3) Proportion of Age 65+ Populations

Population aging has raised concerns about pension financial sustainability because much of the support for elderly citizens is provided by public pensions in contemporary society (OECD, 2003). Most countries implemented public pension systems on a PAYG basis, which rely on transfers from younger to older generations. Pension expenditure has become increasingly burdensome because the number of old age population has simultaneously risen with declining birth rates. According to previous studies, the strongest effect on pension expenditure corresponds to increases in the percentage of the aged 65+ populations (Harper, 2014; Pampel & Williamson, 1985, 1989; Tabellini, 2000; Fernández, 2012; TEPE & VANHUYSSE, 2009). The “elderly power” hypothesis also suggests that countries with larger shares of elderly citizens see increases in pension expenditure; since elderly voters are more likely to advocate for expansive pension systems (Sinn & Uebelmesser, 2002; Tepe and Vanhuyse, 2009). Thus, controlling the age of

the population is important. The proportion of aged 65+ population (AGE) data used in this study was collected from the World Bank.

(4) Service Sector Employment Rate

Increased employment in service-based jobs (SERV) creates noise in this study's ability to evaluate pension effort. Most service jobs are atypical in nature, meaning they tend to not follow the 40-hour-work-week (de la Croix, Pierrard, & Sneessens, 2013; Schludi, 2005). There are two consequences to this, atypical work generally disqualifies employees from pensions, and pension revenue declines due to reduced working hours. In the short-term the existing cost of pension systems may be higher than revenues; however, in the future, their disqualification from pension systems may result in lower future expenditures. Since the impact of this trend is unclear, it is the decision of this study to control this variable (Swank, 2001). Data was originally sourced from the World Bank.

(5) Female Labor Participation Rate

Female labor participation rate (WOP) is the proportion of the female population aged 15 and older that is economically active. Prior studies found that increases in the female employment rate are correlated to increases in

pension expenditure (Frericks & Maier, 2008; Tepe & Vanhuyse, 2009). First, female workers are generally employed to a higher degree than men in service-based jobs, and as was previously discussed, this increases the likelihood that they would be a burden on the pension system. Second, female employees experience a much larger degree of job interruptions or reduced working hours due to factors like childbirth and parenting. This means they are more frequently disqualified from employment-based private pension programs and are a larger burden on welfare systems. Data was collected from the World Bank (modeled ILO estimate).

(6) Employment Rate

The employment rate (EMP) is defined as a measure of the available labor that is being utilized; it is calculated as the ratio between the employed to working age population. For all public pension systems, especially for PAYG systems, governments pay benefits to the current population of retirees using the contributions generated from the payroll taxes of those currently employed; therefore, if the employment rate increases faster relative to the retirement rate, more revenue is available to pay for the system (Hairault, Langot, & Sopraseuth, 2010; Wolf, Zohlnhöfer, & Wenzelburger, 2014; Ross, 2000). Meaning the government needs to spend less additional capital to sustain the system. Data was originally sourced from the World Bank.

(7) Total Fertility Rate

Modern demographic changes have significantly burdened pension financial sustainability in two ways: one is an increasingly older population, and the other is a decline in birth rates. Recent literature has empirically analyzed the correlation between fertility and pension expenditure. Some studies found that when fertility rate increased, pension expenditure also increased. This is partly due to the higher cost associated with children; resulting in less available capital that may have been allocated toward a retirement fund (Cremer, Gahvari, & Pestieau, 2011; Fenge & Scheubel, 2017; Fanti & Gori, 2012). However, the relationship between the fertility rate and pension expenditure is extraordinarily complex; this due to a large time delay between the current birth rate and the resulting pension expenditure. Thus far, some studies find that increasing fertility rate may potentially reduce the old-age dependency ratio, and increase the size of the working population. Since pension expenditure is, to a large degree, determined by the size of the old-age dependency ratio, it may be logical initially to assume that an increase in the fertility rate potentially reduces pension expenditure in the long run (Pampel & Williamson, 1985). Therefore, it is hard to make a firm conclusion to what set of parameters drive the relationship between fertility rate and pension expenditure. Fertility rate (TFR) datasets were collected from the World Bank.

2) Political Factors

Recall from chapter two that partisanship and pension effort are closely related to one another. According to existing studies, left-wing parties tend to advocate for generous welfare benefits; whereas right-wing parties prefer market-based policies, founded on trickle-down economics (Huber & Stephens, 2001; Potrafke, 2009; Tepe & Vanhuyse, 2009; Kwon & Pontusson, 2010; Aggarwal & Goodell, 2013; Myles & Pierson, 2003; Keman & Pennings, 2006). Due to the distinct differences between these ideologies and hyper-partisanship, conflicts over management of welfare benefits, particularly pension benefits, create significant legislative friction. This study analyzes data related to pension effort over a 26-year period. In that time, it is expected that control over the reins of power will have potentially changed hands multiple times. When administrations change, between left, right and center parties, welfare policy is vulnerable to potential expansionary or contractionary reform. If the frequency with which power changes hands increases, pension policy could increasingly change along with it. This fluctuation in expansionary and contractionary policy needs to be controlled in order to closely examine the effects of general pension reform. Based on previous work, to control for the effect of government ideology on pension policy change, government ideology (GOV) will be measured as a function of parliamentary seat share. This is categorized into: left-wing parties, right-wing

parties and central parties, based on the Comparative Political Data Set (CPDS). This is a collection of political and institutional country-level data, provided by K. Armingeon. This refers to the relative parliamentary control of power of left, right and center parties, and is weighted by the number of days in office in a given year.

Since the CPDS dataset does not include Korea and China, this study constructs a similar measure for them. Using the CPDS method, measuring relative parliamentary control for Korea is relatively straightforward, because it too has a parliament, the National Assembly (Y. T. Kim, 2014; S. S. Kim, 2013; Lim, 2014). Terms in the National Assembly are four years long, this study uses the time between elections as its unit of time. For example, the election 2012, among the two major parties, the Saenuri Party won 152 seats out of 300, while the Democratic United party won 127. The New Progressives Party won 13 seats and the Liberal Forward Party won 5 seats. Considering their political ideologies, the Saenuri Party and the Liberal Forward Party together will be considered as right-wing parties, the Democratic United party is a central party, and the New Progressives Party is a left-wing party. In some cases, weighting did not account for the entire parliament due to the non-partisan affiliation of some members.

In the case of China, since it is a one-party system, political disposition is examined as a function of the particular political preferences of an

administration. During this period (1987-1992), Deng Xiaoping's ideology of "efficiency first, equality second" informed the Chinese government's attempt to employ trickle-down market strategies to deal with welfare needs and demands (Xia, 2015). Jiang Zemin's (1993-2003) administration also advocated Deng's ideology. However, in the aftermath of economic reform, including the increasing bankruptcy of state-owned enterprises (SOEs) and massive layoffs, new welfare demands emerged. Hu Jintao (2003-2013) recognized these new social needs. In the Communiqué of the Sixth Plenum of the Communist Party of China (CPC) Central Committee, Hu Jintao adopted the "human-centric ideology and resolutions of the CPC Central Committee on major issues regarding the building of a harmonious society." During this period of time, pension reform systems proceeded by re-establishing a variety of pension insurance schemes (Gu, 2001; Xia, 2015). Following the "harmonious society" ideology, the current Xi Jinping administration continued to adopt a "human-centric approach" at the 19th National Congress, saying that "improving people's livelihood and well-being is the primary goal of development." Accordingly, different administrations show changing political ideologies. For comparability, this study codes government ideology in the case of China by different administrations. This study groups the political ideologies of China into two groups, from 1990-2003 the ideologies of Deng Xiaoping, Jiang Zemin are considered right-wing,

due to the nature of their “efficiency first, equality second” beliefs. The “harmonious society” ideology of Hu Jintao, Xi Jinping from 2003-2015 is considered as centrist ideology.

3.1 Methodology

The methodology is conducted in two parts. First, hierarchical clusters and *k*-means cluster analysis are employed to classify pension reform variables into different pension reform clusters. Next, a Linear Mixed-effects Model (LMM) is applied to statistically evaluate the impact that each pension reform cluster has on pension effort.

The first part is to apply an unsupervised²⁴ approach – cluster analysis - to cluster pension reform variables into unique homogeneous groups. The large-scale classification of pension reform data using cluster analysis is substantial for three reasons. First, classifying pension reform variables in this way empowers this study to evaluate whether temporal patterns of enacted reforms trend toward retrenchment, or toward expansionary policy. Second, pension reform is a complex and ambiguous process, for instance

²⁴ Data mining techniques can be broadly divided into supervised and unsupervised methods. Supervised learning methods use data labels (data with defined categories) to predict or classify outputs by employing regression and classification methods. Unsupervised learning is used to classify unlabeled data, and also does not depend on predefined classes and training examples (data without defined categories) (Tibshirani et al, 2001).

Häusermann's pension insurance reform type contains eight sub-variables. How were these sub-variables determined? How were the independent and dependent relationships between reform groups justified? Intuition-based classification is useful for the creation of an initial framework. On the other hand, mathematical classification using a clustering algorithm to systematically partition data provides concretely classified groups that can be used for empirical analysis (Jang & Hendry, 2007). Lastly, pension reform clustering can classify similarities on a country-to-country level. The organizational structure is based on Häusermann's proposed four pension reform types - Insurance, Capitalization, Targeting and Recalibration; the four reform types are comprised of 10 pension reform variables²⁵. Specifically, the Insurance variable set consists of the following seven variables: retirement age (male), pension contribution years, contribution rate, reference years for full benefits, pension indexation, and eligibility of early retirement pension related formulations. Capitalization refers to shifting from PAYG to NDC or shifting from DB to DC. Targeting is represented by a means-tested pension benefit, or increased pension eligibility for vulnerable occupational groups and or the

²⁵ This study generated pension reform clusters using the variables described in section 3.2, they are as follows: male retirement age, required contribution years for full pension benefits, required contribution rate, maximum allowable for early retirement years, early retirement penalty, pension indexation, capitalization, targeting and recalibration.

elderly. Recalibration refers to a pension credit provision, or a provision that increases pension eligibility for short-term unemployed workers.

The second part is to apply a Linear Mixed Effect Model (LMM) to statistically examine how pension reform clusters affect pension expenditure and generosity. To execute the methodology of this study, the structure of the datasets collected need to be understood. Datasets are organized into pooled time-series cross-sectional data structures, using data collected from 15 countries over the period 1990-2015. The datasets in this study contain two main features: a small range of units (15 countries) that are repeatedly observed over a relatively long time period (26 years), and unbalanced panel structured data (missing data). An example of a country with unbalanced panel structured data is Italy where only 23 years of data were available for this study. Cross-sectional panel data has repeated measures (e.g. each year's pension effort) nested within a given country. For instance, the data matrices used in this study are represented by 15 countries ($N=15$) and are observed over a 26-year period ($T=26$); therefore, there are $NT = 390$ observations starting from country i in year t , then country i in year $t+1$, all the way to the last country $i+n$ in the last year of the investigational period $t+n$. Despite its increased observability, time-series cross-sectional data is prone to error. This error arises in two ways: case-based error (heteroskedasticity), and time-based error (autocorrelation). Thus, choosing the appropriate methodology is important.

Prior studies have applied ordinary least squares (OLS) regression or panel-corrected standard errors (PCSE), but they are unable to fully resolve errors of this type; errors are independent of group factors and are evenly distributed within a group (Bates, Mächler, Bolker, & Walker, 2015; Bates, 2007; Faraway, 2016)²⁶. Recent studies have discovered panel-typed data can be effectively analyzed using a mixed effect model since both case-based error and time-based error are included (Fairbrother, 2014). Accordingly, this study applies a linear mixed-effect model that contains both fixed effect and random effect models.

3.1.1 Part One: Pension Reform Classification

²⁶ Early studies commonly applied the ordinary least squares (OLS) method to TSCS data, but both the temporal and the spatial properties of TSCS data make this problematic. TSCS datasets consist of a lot of parameters, therefore analysis using OLS is prone to large error (Beck & Katz, 1995). Owing to the panel structure of TSCS data, the residuals from resulting regression equations violate three major assumptions: 1). Panel heteroscedasticity: the error across cross-sectional units due to characteristics unique to each unit (i.e. each country may have its own error variance); 2). Contemporaneous correlation: the error across cross-sectional units that are correlated to each other due to common shocks in a given period (i.e. errors are correlated across countries in the same year due to common exogenous shocks); 3). Serial correlation: the errors within units that are temporally correlated (i.e. errors are not independent from one time period to the other). To overcome these issues, one option is to use the Panel Corrected Standard Error (PCSE) estimator technique. This improves on OLS standard errors by replacing them with panel-corrected standard errors, but at the same time, it still retains the original OLS parameter estimates (Beck & Katz, 1995). Since the most common cross-sectional issues are heteroscedasticity and contemporaneous correlation, the key motivation for using PCSE is to improve inferences made from TSCS data by considering the complexity of the error process (Ahn, 2002; p62; Beck & Katz, 2011). However, recent studies argue that PCSE changes the estimates of standard errors, but does not change the coefficient point estimates from pooled OLS (Wilson & Butler, 2009; Reed & Webb, 2010). It is to say that this approach does not address any bias that may be present in the pooled OLS coefficient point estimates.

In the first step, pension reform variables are clustered into unique pension reform groups that represent different pension reform policy trajectories. This is done using two methodologies: hierarchical agglomerative clustering, the elbow point, and *K*-means cluster analysis. These methods are widely used in comparative social policy studies because they are effective at identifying welfare state characteristics (Sharkh & Gough, 2010; Powell and Barrientos, 2004; Kammer, Niehues, & Peichl, 2012; Marcinkiewicz & Chybalski, 2019). The comparative social policy of welfare state regimes particularly benefits from classification performed using cluster analysis; suggesting that cluster analysis is the most representative heuristic method of identifying underlying characteristics and exploring similarities and patterns (Gough, 2001; Bambra, 2007; Grimm & Yarnold, 2000; Cramer, 2003; Sharkh & Gough, 2010; Seeleib-Kaiser; 2016). Accordingly, this study employs cluster analysis where pension reforms are grouped into different pension reform clusters. The goal of these unsurprised methods is to identify a reduced number of key independent variables that are necessary to empirically analyze the datasets used in this study (Norusis, 2011). Two clustering steps are necessary because *K*-means clustering heavily relies on an arbitrarily user-defined number of clusters. First, multiple parameters are specified in order to create cluster membership during hierarchical clustering. The goal of hierarchical clustering is to find similar clusters through mathematical

computation (e.g. single, complete and average linkage clustering methods)²⁷. The average linkage clustering method was used in this study because this method can provide more accurate clusters by using an unweighted pair-group method. This method is also not limited in the same way that single and complete linkage clustering methods are, which either use the minimum or maximum distance between cluster elements to designate the hierarchy of clusters (Norušis, 2011). The Average (Between-Group) Linkage Clustering Method used in this study grouped pension reform policies with similar reform characteristics into clusters (Murtagh & Legendre, 2014). Hierarchical clustering (Between-Group Linkage Method) is not a data mining technique that is used for creating a structure within a dataset, rather it is a technique used to determine a number of clusters. Based on the cluster membership generated from hierarchical clustering, the elbow method will then be performed to determine an optimal number of clusters by measuring the WSS (total within-clusters sum of square) and minimizing it. The elbow method generates an elbow or distortion curve, where the x-axis represents the number of clusters and the y-axis represents within-group sum of squares (Arumawadu

²⁷ Single linkage clustering organizes clusters in a bottom-up fashion based on the minimum distance between clusters. This methodology often produces chained clusters (several clusters that are joined together) because of the small distance between clusters with similar elements. Complete linkage clustering references the maximum distance between cluster elements rather than minimum distance. This can solve the chained clusters problem seen in single linkage clustering. Average linkage clustering overcomes the limitations of both single and complete linkage clustering by using an unweighted pair-group method (Norušis, 2011).

et al, 2013). The point where the curve distorts and begins to plateau is generally considered suitable for application since additional clusters do not significantly reduce the total WSS.

The second step, *K*-means cluster analysis, employs these clusters to analyze a desired relationship. *K*-means cluster analysis is responsible for creating a membership structure within the dataset used in this study. This method is a partition-based cluster analysis. A *K*-means clustering algorithm generates a *k* number of initial centroids, then assigns these centroids to the cluster with the closest centroid. These centroids are iteratively calculated and fit until they suitably match the pre-defined cluster centroids (Abdul et al, 2011). The Euclidean distance is used to find distance between the data points and the centroid; the pension reform data points *x* and *y* can be described by the following *K*-means clustering algorithm:

$$d(x_i, y_i) = \sqrt{\sum_{j=1}^d (x_{i1} - y_{j1})^2}, i=1 \dots N; j=1 \dots k$$

Where $d(x_i, y_i)$ is the distance between data point *i* and cluster *j*. Therefore, *K*-means clustering creates a cluster structure within the pension reform dataset used in this study, and then labels these clusters based on their connectivity to different pension reform characteristics. These techniques are used to only cluster data together, their impact on pension effort is unknown.

This study then employed the independent pension reform cluster variables garnered from *K*-means clustering in a Mixed-Effect Model. This is discussed in detail in the second part.

3.1.2 Part Two: Evaluation for Pension Effort - Linear Mixed-effect Model (LMM)

In the second part, a Linear Mixed-effect Model (LMM)²⁸ is used to evaluate how different pension reform clusters, identified using cluster analysis, affect pension expenditure and pension generosity. LMM is widely applied in the field of social science for analysis of longitudinal, panel and cross-sectional data (Peng & Lu, 2012). In recent years, LMM has frequently been employed in comparative welfare state studies because this correlation coefficient matrix allows the inclusion of fixed and random effects while taking the structure of cross-sectional data into account (Peng & Lu, 2012; Matuschek, Kliegl, Vasishth, Baayen, & Bates, 2017; Chen, Saad, Britton, Pine, & Cox, 2013; Chung & Muntaner, 2006; TK Kim & K Zurlo, 2009; Goerres & Prinzen, 2010; Eger & Breznau, 2017). LMM analysis is advantageous because it can accommodate missing and unbalanced panel data

²⁸ A LMM is sometimes also called a multilevel model or a hierarchical model, depending on the context. This is a type of regression model that includes fixed and random effects. Fixed effects are variations that are explained by the independent variables of the study; random effects are variations that are not explained by the independent variables of the study.

(T. K. Kim & Zurlo, 2009; Wooldridge, 2003, 2013; Peng & Lu, 2012; Gałecki & Burzykowski, 2013). One key advantage of LMM is its incorporation of both fixed and random effects that can deal with the issue of unobserved heterogeneity between and within countries. Previous studies emphasized that the stochastic nature of parameters can be incorporated more efficiently with a mixed effect model (Faraway, 2016; Müller et al., 2013). Often it employs a random intercept that varies for each country, but the slopes are fixed across countries. Its notation in matrix form is as follows:

$$Y_i = X_i\beta + Z_ib_i + \varepsilon_i$$

$$i = 1 \dots, m \quad (b_i \sim N(0, \psi); \varepsilon_i \sim N(0, \sigma^2))$$

Where the dependent variable Y_i is an $n \times 1$ column vector; X_i is an $n \times p$ matrix of the covariates whose effect are assumed to be fixed; β is a $p \times 1$ column vector of the fixed effects regression coefficient; Z is a $N \times q$ design matrix for the q random effects; b is $q \times 1$ vector of the random effects ($b_i \sim N(0, \sigma^2)$), ψ is the $q \times q$ covariance matrix for the random effects. In the equation, ε_i is $N \times 1$ column vector of the residuals ($\varepsilon_i \sim N(0, \sigma^2)$). For simplicity Y_i ($Y_i \sim N(X_i\beta, \sigma^2)$) is assumed to be the same as the column vector for the residuals. Accordingly, the LMM's regression is parameterized into models is to divide the mean dividing means the model's regression parameters

into two distinct groups: fixed effects and random effects. The fixed effect parameters are constant over the entire study's observation range, while the random effects are allowed to vary randomly from one country to another across this same observation range. These is an advantage to using a model that considers random effects; one country might consistently be higher or lower than the mean, while the others may be lower or higher due to unobserved factors (Galecki & Burzykowski, 2013). These differences would be reflected in the random effects portion of the model, each country has its own subject-specific mean response trajectory over the observed period. These differences can also be considered when the LMM group fixed and random intercept parameters together, showing that when combined they give an estimated intercept for a set of countries (Equation 1).

$$Y_{ij} = (\gamma_{00} + \mu_{0j}) + \sum B_j CNT + \sum \gamma_{ij} Clusters + \sum \gamma_{ij} control\ variables + \varepsilon_{ij} \quad (\text{Equation 1})$$

The LMM model used in this study is expressed by equations (2) and (3):

$$\begin{aligned} PE_{ij} = & \gamma_{00} + \sum B_j CNT + \sum \gamma_{ij} Clusters \\ & + \beta_{ij} GDP + \beta_{ij} age65 + \beta_{ij} wop + \beta_{ij} open \\ & + \beta_{ij} birth + \beta_{ij} emp + \beta_{ij} ser + \beta_{ij} gov + \varepsilon_{ij} + \mu_{0j} \end{aligned} \quad (\text{Equation 2})$$

$$\begin{aligned}
PG_{ij} = & \gamma_{00} + \sum B_j CNT + \sum \gamma_{ij} Clusters \\
& + \beta_{ij} GDP + \beta_{ij} age65 + \beta_{ij} wop + \beta_{ij} open \\
& + \beta_{ij} birth + \beta_{ij} emp + \beta_{ij} ser + \beta_{ij} gov + \varepsilon_{ij} + \mu_{0j}
\end{aligned}$$

(Equation 3)

Equation (2) and (3) show that PE_{ij} and PG_{ij} refer to the dependent variables pension expenditure and pension generosity in year i year for j country ($i=0, 1, 2, \dots, 26, j=1, 2, 3, \dots, 15$). PE_{ij} and PG_{ij} at year i for country j are represented by the combination of the mean pension effort among all the countries γ_{00} . γ_{ij} *pension reform clusters* represents the fixed-effects and γ_{ij} *control variables* represents the random effects between and within countries. The control variables in this study are represented as $\beta_{ij}GDP$, $\beta_{ij}age65$, $\beta_{ij}wop$, $\beta_{ij}open$, $\beta_{ij}birth$, $\beta_{ij}emp$, $\beta_{ij}ser$, $\beta_{ij}gov$ for each country's GDP(log), percentage of the population that is aged 65+, female labor participation rate, financial openness, total annual birth rate, employment rate, service employment rate, and governmental ideology respectively. $\sum B_j CNT$ represents random effect intercepts and $\beta_j \sim (0, \beta_j^2)$, and $\varepsilon_{ij} \sim N(0, \sigma^2)$ are the assumptions for variance. The LMMs account for countries by estimating the overall intercept B_j and are typically assumed to have a distribution of $\sim N(0, 2)$. The overall intercept can be interpreted as the

mean state-level pension expenditure for a given year. The most straightforward LMM condition is when each country has a randomly determined intercept, which sufficiently accounts for the association between repeated measurements. In general LMM provides a flexible structure for modeling the covariance among repeated observations; these yield valid estimates of regression parameter variance (Wooldridge, 2013; Peng & Lu, 2012; Galecki & Burzykowski, 2013). This study utilizes the program R (R studio toolbox) for this analytical model to identify how pension policy expenditure and generosity are affected by each reform cluster, generated from step one.

Chapter Four: Empirical Analysis

Chapter Four will focus on executing an analytical procedure using the methodology of Chapter Three within the appropriate context laid out in Chapter Two. The results from each section of this analysis will be discussed at the end of each section of this chapter. The main themes that are explored using these analytics are: how diverse groups of pension reforms affect pension policy - with the inclusion of expansionary policy; how previous pension reforms restructured pension sustainability with respect to pension expenditure; and how have previous pension reforms restructured pension generosity with respect to pension replacement rate. All analysis was performed on data collected during the Compound Reform Period (CRP) (1990-2015). Section 1.1 will provide a descriptive analysis that is broken into three subsections: 1) how the characteristics of collected data are used in this study; 2) how the socio-economic and demographic transformations during the CRP have impacted pension expenditure and generosity; 3) how these transformations were reflected in succeeding pension reform policies. Section 2.1 will employ cluster analysis to sort pension reform policies into different reform clusters. This allows for interpretation of how pension reform policies performed differently for each cluster. In parallel with the previous steps, Section 3.1 will explore characteristics of pension reforms for each cluster. By

using a Linear Mixed Effect Model (LMM), Section 4.1 will discuss the LMM used to identify how pension policy expenditure and generosity are affected by each reform cluster.

1.1 Descriptive Analysis

1.1.1 Data

This section outlines the descriptive statistical data used in this study during the CRP (1990-2015). As mentioned in Chapter 3, a total of fifteen countries are covered in this study and the data collected for this study was divided into two groups: macro-socio-economic and pension reform data. Pension reform variables (categorical variables and numeric variables are listed in the table) are the key feature used by this study to examine how pension reforms affected pension effort in the CRP. The macro-socio-economic variables (demographic, economic, and political factors) included in this study, were applied with the intention of increasing the overall study estimation accuracy.

Table 6 provides the descriptive statistics used in this study. To appropriately interpret this table two examples are provided. From the pension reform variable group, the retirement age (male) (the eligibility age for full

retirement benefits) has a mean of 63.3 years old. The minimum retirement age is 57 years old and the maximum age is 67 years old.

From the macro-socio-economic group, the aged 65+ population (the proportion of a country's total population who are 65+ years old) has a mean of 14.91 percent. The minimum and maximum proportion of this group are 5.23 and 26.02 percent, and the standard deviation is 3.78 percent. While there is a variance in the relative proportion of each countries' aged 65+ population, all countries in this study experienced an aging of their population during the CRP.

Table 6. Macro-socio-economic and pension reform variables during the CRP

				<i>Level (%)</i>		<i>Years (N)</i>	
Variable Type		Statistics					
Categorical Variables		N	0 (%)		1 (%)		
Pension Reform Variables (categorical)	Pension Indexation	390	35.9	64.1			
	Capitalization	390	85.9	14.1			
	Targeting	390	87.4	12.6			
	Recalibration	390	87.7	12.3			
Numeric Variables		N	Mean	Std.	Minimum	Maximum	
Pension Effort	Pension expenditure (a percentage of GDP (%))	384	7.6	3.6	0.7	17.1	
	Pension Generosity						
	Gross Pension Replacement Rates (%)	390	58.9	15.2	26.4	95.7	
	Retirement Age, male (years)	390	63.3	2.5	58.0	67.0	
Pension Reform Variables (Numeric)	Contribution Rate	376	16.1	9.0	0.0	33.0	
	Required Contribution for Full Benefits	390	35.6	8.4	15.0	50.0	
	Reference Period (income period sampled in years)	390	29.3	12.6	5.0	50.0	

	Max Allowed Early Retirement (years)	390	3.2	1.8	0.0	7.0
	Early Retirement Penalty (% of total pension benefit per year)	390	3.5	2.8	0.0	9.6
	Aged 65+ Population (% of total)	390	14.9	3.8	5.2	26.0
	Financial Openness (Chinn-Ito index)	378	1.6	1.3	-1.9	2.4
Macro socio-economic variables	Service Sector Labor Participation (% of total)	375	64.9	12.8	18.7	81.5
	GDP per capita	390	29050.7	17251.1	317.9	88415.6
	Political Ideology (% of examination period)	390	L (26.2)	C (2.1)	R (51.3)	M (2.3)

1.1.2 Macro-socio-economic Changes

This section illustrates how macro-socio-economic changes challenged pension systems during the CRP (1990-2015). Despite differently inherited institutional set-ups for each pension system, within macro-socio-economic, aging population along with labor market transformations are the most common factors that challenge the financial sustainability of pension systems.

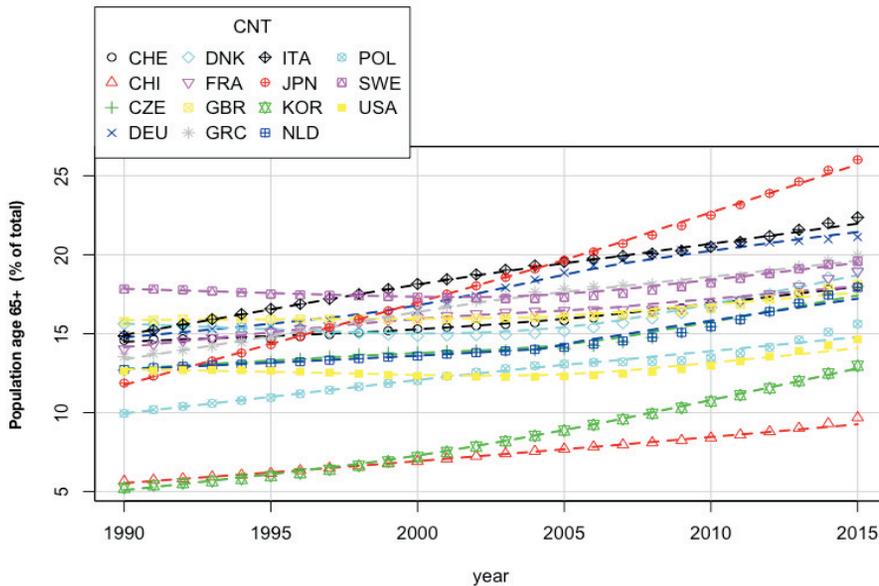


Figure 4. The percentage of the aged 65+ population by country between the years 1990 and 2015. In every country the percentage of the population of this demographic has increased over the CRP.

In figure 4 the age 65+ population has continued to exponentially increase throughout the CRP. In this study, China has the least aged population and Japan has the most aged population. For China, while its population is currently less aged, China has undergone unprecedented demographic changes over the period of this study. In Japan, the percentage of the population aged 65+ increased from 11.9 percent in 1990 to 26 percent in 2015. An aging population is fueled by two significant factors: low fertility rate and increasing life expectancy (details in appendix 2, fertility rate and life expectancy - life expectancy from age 60). Consequently, pension reforms are then affected in two ways: a reduction in the number of individuals contributing to the system,

and an increased number of individuals depending on pension systems for longer periods of time. Macro-socio-economic transformations are another form of change challenging pension system financial sustainability. Three indicators discussed here are GDP growth per capita, service sector labor participation rates, and globalization. In figure 5 (a), toward the end of this study, GDP per capita had begun to slow down in most countries studied: particularly, Japan, Sweden, and Italy. Such an economic slowdown has enlarged the gap between pension revenues and pension benefits (Schludi, 2005; Häusermann, 2010). In figure 5 (b), all countries at the beginning of this study experienced high rates of service employment, but, in the relative context, these numbers continued to climb through 2015. Service sector employees and atypical workers tend to have high job insecurity and, at the same time, tend to become dependent on public pension programs. Job insecurity prevents these workers from adequately contributing to public pension systems for long, consistent periods of time; while job type prevents these workers from qualifying for public pension systems (Häusermann, 2012). Ultimately not only are service sector and atypical workers affected by the pitfalls of inherited pension systems, but so are the beneficiaries of the greater system as a whole. Similar to the challenge of population aging, an increase to service and atypical working populations reduces the number of effective contributors to public pension systems.

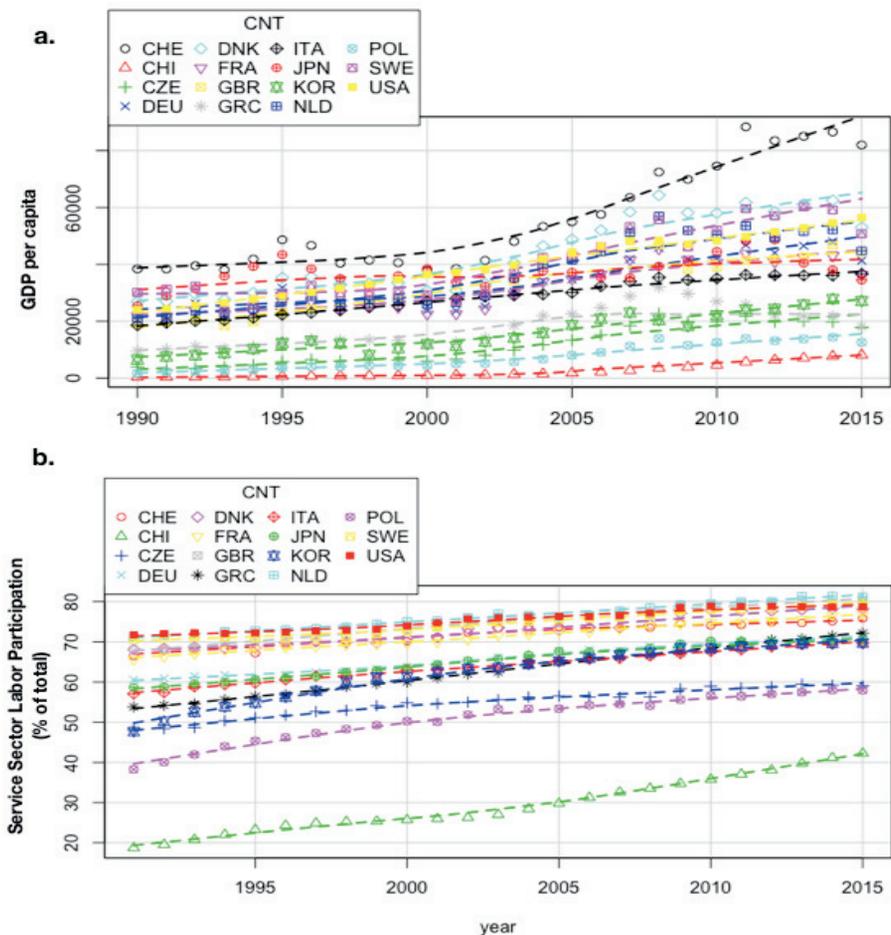


Figure 5. (a) GDP growth per capita during the CRP (1990 - 2015). (b) Service sector employment rate as a percent of the total population during the CRP (1990 - 2015).

As economic openness increases, aka increasing globalization, competition in the marketplace also rises, due to increased exposure to global supply. Industries, particularly manufacturing sectors, tend to increase their global competitiveness by cutting costs through shifts to cheaper sources of labor, thus resulting in at-home labor transitions to other sectors, particularly service and atypical work.

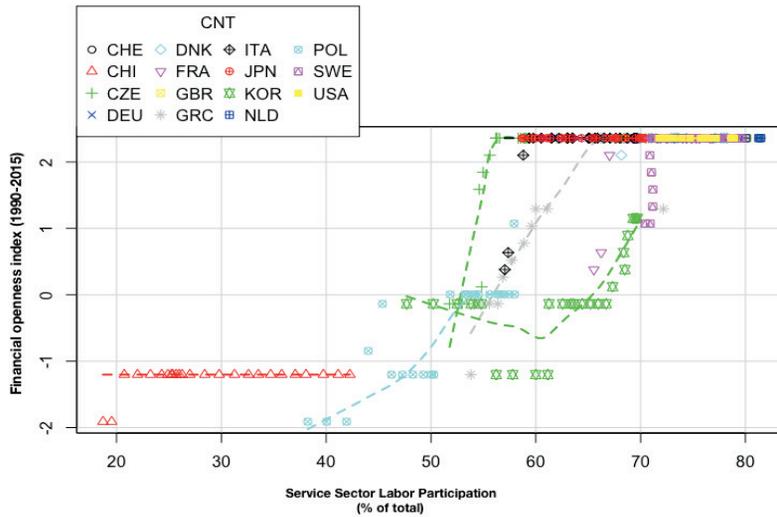


Figure 6. The percentage of service sector labor participation and financial openness by country between the years 1990 and 2015.

As previously mentioned, strains to entitlement programs and cuts to spending tend to be at the forefront of pension policy discussions (‘efficiency’ theory). Some prior studies argued that governments may increase welfare spending in response to increasing globalization (‘compensation’ theory) (Swank & Steinmo, 2002; Burgoon, 2001; Mares, 2004, 2005). The exogenous influential factor economic openness, defined as the Chinn-Ito index, shows a relationship between economic openness and service sector labor participation rates, as shown in figure 6. The following section will briefly illustrate how pension expenditure and pension generosity have changed during the CRP.

1.1.3 Tendencies of Pension Expenditure and Pension Generosity

This section provides a descriptive overview of how pension effort (pension expenditure and pension generosity) changed for 15 countries over a 26-year period during the CRP (1990-2015). Since the 1990s, the post-industrialization of developed economies has been primarily characterized by the aging of their populations, economic slowdowns, globalization, and an increased proportion of service sector employment. These are also known as new social risks and socio-economic changes. These new social risks and socio-economic changes have resulted in an increase in pension expenditure. Pension reform seeks to rebalance and maintain pension sustainability and their implementation has accelerated since 1990 (Pierson, 1999; OECD, 2017).

(1). Pension expenditure

Figure 7 provides a pension expenditure timeline between 1990 and 2015 for the 15 countries examined in this study; these are provided in 5 yearly snapshots in Table 7.

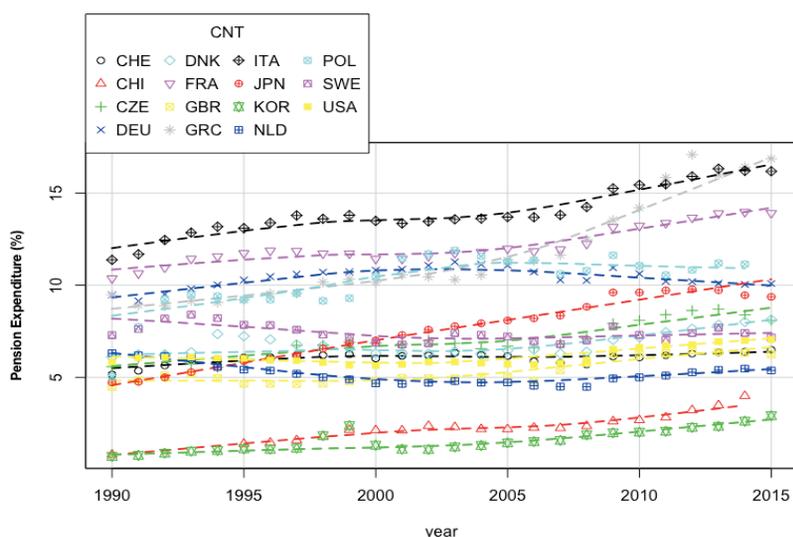


Figure 7. Pension expenditure timeline during the CRP from 1990 to 2015

Table 7. Average annual change of pension expenditure as a proportion of total GDP during the CRP (1990 to 2015).

Countries	Level (% of GDP)				Average Annual Change (%)	
	2000	2005	2010	2015	2000-2005	2010-2015
CHI	2.132	2.185	2.679	3.990	0.005	0.083
CZE	6.863	6.690	8.092	8.084	-0.005	0.000
DNK	6.307	6.456	7.162	8.130	0.005	0.026
FRA	11.430	11.980	13.222	13.909	0.009	0.010
DEU	10.813	11.080	10.619	10.084	0.005	-0.010
GRC	10.153	11.360	14.198	16.865	0.023	0.035
ITA	13.489	13.701	15.441	16.183	0.003	0.009
JPN	7.002	8.084	9.605	9.369	0.029	-0.005
KOR	1.314	1.440	2.027	2.915	0.018	0.075
NLD	4.673	4.722	4.997	5.372	0.002	0.015
POL	10.471	11.275	11.054	NA	0.015	NA
SWE	6.886	7.218	7.306	7.168	0.009	-0.004
CHE	6.023	6.152	6.080	6.486	0.004	0.013
UK	4.799	5.047	5.047	6.238	0.010	0.043
USA	5.635	5.716	6.625	7.053	0.003	0.013
Average	7.199	7.540	8.277	8.123	0.009	-0.046

For example, pension spending in Sweden (7.3 percent in 1990 to 7.7 percent in 2015), Denmark (6.3 percent in 1990 to 8.1 percent in 2015), Japan (7.0 percent in 1990 to 9.4 percent in 2015), the UK (4.8 percent in 1990 to 6.2 percent in 2015) and the US (5.6 percent in 1990 to 7.1 percent in 2015) have a decreasing pension expenditure trend. In particular, Japan has shown a decreasing trajectory of pension expenditure even though it has the most aged population. In the case of Sweden, in order to curb pension expenditure, pension reform aimed to link earnings and benefits to the labor market distortions between 1994 and 1998 by shifting from a DB to NDC system; they also implemented restrictions on early retirement (Toft, 2008). Germany and the Netherlands also follow this trend. This data is useful for providing an initial look at how different countries presumably have responded to the new social risks and socio-economic changes that have emerged in the CRP. As will be examined in more detail later in this chapter, each country has had a unique response.

(2). Pension Generosity

Figure 8 provides a pension generosity timeline between 1990 and 2015 for the 15 countries examined in this study; these are provided in 5 yearly snapshots in Table 8.

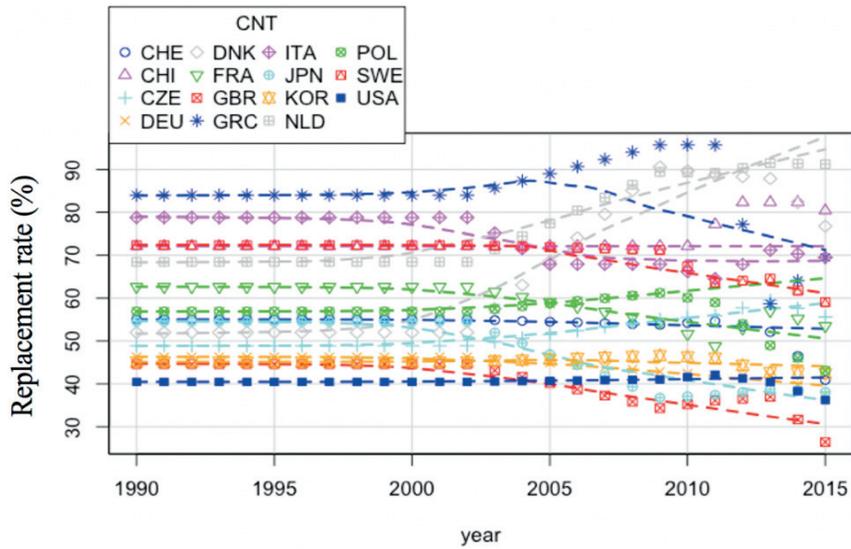


Figure 8. male income replacement rate, as a measurement of pension generosity during the CRP (1990 to 2015).

As figure 8 illustrates, the replacement rate has dramatically decreased in a number of countries. In the UK, Japan, Italy, Germany and Sweden the replacement rate dramatically decreased. This may indicate a country's response to macro-socio-economic transformations, through a scaling down of their replacement rate.

Table 8. The average annual change of pension generosity during the CRP (1990 to 2015). This data is reported as the average annual income replacement rate (male only)

Countries	Level (%)				Average Annual Change (%)	
	2000	2005	2010	2015	2000-2005	2010-2015
CHI	72.1	72.1	72.1	80.4	0.00	-0.02
CZE	48.9	51.5	55.5	55.7	-0.01	0.00
DNK	52	68.5	89.7	76.8	-0.05	0.03
FRA	62.6	59.1	51.6	53.5	0.01	-0.01
DEU	46.3	44.8	42.4	37.5	0.01	0.02
GRC	84	89	95.7	69.5	-0.01	0.07
ITA	78.8	67.9	66.2	69.5	0.03	-0.01
JPN	54.5	46.9	37.1	38.1	0.03	-0.01
KOR	45.1	45.7	46.3	42.4	0.00	0.02
NLD	68.4	74.4	89.3	91.3	-0.02	0.00
POL	56.9	58.7	60.1	43.1	-0.01	0.07
SWE	72.4	71.9	63.6	59.1	0.00	0.01
CHE	55.1	54.5	54.2	40.9	0.00	0.06
UK	44.6	40.2	35.2	26.4	0.02	0.06
USA	40.5	40.7	41.6	36.2	0.00	0.03
Average	58.8	59.1	60.0	54.7	0.00	0.02

From table 8, countries like the UK and Italy have decreased their average replacement rates by nearly 20 percent over this period of time. Countries like China, Poland, and the Czech Republic have maintained their level of replacement during the same period. Each countries' response to changes and whether or not that response has been effective at curtailing expenditure and maintaining a sustainable amount of generosity remains to be seen. Therefore, two questions must be answered. How has pension reform affected pension expenditure and pension generosity, from both a short-term

and a mid-term timeframe? Were these reforms effective at curtailing pension expenditure and pension generosity?

1.1.4 Pension Reform across Countries from 1990 to 2015

The previous section introduced the general socio-economic factors that have influenced the pension reforms of the 15 countries examined in this study during the CRP. From chapter three, pension reform variables are used in this section to explore different reforms in relation to retrenchment and expansionary policy. Countries have uniquely reformed their inherited pension systems by modifying some of the following variables: insurance (retirement age, contribution rate and years, pension calculation reference years, pension indexation, early retirement accessibility), capitalization, targeting, and recalibration.

(1). Retirement Age

Increases to retirement age²⁹ are a popular method of reform that have been adopted in almost all countries. The minimum retirement age in 1990

²⁹ Retirement age is defined as the official age that a man or woman can retire and receive full pension benefits. This also equates to the pensionable age: “Pensionable age is defined as the age that an individual may first withdraw full benefits (i.e. without benefit penalties)” (OECD, 2011, p 20.).

was 58 for men and 55 for women, in 2015 this had increased to 61 for both men and women. This excludes Sweden (retirement age of 65) and China (retirement age of 60), the two countries that did not reform their retirement ages. Initially inherited pension systems were primarily designed with a minimum retirement age of 60 years old. At the time of their inception, the life-expectancy among the countries in this study was approximately 65 years old (1950's); compared with the life expectancy of 2015, which is approximately 78. The amount of time post-retirement has increased by more than 10 years. This increase in life-expectancy is the first reason why many countries have moved to increase the required age to retire. Additionally, many of these countries have pension systems designed around defined benefits and PAYG, where pension benefits are funded by currently active workers' contributions. Therefore, the aging of the world's population and a shift from industrial to post-industrialization are challenging these systems' ability to fund a population that is increasingly living longer with this original retirement age requirement. The point of increasing the retirement age is to increase the proportion of the population that is actively working and making contributions to sustain these systems.

Table 9. The Retirement age in the CRP (1990 to 2015), along with its change over this 26-year period.

Countries	Years (N)					
	1990		2015		Changes (1990-2015)	
	Male	Female	Male	Female	Male	Female
CHI	60	55	60	55	0	0
CZE	60	59	63.2	62	3.2	3
DNK	67	65	65	65	-2	0
FRA	60	60	63	63	3	3
DEU	63	60	65.4	65.4	2.4	5.4
GRC	58	58	67	67	9	9
ITA	57	55	65.3	62.3	8.5	7.3
JPN³⁰	60	56	65	60	5	4
KOR	60	60	61	61	1	1
NLD	65	65	65.3	65.3	0.3	0.3
POL	65	60	66.2	61.2	1.2	1.2
SWE	65	65	65	65	0	0
CHE	65	63	65	65	0	2
UK	65	60	65	65	0	5
USA	65	65	66	65	1	0
Average	62.3	60.9	64.2	63.1	2.2	2.3

Table 9 shows an increasing trend in the required retirement age to receive benefits. As life-expectancy continues to increase and birth rates continue to decline, it can be expected that this trend may accelerate in the near future as countries attempt to respond. For instance, Greece increased their required retirement age for both men and women from 58 to 67 years old, as a result, Greece now has the highest retirement age among the countries in

³⁰ In Japan, demographic transitions (a severely low fertility rate and increasingly aging population) were recognized in the early 1990s. Raising the retirement age became a pension policy reform priority since Japan's standard retirement age was lower than other developed countries. Japan was facing compressed demographic aging due to particularly low birthrate and increasing life expectancy; retirement age will continue to increase beyond 65 from 2018 to 2025 and 2030 for both men and women.

this study. In only one country was the retirement age decreased. Denmark, as a counterbalancing measure to the population of people who retire early, reduced the required retirement age for full benefits from 67 to 65 years old. However, at the same time, the early retirement age was gradually increased from 60 to 65 years old effectively phasing out early retirement. Among these countries, from 1990 to 2015, the average retirement age has increased by 2.2 years for men and 2.3 years for women.

(2). Insurance: Contribution Period

Increasing the retirement age delays the date when pensioners may withdraw benefits, and enlarges the number of contributors. While this is one way to reform the cost of a pension system, enhancing the required contribution period is another way to also reform pension expenses. The initially designed contribution period balanced a specified period of retirement with a specified period of years working in the labor force. However, since most pension systems provide benefits for life, if the life-expectancy of a typical worker increases, but the amount of time they spend contributing to the system remains static, the cost-benefit balance is disrupted. Reforming the required contribution period rebalances the cost-benefit relationship by requiring a longer contribution period to receive full benefits.

From table 10, there is fairly uniform growth among most countries'

required contribution period during the CRP. The average contribution period grew from 33.4 years in 1990 to 38 years by 2015. Greece, reformed their required contribution period from 35 years to 45 years; France, from 37.5 years in 1990 to 41 years by 2015. Note, some countries require workers to contribute to their system until the required retirement age; these particular systems emphasize contribution over the entire working life of a “typical” worker. Denmark is a unique case³¹; their contribution period is structured on a residence and PAYG basis. Workers must reside and work for 40 years (originally 25 years) within Denmark between the ages of 15 and 65. If the requirement is not fully met, benefits are scaled to the number of residency years. The residency requirement forces workers to not only contribute to the Denmark government through income taxes, but through other tax revenues associated with residency (i.e. sales tax, property tax, etc.). The intention of this reform was to encourage people to work for a longer period of time before retiring.

³¹ Denmark and the UK’s contribution period are unique coding cases. The aim of residential period and or a domestic working period is to condition full pension benefits and early retirement. For instance, Denmark scales the allowable year someone may retire early to the number of years they work. Data is collected from OECD, and combined with ISSA data to reflect reform implementation for each country.

Table 10. The required contribution period (in years) for the years 1990 and 2015. The difference between these two years is calculated in the far-right column.

Countries	Years (N)		
	1990	2015	1990-2015 changes
CHI ³²	15	15	0
CZE	25	31	6
DNK	25	40	15
FRA	37.5	41	3.5
DEU	45	45	0
GRC	35	45	10
ITA	37	42.6	5.6
JPN ³³	35	40	5
KOR	40	40 ³⁴	0
NLD	45	50	5
POL	25	25	0
SWE	30	30	0
CHE	42	45	3
UK	29	45	16
USA	35	35	0
Average	33.4	38.0	4.6

(3). Insurance: Contribution Rate

Contribution rate refers to the proportion of an individual's income tax that is used to contribute toward the cost of retirement benefits. Often, this

³² For China the contribution period to qualify for minimum benefits is coded as 15 years, for full benefits an individual must contribute for 35 years. The reference period is based on a full contribution period, 35 years. The data was collected from the ISSA.

³³ For Japan the contribution period to qualify for minimum pension benefits is 25 years, for full benefits an individual must contribute for 40 years. Originally the contribution requirement for full benefits was 35 years until the program was reformed. This data was collected from the ISSA.

³⁴ Data is collected from the ISSA and OECD (Pension at a Glance) for each country. For coding consistence, reference years were logged according to required contribution period to qualify for full pension benefits.

contribution rate is shared between employees and their employers. In the case of countries with high benefits but low required contribution rates, reforms that increase this rate, pass the increasing costs onto contributors³⁵. This is in part due to macro-socio-economic changes and the rise of new social risks. On the right-hand side of table 10 is a column that provides the contribution rate change from 1990 to 2015. It shows that, contribution rate has remained broadly stable in most countries, except for Korea and Italy where there was a sharp increase (OECD, 2011). The left two columns of this table report the total contribution rate for the years 1990 and 2015 respectively. Reforms to contribution rates have been implemented in a variety of ways. In the case of both Japan and Germany, policies that applied an annual fixed increase to modify contribution rates were used. This mechanism applied smaller increases over a broader period of time to mitigate immediate impacts on contributors. For Japan, the contribution rate increased on average 0.36 percent every year beginning in 2004, from 13.6 percent to 17.8 percent of an individual's income tax in 2015. In other cases, countries applied, relatively,

³⁵ Often, this contribution rate is shared between employees and their employers. For Japan, the contribution rate increased on average 0.354 percent every year beginning in 2004, from 13.6 percent to 17.8 percent of an individual's income tax by 2015. In the case of Korea, the contribution rate increased from six to nine percent for both employers and employees after reform. However, before reform, self-employed individuals contributed only three percent. This was then increased to nine percent in 2008. This study didn't consider this difference, but rather coded it as six percent - the same as standard employees. In the case of the UK and Denmark this study coded their contribution rates as zero percent, according to the OECD and ISSA. Other sources that would have properly reported this information were not used because of the desire on behalf of this study to maintain a consistent source of data.

radical increases to their contribution rates; in Korea this was a 50% increase from six percent to nine percent in 2005.

Table 11. Pension contribution rate changes during the CRP (1990 to 2015).

Countries	1990	2015	1990-2015 changes
CHI	NA.	28	NA.
CZE	26.9	28	1.1
DNK	0	0	0
FRA	21.5	16.9	-4.6
DEU	18.7	18.7	0
GRC	20	20	0
ITA	28.3	33	4.7
JPN	16.5	17.8	1.3
KOR	6.0	9.0	3.0
NLD	18.3	17.9	-0.4
POL	NA	19.3	NA
SWE	18.5	18.5	0
CHE	8.4	8.4	0
UK	0	0	0
USA	12.4	12.4	0

(4). Insurance: Reference Period

Reference period is the assessment period used to calculate received benefits. For most countries, this reference period was initially defined as the highest paid 5 years of income³⁶.

³⁶ Reference period is the assessment period used to calculate received benefits. For most countries, this reference period was initially defined as the highest paid five years of income. The consequence of higher life-expectancy is a longer period of benefits paid. For most workers, the shorter the reference period is, the higher the effective yearly benefits will be.

Table 12. The reference period (in years) for the years 1990 and 2015. The difference Between these two years is calculated in the far-right column.

Countries	Years (N)	
	1990	2015
CHI ³⁷	LT (15)	LT (35)
CZE	B25	LT (30)
DNK	B25	LT (40)
FRA	B5	B25
DEU	LT (45)	LT (45)
GRC	B10	LT (10)
ITA	B5	LT (45.6)
JPN	LT (35)	LT (40)
KOR	B20	B20 ³⁸
NLD	LT (45)	LT (50)
POL	LT (25)	LT (25)
SWE	B15	LT (30)
CHE	LT (42)	LT (45)
UK	LT (29)	LT (45)
USA	B35	B35

Note:

LF - lifetime career. The standard definition is used for lifetime career is the length of individual's career based on the standard retirement age, and differs from country to country. *B* - reference period defined as the number of highest-earned years of income during an individual's career.

Therefore, countries can reform the sustainability of their systems through increasing the reference period used when calculating benefits, effectively reducing their value. For some cases this was reformed to the highest paid 20 years, and in other cases a worker's entire working period is used in this assessment.

³⁷ For China the contribution period to qualify for minimum benefits is coded as 15 years, for full benefits an individual must contribute for 35 years. The reference period is based on a full contribution period, 35 years. This data was collected from the ISSA. Since the 1990s, Chinese pension systems were fragmented based on province, therefore reference years are not perfectly contiguous across the nation. To simplify this feature, this study homogenized reference years across China and coded it as 15 years for minimum benefits, and 35 years for full benefits. This assumption is applicable because China implemented NDC reforms in the late 1990s reducing system fragmentation.

³⁸ For Korea the contribution period to qualify for minimum benefits is coded as 10 years, for full benefits an individual must contribute for 20 years. The reference period is based on a full contribution period, 20 years. This data was collected from the ISSA and the OECD.

LT - reference period is defined as the number of years of an individual's career, before retirement, that are used when calculating their representative earned income.

Source, ISSA 1995-2015: country profile; OECD 2007; 2017: Pension at a Glance

The consequence of higher life-expectancy is a longer period of benefits paid. For most workers, the shorter the reference period is, the higher the effective yearly benefits will be. Therefore, countries can reform the sustainability of their systems through increasing the reference period used when calculating benefits, effectively reducing their value. For some cases this was reformed to the highest paid 20 years, and in other cases a worker's entire working period is used in this assessment. In 1990, five countries (Germany, Japan, Poland, Switzerland, and the UK) defined their reference period using a worker's entire career. By 2015, this number had jumped to 12 countries. However, France, Korea, and Greece defined their reference periods based on a fixed period of highest paid earnings (see table 12).

(5). Insurance: Early Retirement and Early Retirement Penalties

Early retirement was designed to alleviate unemployment³⁹ primarily among workers in their prime working age by encouraging older workers to

³⁹ Before 1972, there was no social security early retirement age, but later Germany legislated an early retirement policy. For men the age was 62 and women the age was 60 years old. However, there was no early retirement penalty.

retire sooner. However, as was previously discussed, with life-expectancy increasing and birth rates on the decline, early retirement policies have become out-of-step with the economies of the CRP. Early retirement policy reforms have been a popular method of reform. As table 13 details, the early retirement age, indicated by the allowable number of years before the required retirement age, has changed between 1990 and 2015. Additionally, the penalty for retiring early has also changed over this period.

Table 13. The maximum number of allowable years before the required retirement age that a worker may retire, and its corresponding retirement penalty.

Countries	Years (N)		Penalty Level (%)	
	1990	2015	1990	2015
CHI	5	5	0	0
CZE	3	3	2.4	5.6
DNK	7	0	9.6	0
FRA	3	2	5.0	5.0
DEU	3	2	3.6	3.6
GRC	3	3	0	0.7
ITA	3	2	0	1.0
JPN	5	4	6.0	6.0
KOR⁴⁰	5	4	5.0	6.0

⁴⁰ This variable measures the number of allowable years before the “standard” retirement age that a person may retire for a given country. For instance, in the case of Czech Republic, the standard retirement age was 60 in 1990 and was gradually raised to 63.2 by 2015. Originally the maximum number of allowable years an individual could retire before the standard retirement age was five, but was reduced to three years during the CRP. The penalty for early retirement is different per year. If an individual qualifies with 35 years of contributions, the early retirement penalty is 0.9 percent for every 90 days of the first 360 days of early retirement, 1.2 percent for each 90 days between 361 and 720 days, and 1.5 percent for each 90 days thereafter. This study only considers workers that have made life-long contributions, retire as early as allowed, and then averages the yearly early retirement penalty. According to the OECD and ISSA datasets, this was 2.4 percent per year in 1990, and increased to 5.6 percent per year by 2015. In the case of Denmark, the early retirement age gradually decreased, and was abolished by 2015. The maximum number of allowable years an individual could

NLD	5	0	0	0
POL	5	0	5.5	0
SWE	4	4	4.3	4.3
CHE	3	3	6.8	6.8
UK	0	0	0	0
USA	3	3	3.6	6.7

The maximum allowed early retirement age gradually decreased in almost all countries, with a few exceptions where the policy remained unchanged. In Denmark, the maximum early retirement age was 7 years in 1990, but by 2015 it had been completely phased out. Among all countries the maximum observed early retirement age was 7 years in 1990, but since has changed to 5 years in 2015.

In parallel with an observable decrease in the early retirement age, an early retirement penalty – a reduction to benefits if a worker retires before the required retirement age - has been enacted in most countries. In the U.S. the early retirement penalty increased from 3.6 percent per year of early retirement

retire before the standard retirement age was seven years, and was phased out by 2015. A penalty was phased in based on birth year, with a total average penalty for all individuals of 9.6 percent per year. For Korea, the maximum allowed number of years an individual may retire was five years before the standard retirement age. The early retirement penalty was five percent per year from 1988 to 2007. The penalty rate was increased from five percent to 6 percent per year. However, penalties were phased-in according to the maximum and the minimum retirement year. This study used Korea's first year penalty rate of 6 percent per year based on ISSA data. (Note: this study referenced data from ISSA. According to the Korean early retirement penalty reform laws implemented in 1998 and 2007, a penalty was phased in based on the number of early retirement years. This actual per year penalty is then calculated using a base penalty rate, and is then multiplied by the number of years an individual retired early. For example, if an individual retires early by one year, the early retirement penalty is 6 percent, 12 percent for two years, and 18 percent for three years (NPS, 2008).

to 6.7 percent. Some countries choose to both reform their early retirement age and associated penalty. Korea decreased their early retirement age from 5 to 4 years, and also increased their early retirement penalty from 5 percent to 6 percent per for each year of early retirement.

(6). Insurance: Pension Indexation

Pension indexation is the method of adjusting pension benefits to account for changes in the cost of living (e.g. prices and/or earnings). Over the past 25 years, countries have reformed their pension benefits indexation method from indexing based on wages (wage indexation) to the Consumer Price Index (CPI)⁴¹ (CPI indexation). This is because wages tend to grow faster

⁴¹ Since the growth of CPI is slower than average wage growth, countries have changed pension indexation from wage-based to CPI-based indexation. A shift from wage to CPI-based indexation may significantly reduce pension effort. Since the growth of CPI is slower than average wage growth, countries have changed pension indexation from wage-based to CPI-based indexation. For instance, in the case of Japan, wages are expected to grow faster than the CPI by one percent annually. Accordingly, a shift from wage to CPI-based indexation may significantly reduce pension effort. Japan passed a law that shifted wage-based indexation to CPI-based indexation in April of 2000. However, some countries chose a mixed model indexing benefits based on both wages and CPI. For mixed systems, this study coded this indicator according to each country's political trends in order to choose which indexation is more heavily weighted. Switzerland uses a mixed model with a 50/50 distribution, but based on recent policy trends this study considers Switzerland as a wage indexation weighted country for data purposes. The Czech Republic adopted a 33 percent wage and 67 percent CPI-based indexations. The UK is unique, they imposed a triple indexation pension benefits rule (highest of CPI inflation, average earnings growth, or a 2.5% underpin). The government has the discretion to change their method of indexation, however triple indexation is not enshrined in law. This study treats the UK as a CPI-based indexing country, since the political trend has shifted toward less generous indexing options (Whitehouse, 2009). For instance, since 2011, state pensions need to be updated annually in line with CPI.

than CPI (Hohnerlein, 2019; Bonoli, 2012). In the more recent half of the CRP, modifications to pension indexation from wages to CPI increased in popularity in part because of the global economic recession of 2007-08. Table 14 provides a contrast of pension benefit indexation methods for each country in this study between the years 1990 and 2015.

Table 14. The pension indexation methodology of each country in the years 1990 and 2015.

Countries	1990	2015
CHI	prices +wages	prices +wages
CZE	CPI +wages	CPI (67%) +wages
DNK	wages	wages
FRA	wages	CPI
DEU	wages	wages
GRC	CPI +wages	CPI +wages
ITA	wages	CPI
JPN	Wages	CPI
KOR	CPI	CPI
NLD	wages	wages
POL	wages	CPI +wages
SWE	CPI	CPI
CHE	CPI +wages	CPI (*) +wages
UK	CPI	CPI
USA	CPI	CPI

Note: CPI, Consumer Price Index

Source, ISSA 1995-2015: country profile; OECD 2007; 2015: Pension at a Glance, Garone (2016)

Italy, France, and Japan all have changed their indexation method from wage indexation to CPI indexation (Italy in 1992, France in 1993, Japan in

2001). Some countries like the Czech Republic, have chosen a combination of price and wage indexation instead, but have given more weight to CPI indexation (OECD, 2017). The Czech Republic adopted a 33% wage and 67% CPI-based indexation combination. China also indexes their benefits based on a mix of wages and CPI, using a balance of 40% and 60% (OECD, 2009; Vleminckx, 2015). In 2015, wage indexation could only be found in Denmark, Germany and the Netherlands.

(7). Capitalization

Capitalization is defined as a pension reform that shifts public pension systems to combination systems where public pensions are supplemented by private programs. Common examples of capitalization reforms include: the transition from PAYG to DC or NDC, the addition of a mandatory funded system, or the establishment of incentives (e.g. tax deductions) for enrolling into a pre-funded pension or individual savings programs. Due to financial challenges that have endangered the solvency of public pension systems, reform policies enacted during the CRP have been primarily contractionary in nature. To supplement the loss of generosity for these systems, governments have used capitalization techniques to mitigate the financial burden placed on retirees. Most countries, typically when introducing Capitalization reforms,

mandatory or quasi-mandatory contributions to funded occupation or private pension systems. Countries like the Netherlands and Switzerland in this study legislated reforms of this type. Finally, some countries instead try to incentivize participation in reform programs by establishing incentives (e.g. tax deductions) for enrolling into a pre-refunded pension or individual savings programs. Three countries, Korea, France, and Greece, have introduced voluntary occupational pensions.

(8). Targeting

As mentioned in Chapter 2 (1.5), Häusermann defines targeting as reforms that address issues with benefit eligibility for the elderly or vulnerable occupational groups. This is executed by loosening the direct association between a specific individual's contributions and benefits. Some examples of this reform type are means-tested pension benefits or additional insurance conditions for atypical workers whose income is low enough to make them ineligible for coverage (Häusermann, 2010).

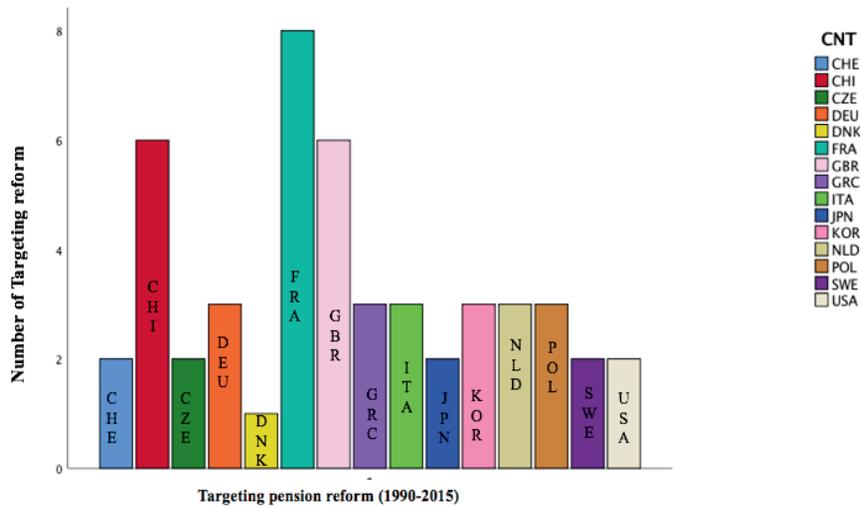


Figure 10. Targeting pension reforms from 1990 to 2015.

During this period, targeting reforms were implemented in many countries (Figure 10). For instance, the Czech Republic, France, Korea, Greece, and Sweden have established a means-tested pension or increased benefits to prevent old age poverty and protect low-income working populations. In Germany, the government also established basic security benefits in order to reduce poverty among those aged 65+ (ISSA, 2003).

(9). Recalibration

Häusermann defines recalibration as modification to the eligibility criteria of pension systems, to account for members of society who are not actively participating in the labor force. For instance, pension credits toward pension eligibility may be provided to workers in exchange for their re-

entrance into the market⁴². This type of pension measure has been enacted more in Germany and France relative to other countries (Figure 11).

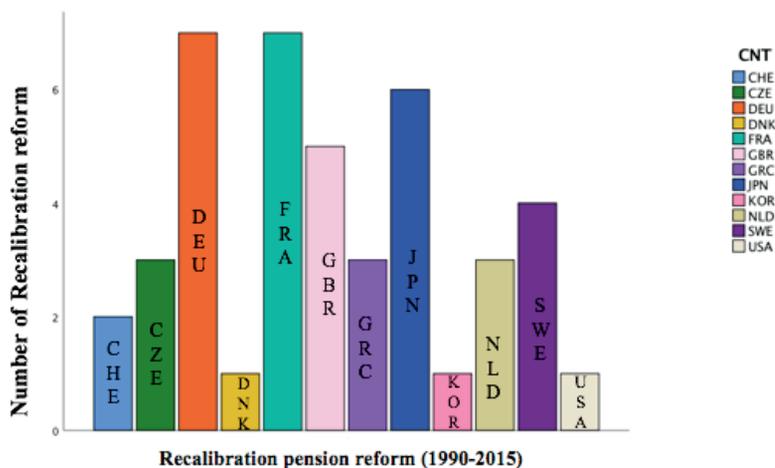


Figure 11. Recalibration pension reforms from 1990 to 2015.

For Sweden, where female labor participation is relatively high, a guaranteed pension is available for those aged 65+ and with 40+ years of

⁴² Under Germany's pension credit program (Kindererziehungszeiten), the parent who is "mostly" responsible for childcare receives the equivalent of one pension point per year for the first three years of his or her child's life. The credit is provided for children born after December 31, 1991, and is typically awarded to the mother; however, a father may also receive the credit upon written request to the German statutory pension insurance scheme (Deutsche Rentenversicherung Bund, or DRV-Bund). (Parents of children born from 1986—when the caregiver credit program was created—to December 31, 1991, receive credits for only the first year of their child's life.) In addition, a 2001 pension reform law established additional credits—equal to one-half of the pension points a parent receives as a result of his or her work contributions, up to a maximum (own pension points plus bonus credit) of one pension point per year—for parents who continue to work while raising a child aged 3–10. The credits provide an incentive for parents to return to work after providing childcare. (The law also provides parents who leave the labor force entirely to provide care for two or more children—one of which is younger than age 10—with an additional one-third of a pension point.)

residence in the country (A. Diamond, 2009). Thus, recalibrations, such as providing contribution credits or accounting for non-contributions, are less relevant. In contrast, Germany's pension has been challenged by intense post-industrialization. Germany removed pension rights shared by spouses in 1996. Additionally, Denmark created incentives to encourage citizens to actively participate in the labor force, while Switzerland tried to bridge the gap in pensions available to men and women. Countries such as China and Poland have not implemented recalibration reforms during this period of time.

1.1.5 Summary

In sum, increasing old social risks and emerging new social risks have triggered pension reform in all countries during the CRP. Plans to alleviate financial pressures derived from macro-socio-economic changes resulted in both contractionary and expansionary pension reforms. This descriptive and preliminary analysis provides an overview of how some countries have implemented various pension reforms. These include pension reform efforts such as modifying insurance parameters, shifting from DB to DC systems, providing incentives to encourage people to participate in the labor market, and also relaxing the relationship between contributions and benefits for vulnerable groups. In short, there are other methods of pension reforms outside

of retrenchment. Considering these reform complexities, the following section aims to cluster pension reform into similar groups in order to examine how different types of pension reform diversely affect pension policy.

2.2 Cluster Analysis Results

2.1.1 Identifying Pension Reform Clusters

As addressed at the start of chapter four, each of the countries in this study were confronted with similar macro-socio-economic changes and challenges to their pension systems. However, these conditions differed considerably depending on their pension structures and institutional legacies. These differing characteristics resulted in the diversities in pension reforms that this study has discussed at great length. In this section, the methodology used in this study to group the wide range of pension reform elements into a few similar pension reform clusters is presented in two steps: first an introduction to each pension reform cluster is provided, along with how it was created; then the clusters are compared based on their reform characteristics. A zero-order correlation check was performed to examine the correlation

between pension variables and the vector of these correlations (Appendix: table B)⁴³.

As introduced in Chapter Three, this study employs cluster analysis (agglomerative hierarchical clustering and *k*-means clustering) where pension reform variables are grouped into different pension reform clusters. Often, hierarchical cluster analysis is performed together with K-means cluster analysis in order to provide an optimal number of clusters prior to *K*-means cluster analysis. The results of hierarchical cluster analysis provide the number of clusters; this is at the discretion of the researcher and depends on the theoretical background. These cluster labels are then input into the K-means cluster analysis creating a structure within the dataset used in this study (Gough, 2001; Cramer & Page, 2009). The K-means clustering technique classifies clusters based on patterns of similarity and differences, and in this work, identifies how the pension policies of different countries can be organized. This study generated pension reform clusters using the variables described in section 2.1, and are as follows: male retirement age, required contribution years for full pension benefits, required contribution rate, maximum allowed early retirement years, early retirement penalty per year,

⁴³ Within the linear mixed effect model, correlation analysis includes pension reform variables and also control variables. A relatively high correlation (> 0.7) was found between the variable pairs financial openness and service-sector employment rate, along with employment rate and female labor participation. Since this study treats them as control variables, their correlation did not adversely affect any following analysis.

pension indexation, capitalization, targeting and recalibration. Technically, the hierarchical clustering and *K*-means clustering in this study is performed with the Between-Group Linkage Method and Ward's method; this groups pension reform policies with similar reform characteristics into clusters with minimal variance, carried out using SPSS (Ward, 1963). Examined by using hierarchical clustering and the elbow method, the number of clusters can be determined using the dendrogram and elbow graphs depicted in figure 12. The dendrogram and the elbow point graphically present different degrees of clustering, depending on the specificity used to sort pension reforms with similar traits.

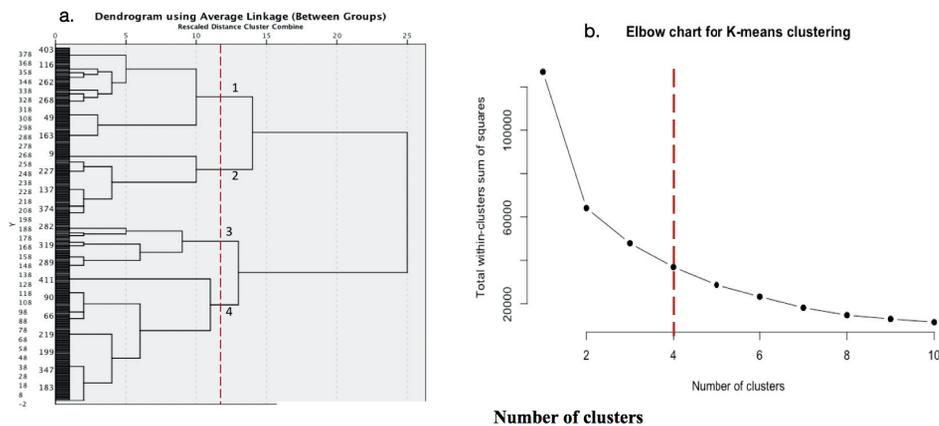


Figure 12: **a)** Dendrogram generated using the Average Linkage Method. The horizontal axis shows the distance between each cluster, in which four clusters were identified. The red-dashed line represents where this study cut the dendrogram to determine the number of clusters, four. **b)** The elbow point chart refers to variation as function of the number of clusters. The variation for four clusters was deemed appropriate for this study.

When hierarchical clustering and the elbow method are used together an optimal number of clusters can be determined. Hierarchical clustering measures the distance between pension reform variables and then groups them together based on their degree of proximity; the elbow method helps to choose the optimum number of clusters by measuring the WSS (total within-clusters sum of square) of each point against the centroid. The dendrogram is first examined and a cut is made at the dashed red line indicated in figure 12(a). At this cutting point there are two available clustering options, two and four clusters⁴⁴. An optimal number of clusters achieve intra-cluster compactness and inter-cluster separability (Zhou, et al, 2017). Since a clear decision cannot be made from the dendrogram alone, an elbow chart can be applied to justify a choice by minimizing the intra-cluster variation (or total within-cluster sum of square (WSS)). From the elbow chart generated for this study, visual inspection of four clusters shows that adding another cluster doesn't significantly improve the total WSS. Additionally, a two-cluster model is inappropriate for this study because the similarities and differences between the policies of different countries, at different periods of time, are hard to identify due to a lack of cluster resolution. Therefore, a four-pension reform cluster model was employed for this study. The four pension reform clusters

⁴⁴ Previous works typically selected the value of their cluster set from the options that are available from the 10 to 15-point range on the rescaled distance axis (x-axis) (Jung Y, et al, 2002).

identified in this study are labeled as follows: the labor-activated pension reform (LAP) cluster, the extended privatization pension (EPP) reform cluster, the latecomer structural pension (LSP) reform cluster, and the extensive retrenchment pension reform (ERP) cluster. The following section details the similarities and differences between the identified clusters.

2.1.2 Pension Reform Cluster Descriptive Statistics

1). Pension Reform Variables

Pension reform variables are the feature used in this study to differentiate pension reforms and their clusters. Macro-socio-economic factors of each country based on the results of ANOVA analysis are statistically different (Appendix: table C). Table 15 summarizes the characteristics of each pension reform cluster and their corresponding pension reform variables.

Table 15. Cluster analysis descriptive statistics – pension reform variables

Reform Clusters		Labor-activated Pension Reforms (LAP)	Extended Privatization Pension Reforms (EPP)	Latecomer Structured Pension Reforms (LSP)	Extensive Retrenchment Pension Reforms (ERP)	Between Group and Within Groups
Numerical Variables	Retirement age	64.8 (60, 67)	64.5 (60, 66)	61.9 (60, 66.2)	61.5 (58, 67)	F (3, 372) 72.129***
	Contribution year	34.2 (25, 42)	43.8 (38, 50)	22.2 (15, 31)	38.0 (30, 45)	F (3, 372) 558.347***
	Reference year	34.2 (25, 42)	43.7 (38, 50)	22.5 (15, 30)	14.2 (5, 25)	F (3, 372) 858.457***

Categorical Variables	Early retirement year	3.4 (0, 7)	2.6 (0, 5)	2.7 (0, 5)	3.7 (2, 5)	F (3, 372) 9.567***
	Contribution rate	8.84% (0, 18.5)	14.98% (0, 33)	25.36% (19.52, 28)	18.12% (6, 32.7)	F (3, 372) 70.076***
	Early retirement penalty	4.64% (0, 9.6)	3.39% (0, 6.8%)	2.5% (0, 5.6)	3.37% (0, 6)	F (3, 372) 8.673***
	Pension indexation	0: 37.9% 1: 62.1%	0: 50.9% 1: 49.1%	0: 10.9% 1: 89.1%	0: 30.1% 1: 69.9%	X ² (3) 30.314***
	Capitalization	0: 83.2% 1: 16.8%	0: 81.8% 1: 18.4%	0: 89.1 1: 10.9	0: 90.3% 1: 9.7%	X ² (3) 4.426
	Targeting	0: 92.6% 1: 7.4%	0: 87.7% 1: 12.3%	0: 84.4% 1: 15.6%	0: 83.5% 1: 16.5%	X ² (3) 4.272
	Recalibration	0: 89.5% 1: 10.5%	0: 84.2% 1: 15.8%	0: 95.3% 1: 4.7%	0: 88.3% 1: 11.7%	X ² (3) 5.059
	Total case	95	114	72	103	

Note: the numerical reform variables provide: mean (minimum, maximum); categorical variables: pension indexation 0= wage, 1=price. Other categorical variables provide the implementation frequency of reforms. F-test and X² analyzing between and within group difference, and df is reported in brackets.

To distinguish between and within the clusters, and express the degree of similarity or differences between the identified clusters, an ANOVA (numerical variables) and a Pearson Chi-Square (categorical variables) statistical analyses were performed, and the resulting contribution of each variable is denoted.

Among these clusters, the labor-activated pension (LAP) reform cluster has the highest average retirement age, 65 years old (figure 13).

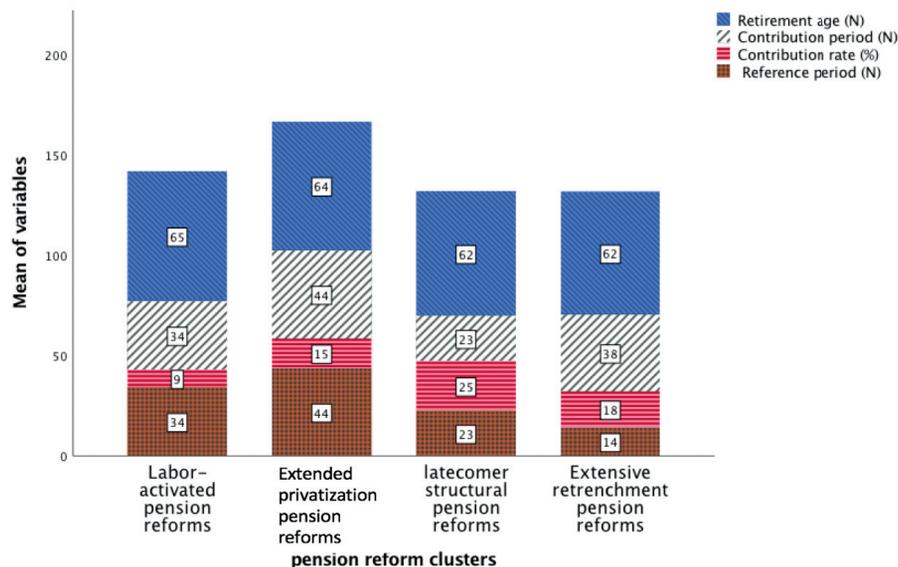


Figure 13: Numerical pension reform variables composition of each pension reform cluster. Each numerical reform variable is represented by its mean value. Units are designated for each variable in the legend.

According to prior studies, especially for PAYG systems, governments pay benefits to the current population of retirees using the contributions generated from the payroll taxes of those currently employed. If the retirement age is increased, old-age employment rate is expected to increase, the ratio between the period retired to the period employed decreases, and more revenue is available to pay for the system (e.g. Wolf, et al., 2008; Ross, 2000). The LAP cluster uses their high retirement ages to do exactly this: maintain a larger base of workers in the labor market to continue contributing. This policy is generally combined with long required contribution periods and reference

periods for receiving full pension benefits. This cluster shows considerable effort on the part of policymakers to maintain a balance between the number of pensioners and workers in the labor market at any given time. A number of previous studies have highlighted the effects of restricting the eligibility criteria to receive pension benefits, it forces the contributor to delay their exit from the labor market; thus, reducing pension expenditure (R. Disney, 2006; Schludi, 2005; Kwon, 2010). The linear mixed effect model (LMM) will determine whether or not this correlation is significant. Studies have identified that early retirement is a significant contributor to increases in pension expenditure, because the number of contributors decreases and the period of received benefits increases (OECD, 2017; Staubli & Zweimüller, 2013). Studies have identified that early retirement is a significant contributor to increases in pension expenditure, because the number of contributors decreases and the period of received benefits increases (OECD, 2017; Staubli & Zweimüller, 2013). Countries attempting to reduce pension expenditure commonly adopt reforms that decrease the maximum allowable early retirement before the legally defined retirement age, and either require an early retirement penalty or increase the starting age. Among all four reform clusters, labor-activated pension (LAP) reforms have the most restrictions on early retirement. While the average allowable years an individual may retire early is three years, early retirees are penalized five percent each year before the

standard retirement age (figure 14). Other clusters have also modified the maximum allowable early retirement year and reduced pension benefits by penalizing early retirement.

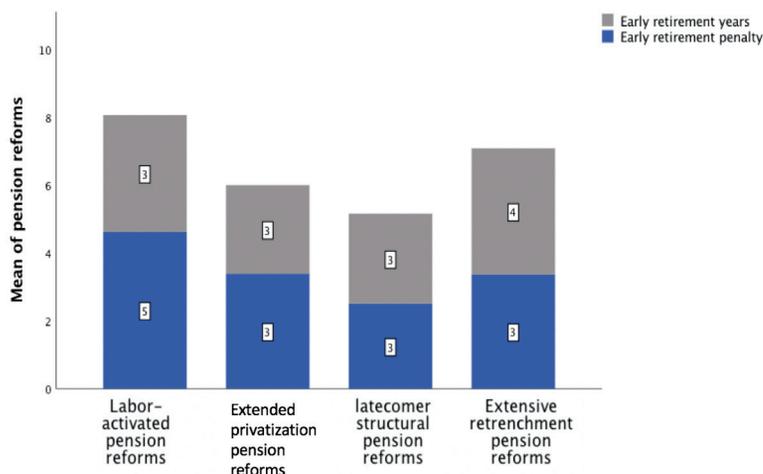


Figure 14. Early retirement years and penalty of each pension reform cluster. The number of years an individual may retire early and early retirement penalty are represented by their mean value. Units are designated for each variable in the legend.

As mentioned in Section 1.4, because wages tend to grow faster than CPI, several countries have changed pension indexation from wage-based indexation to less generous CPI-based indexations, in an attempt to reduce pension expenditure. Pension indexation adjustments have been implemented in all clusters since it is a very effective means of curbing the growth of pension benefits (Whiteford & Whitehouse, 2006; Grech, 2013; Schludi, 2005; Fernández, 2012b). This reform is highly technical and less transparent, some countries moved entirely from wage-based indexation to CPI-based as a

cost-cutting measure (OECD, 2005). CPI-based indexations are dominant in all four pension reform clusters (figure 15).

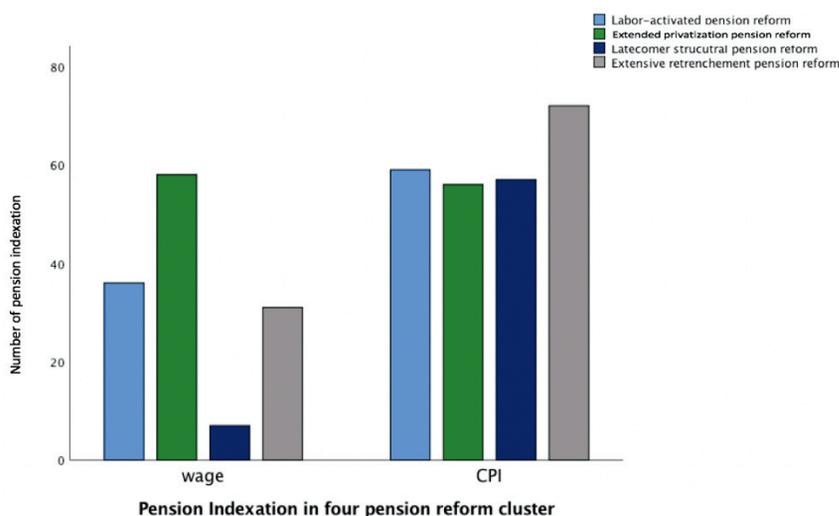


Figure 15: Pension indexation frequency for each pension reform cluster; color indicates cluster.

When the reforms of each cluster included in the three charts (Capitalization, Targeting, and Recalibration) are summed, the extended privatization pension (EPP) reform cluster is the largest. On second inspection of each reform type, this reform cluster almost has the highest number of reforms enacted in each case. This study surmises that the heightened frequency of extended privatization pension (EPP) reforms in all three types is driven by the high frequency of capitalization-typed reforms. A unique feature of the Capitalization variable is that all privatization programs in this

cluster are mandatory. Theoretically, pension privatization shifts the burden of old age income security from the government to the individual (A. Grech, 2015). However, the consequence of privatization is a reduction in income redistribution. This disproportionately affects lower income and atypical-working individuals. A number of studies have analyzed the issues associated with redistribution and pension generosity when public pensions are mixed with privatized systems (Feldstein, 1999; Ramakrishnan, & Selvaraj, 2016; Galasso, 2006; Bonoli, 2005, 2007). Since the extended privatization pension (EPP) reform cluster has the highest frequency of capitalization-typed reforms, and privatization deteriorates pension generosity, this may explain why this pension reform cluster also implemented a higher number of targeting and recalibration reforms. Both the targeting and recalibration reforms may be serving a compensatory role to an increase in social demands and the loss of income security for vulnerable groups. The analytical model presented later in this study will determine whether or not the extended privatization pension (EPP) reform cluster has a negative effect on pension generosity.

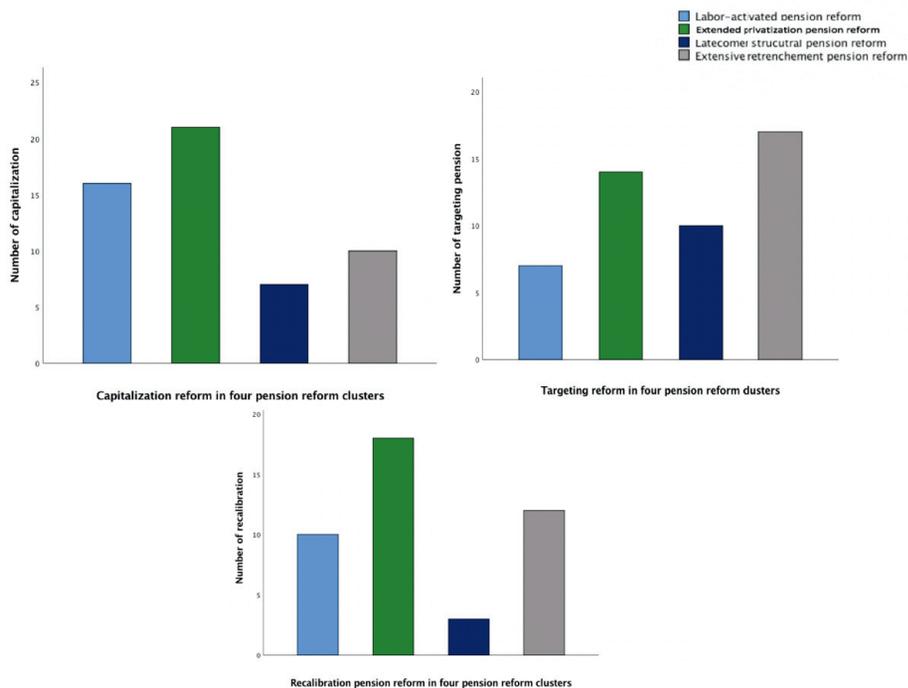


Figure 16: Reform cluster inclusion frequency when sorted by the Capitalization, Targeting and Recalibration pension reform variables; color indicates cluster.

This section provided an overview of some key general principles for each cluster, that may further future exploration of cluster dynamics. Each reform cluster represents groups of reform policies with similar mechanics, and between clusters, their differences. Additionally, an example was provided to show how understanding the relationship between variables in a cluster may provide critical clues to pension reform functionality. The next section will explore how pension expenditure and pension generosity differ from each other.

2.1.3 Pension Expenditure and Pension Generosity

The previous section introduced and discussed how pension reform variables differ between reform clusters. This section looks at each pension reform cluster's unique pension expenditure-generosity relationship (figure 17).

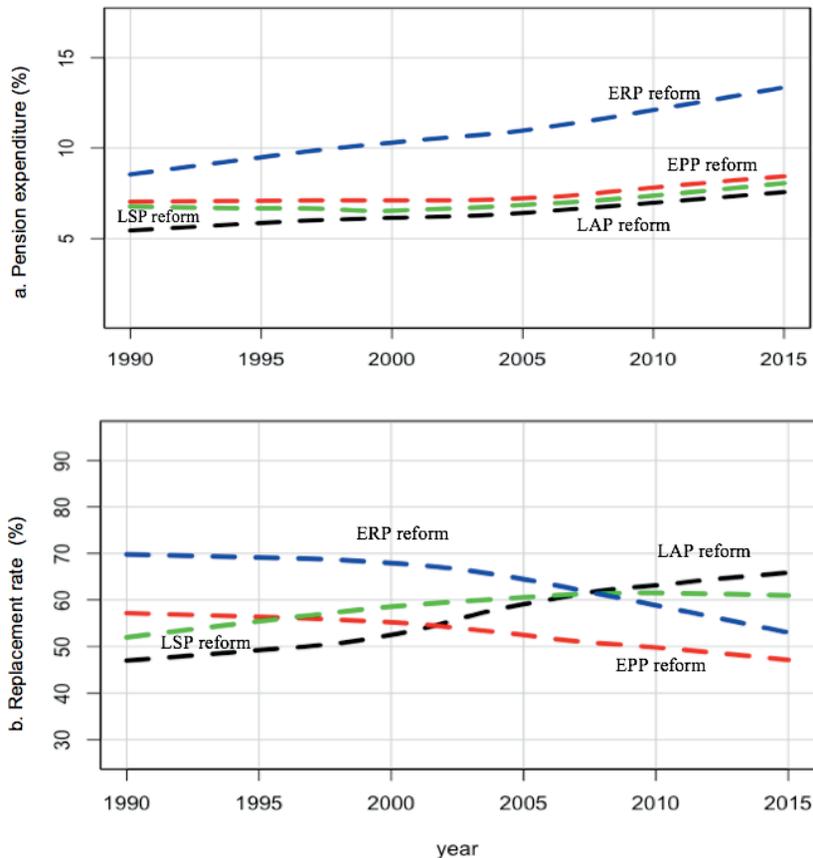


Figure 17. **a**, Pension expenditure for each pension reform cluster during the CRP (1990-2015). **b**, Pension generosity for each pension reform cluster reflected by income replacement rate over the same period.

Legend: (LAP) Labor-activated pension reforms, black; (EPP) Extended privatization pension reform, blue; (LSP) Latecomer structural pension reform, green; (ERP) Extensive retrenchment pension reform, orange.

Unsurprisingly, pension expenditure has increased in all four clusters primarily due to demographic changes; whereas in response generosity is eroded to facilitate pension fiscal sustainability. These increases in pension expenditure, however, have not been uniform, and a cluster's associated pension generosity is not guaranteed to decrease in response. Particularly, increases in extensive retrenchment pension (ERP) reform cluster expenditure during the CRP was high; while labor-activated pension reform (LAP) cluster expenditure only modestly increased during this same period. The exception to this generalized relationship is noticeable in the labor-activated pension reform (LAP) cluster. Pension generosity has continued to rise despite the modest previously mentioned increases in pension expenditure. Theoretically, the trade-offs and synergies between pension expenditure and pension generosity are clear. Financial sustainability (reductions in pension expenditure) is often obtained by lowering pension generosity. Even in the face of the unfavorable demographic and socio-economic environment that has defined the CRP, it is puzzling that the labor-activated pension reform (LAP) cluster has continued to see increases in pension generosity without radical increases in pension expenditure. Nuances like the one mentioned here may be a reflection of the different pension reform strategies that each reform cluster has implemented. Static effects to pension expenditure and pension generosity will be statistically examined later in this study; first the primary

features and reform characteristics of each cluster will be explored in the following section.

3.1 Pension Reform Characteristics in Four Pension Reform Clusters

The previous section introduced the organizational method used in this study to examine pension reforms, pension reform clustering, and some general pension reform principles that can be explained using this technique. This section explores the primary principles and features for each cluster. The general cluster principles are first summarized, the countries that adopted this reform principle are introduced, and then a brief pension reform policy implementation timeline for each country is provided that explains the evolution of their pension system and their underlying intentions.

3.1.1 Labor-activated pension (LAP) Reforms

The labor-activated pension reform (LAP) cluster is a classification of reforms that significantly modify pension parameters. This type of pension reform is a combination of public and supplementary private pension systems, that sustain a pension system by maintaining a larger base of workers in the labor market to continue contributing. The parameters usually reformed to achieve this goal are delays to retirement age, penalties to early retirement, an

increase to means-tested requirements, or the linking of pension benefits to contributions. For instance, to link benefits and contributions, labor-activated pension (LAP) reforms layer labor market pension systems (quasi-mandatory or mandatory) on top of existing public systems. To incentivize participation in the labor market, expansionary reforms, targeting and recalibration reforms, are used to increase the number of contributors to a pension system by lowering eligibility requirements or bringing workers back into the market.

Among all the clusters created in this study, countries included in this cluster had the highest unemployment rates in the 1990s. Additionally, these countries had entirely public systems with low early-retirement ages. As their populations began to increasingly age, the pool of contributors began to significantly decline; further stressing the financial stability of these systems. To counteract the unsustainability of these systems, these countries implemented delays to retirement age, penalties to early retirement, an increase to means-tested requirements, or the linking of pension benefits to contributions. These reforms encouraged persons that would possibly have remained out of the labor force to join or re-enter. For example, one unique tool of these systems are low-income-based means-tested pensions or tax-financed basic pension systems targeted at low-income persons. As a result of these reforms, by 2015, the countries in this cluster had the highest average retirement age, 64.8, well above the 63.3 years old total average (grand mean).

The average employment rate of a key demographic of workers, aged 55 to 64 years old, for countries in this cluster had also increased between the year 2000 and 2015, from 58.7 to 69.4 percent respectively. This is also higher than the total average of 61.1 percent (grand mean). In this study, five countries implemented pension reforms that match the reform features and themes of labor-activated pension reform (LAP)s: Denmark, Sweden (1997-2015), Japan (1990-2000), the UK (1990-2003), and the US.

The current public pension system in Denmark contains two pension programs: means-tested supplementary pension benefits and PAYG. Their PAYG system is a general budget revenue tax-financed system, called the residence-based national pension (*folkepension*). In the early 1970s a voluntary early retirement (VER) (*efterløn*) feature was introduced, primarily utilized by physical laborers, allowing these workers to retire at 60 years old (Baadsgaard & Quitzau, 2011). However, an aging population and an economic crisis in the 2000s led to ballooning unemployment; this placed pressure on the public pension system's financial sustainability because of a reduction in the number of contributors (Hilt Pflieger, Meulengracht Flachs, & Koch-Henriksen, 2010; de la Porte & Natali, 2014). The early retirement feature played prominently in these sustainability issues due to an increasing exodus of older workers, and, ultimately, it forced the Danish government to

reform their system by removing this early retirement benefit. This encouraged workers to postpone their exit from the labor market.

Sweden implemented a labor-activated pension (LAP) reform in 1998. Existing Swedish pension systems at this time were highly generous, and were particularly designed to protect against risks associated with old age. This system combined both Beveridgean and Bismarckian features: a flat tax-financed basic pension (*folkpension*), that was not means-tested, and an earnings-related DB pension system (*allmän tilläggs pension (ATP)*) (Laun & Wallenius, 2015; Sundén, 2006). However, in the beginning of the 1990s, Sweden experienced a deep economic recession that resulted in high unemployment (OECD, 2007). This downturn in employment had adverse effects on public expenditures, particularly pension expenditures. This rising in unemployment and pension expenditures heavily pressured the Swedish government to find a means of financing their existing system, particularly, a way to increase the number of persons actively contributing to the system (i.e. through active employment) (Bergmark & Palme, 2003). Thus, the previously mentioned reform was designed to address this contributor gap, by implementing an NDC program along with a quasi-mandatory occupational pension system. Additionally, these new systems contained a minimum flat-rate guarantee pension (*garanti pension*), that requires residency within

Sweden for at least 40 years or employment within Sweden for at least 30 years (Kangas et al., 2010).

Japan implemented their first pension reform, a labor-activated pension reform (LAP), during the CRP in 1998 (thus they are clustered starting from 1990, refer to chapter 3 on methodology). In the 1990s, Japan faced extraordinary economic hardship, notoriously known as “the lost decade”, with an anticipated rapid aging of their population accompanied by rising unemployment (Kashiwase, Nozaki, & Tokuoka, 2012). Thus, the Japanese government began to focus on the long-term financial sustainability of their pension system due to a shrinking labor force (OECD, 2005). To incentivize prime working age citizens to return to the labor market or delay their retirement, the government strengthened the link between pension benefits and work by permitting workers to opt out of social insurance pensions (OECD, 2017). For instance, large enterprises’ workers are allowed to opt out of the Employee Pension Scheme and apply for an independently funded pension system – the Employee Pension Fund (Okamoto, 2013). By 2001 however, Japan had implemented new reforms and transitioned to the extended privatization pension (EPP) reform cluster.

The UK implemented a labor-activated pension (LAP) reform in 1990. Throughout the 1980s the UK suffered from an economic recession that primarily affected manufacturing workers, and a second smaller recession

between 1990 - 1991. Therefore, in the beginning of the 1990s, the UK significantly transitioned to private pension systems that emphasized a benefit-labor relationship (Blake, 2000). This was done through implementation of the State Earning Related Pension Scheme (SERPS) and State Second Pension (S2P) to expand private pensions by allowing individuals to contract out of public pensions. The UK also implemented new reforms and transitioned to the extended privatization pension (EPP) reform cluster in 2004.

The US has also provided modest mandatory public pension benefits. However, while, relative to other countries, the retirement age in the US is high, they have experienced periods of high unemployment and drops in labor force participation since the beginning of the CRP (the Social Security Administration, SSA, 2006; Lekniute, Beetsma, & Ponds, 2018). Pensions in the US are designed to supplement life in retirement, however, they did not cover the entirety of living costs; rather, the large majority of citizens primarily relied on private market-based pension plans (e.g. a 401(k)). Thus, as the costs of the public system began to rise unreasonably, the US further linked benefits to employment-based contributions through tax-based incentives. For example, when an employee contributed to their 401(k) the equivalent amount, up to USD 16,500 of their pay, was exempt from income tax, USD 22,000 for employees aged 50 or older (OECD, 2008). However, regardless of their

higher retirement age, the US government did still apply an early retirement penalty of 6.75 percent per year; and in recent years, recognizing the demographic aging of their population, the US has begun to gradually increase their retirement age, from 65 to 66 years old in 2006, and again will increase retirement age to 67 years old in 2022 (OECD, 2015).

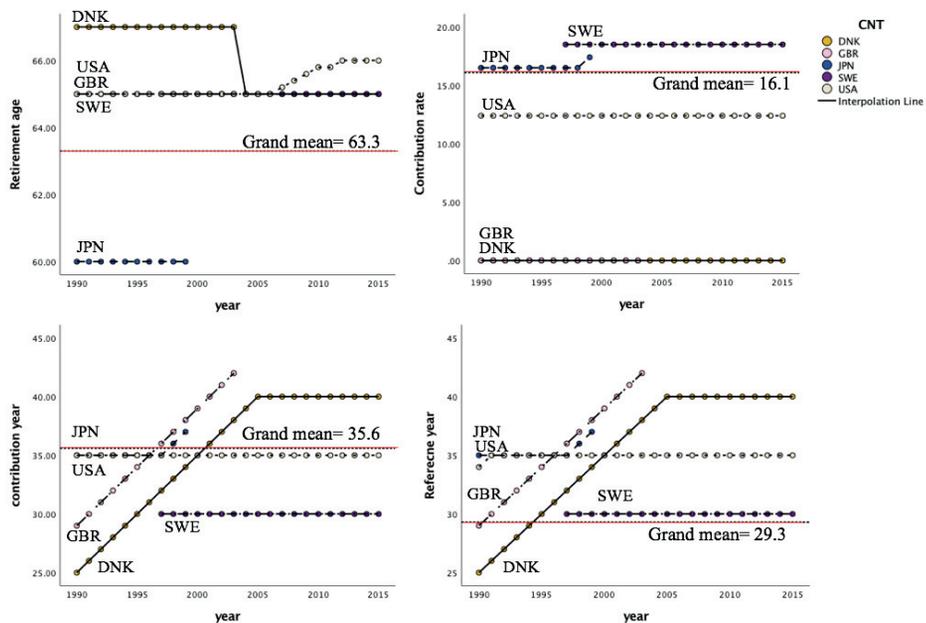


Figure 18: Pension reform in the labor-activated pension reform (LAP) cluster: retirement age, contribution rate, contribution year and reference year.

Figure 18 exhibits how the four most commonly reformed pension parameters have been changed, in countries that have implemented labor-activated pension (LAP) reform, during the CRP. For example, in the case of Denmark, the retirement age decreased from 67 to 65 years old starting in 2004

in order to deal with issues related to early retirement. In addition, their required contribution years and residential period, for full pension benefits, increased from 10 years to 40 years.

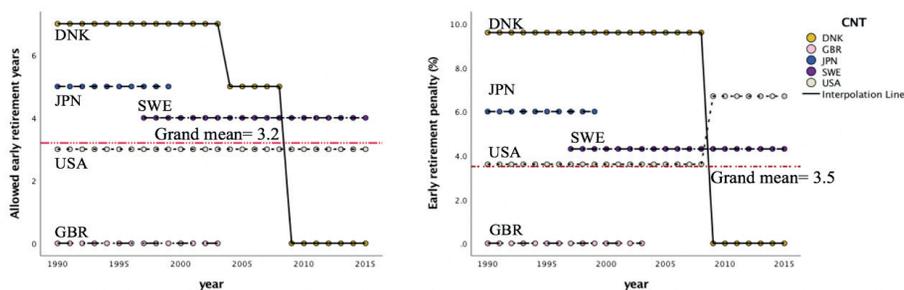


Figure 19: maximum allowed early retirement years and early retirement penalty in the labor-activated pension (LAP) reform cluster.

In order to shorten the average period of retirement, and consequently the period of benefits paid, this cluster of pension reforms postponed workers exit from the labor market. In the case of the US, the maximum allowable number of years an individual may retire early was 3 years, however, the penalty on early withdrawal of pension benefits was increased from 3.6 to 6.7 percent in 2009.

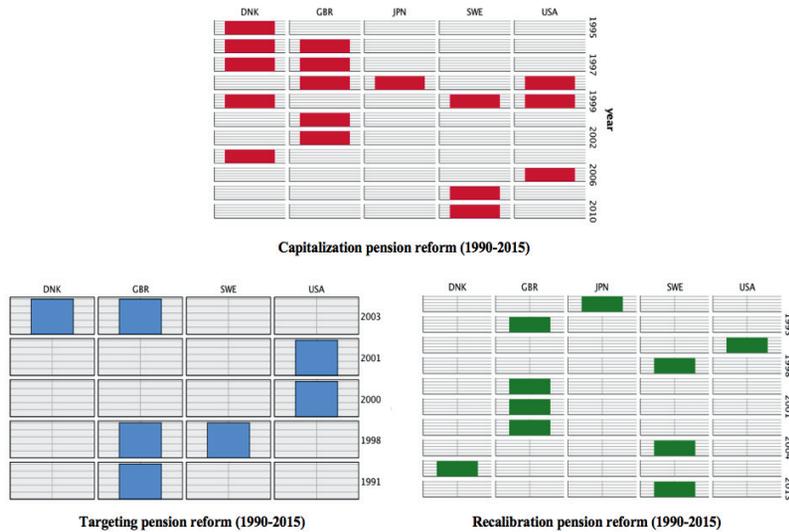


Figure 20: Capitalization pension reform in labor-activated pension reform (LAP) cluster: indicated reform year and countries.

Since one of the primary reform themes of this cluster is to address issues related to the number of contributors to a particular system, capitalization pension reforms are relevant. Reforms in this cluster were all implemented with a capitalization pension reform feature. The US encouraged automatic enrollment into 401(k) plans by providing tax deductions, between 2001 and 2006, that were proportional to the amount invested up to a certain cap.

Targeting and recalibration pension reform features, through compensation, were used to encourage workers to remain or re-enter the labor market. Denmark provided pension credits to individuals who were in the process of receiving job training (e.g. all young people can get a 9-month

pension credit); or they provided waivers on the first two years of income earned by individuals while they were eligible for VERP benefits (ISSA, 2013). All of the reforms in this cluster also provided caregiver credits for time spent out of the workforce while caring for children or the elderly. Sweden offers credits to those who provide care to parents or children.

3.1.2 Extended Privatization Pension (EPP) Reforms

The extended privatization pension (EPP) reform cluster is a classification of parametric reforms that require and incentivize enrollment in occupational or individual pension programs, in conjunction with existing public pension systems. These reforms are designed to shift the responsibility of financing retirement from states to private entities and individuals. However, in order to compensate disadvantaged groups and unpaid workers, various expansionary pension reforms were also implemented in tandem; for example, means-tested pension benefits, tax reductions or earnings-related subsidies to employers, employees or individuals. Additionally, extended privatization pension (EPP) reforms not only add supplementary programs to existing public pension systems, but in return balance system costs, and the existing system is then modified parametrically; particularly these reforms typically increased retirement age, the required number of contribution years, and reference years to access full pension benefits.

The extended privatization pension (EPP) reform cluster is defined by developed nations that had well established first (public systems) and second (occupational and earnings-based systems) pillars at the beginning of the CRP. However, as the world began to globalize and transition into the fourth industrial revolution, drastic macro-socio-economic changes began to change the labor market. Occupational pensions, the second pillar, are often limited to qualified workers (e.g. regular employees), however, labor market changes resulted in an increasing population of atypical and self-employed workers. These workers have high job instability, therefore occupational pensions leave little room for the possibility of these workers gaining retirement compensation. The exclusion of atypical and self-employed individuals leaves a large and growing proportion of workers insufficiently covered. Reforms of this cluster are focused on the redistribution of retirement benefits to these workers while, at the same time, balancing expenditure. Coverage is expanded to atypical and self-employed individuals in one of two ways: through the lowering of occupational pension benefit qualification requirements, or, by incentivizing these workers to invest in individually-held investment funds. These expansionary programs required counterbalancing programs to be implemented that would maintain the longevity of their public pension systems. Parametric reforms, specifically contribution period and reference period reforms, were used to meet this end. By 2015, the countries in this

cluster had the highest average number of required contribution years and reference years in order to receive full pension benefits, 43.8 and 43.7 years respectively, while the total average (grand mean) was 35 and 29.3 years respectively. In this study, five countries implemented pension reforms that match the reform features and themes of extended privatization pension (EPP) reforms: Germany, Italy (2008-2015), Switzerland, the UK (2004-2015), the Netherlands, and Japan (2001-2015).

At the beginning of the CRP, Germany had a traditional Bismarckian social insurance pension system (PAYG, first pillar) along with an occupational pension system (DC, second pillar). However, both the first and second pillar of Germany's pension system only covered qualified stably-employed workers (i.e. regular employment), particularly gainfully-employed individuals, often characterized as fragmented occupational pensions (Ebbinghaus, 2015; Borsch-Supan & Wilke, 2011; Anderson & Meyer, 2003). Even more particular to Germany is the unification of West and East Germany in 1990, where two diametrically different economies merged together. Comparatively, West Germany was significantly more prosperous than East Germany, and therefore had a more developed labor market. This dichotomy was still present, especially in their pension coverage rates, even more than 10 years after reunification. In the early 2000s, occupational pensions provided by the private sector covered more than 34 percent of Germans in the West,

while only 8 percent in the East (Bridgen & Meyer, 2014; OECD, 2017). As a result, the German government extended private coverage. The Rister pension reform, the most representative privatization reform, was introduced in the early 2000s and consisted of tax deductions and state subsidies; with benefits targeted more toward low-income earners (Ebbinghaus & Whiteside, 2012; Schmahl, 2000). In tandem with these reforms the German government passed reforms intended to balance the cost of their public pension systems through increases to the required contribution period, reference period, and retirement age.

Switzerland had a well-established three-pillar pension system. The first pillar (AHV/AVS) provided coverage of the basic needs for all retirees, and contained a means-tested pension supplement; the second pillar consisted of a mandatory occupational pension system; and the third pillar comprised of individual pensions incentivized with tax reductions (Häusermann, 2010b; Ebbinghaus, 2011). While Switzerland's pension system was very mature, with its inception in 1916, coverage under its second pillar was still very fragmented, particularly with respect to gender. Prior to a 1985 reform that made participation in the occupational-based second pillar compulsory, one third of men and one fourth of high-skilled male and female workers, respectively, were covered (Davis, 2012; Leimgruber, 2008; Bonoli & Häusermann, 2010). Within a decade after the passage of this legislation,

second pillar coverage was at nearly 100 percent for male workers, but still, only 80 percent of female workers had coverage due to job instability and lower earnings (OECD, 2009). This is in part because full second pillar occupational pension benefits required employees to have a contribution record of 40 years or more. However, as the labor market continued to change throughout the CRP, the number of atypical workers, for whom full coverage under these requirements was near impossible, began to climb; a group that women are a large proportion of (Bütler, 2000; Bonoli, 2002). In response to these market changes, a reform designed to “to improve coverage of atypical workers by lowering the access threshold to compulsory coverage” was passed in 2003; lowering the qualification threshold to CHF 18,990 per year (ISSA, 2003). By reducing the qualification threshold, coverage among female atypical workers increased from 25 percent to 38.7 percent by 2015 (Bonoli & Häusermann, 2011). In the same manner as Germany, in order to balance pension costs associated with expanded coverage, the Swiss government then increased the required contribution period of their public pension from 42 to 45 years.

The structure of the UK pension system is defined by: a tax-financed Basic State Pension with means-tested income support (first pillar), and a State Earnings-Related Pension (SERPS) and State Second Pension (since 2002) (S2P) (second pillar). After the full implementation of the S2P pension

provision in 2004, the UK changed from the labor-activated pension reform (LAP) cluster to the extended privatization pension (EPP) reform cluster. The UK pension system can be characterized by low public benefits with matured but fragmented, non-compulsory, occupational and private pensions. However, the State Earnings-Related Pension (SERPS), established in the early 1970s, and the State Second Pension did not consider self-employed and atypical workers (Foster, 2018; Agulnik, Barr, Falkingham, & Rake, 1999; Blake, 2003; OECD, 2005). Therefore, qualified workers (e.g. large firms or skilled workers) tended to be broadly covered by both first and second pillar benefits while these atypical workers remained largely uncovered. Additionally, individual (third pillar) pensions were available, but they were based on an opt-in system. Thus, the fragmentation of the second, and optionality of the third pillar resulted in heavy dependence on means-tested pensions (Bridgen & Meyer, 2011). Prior studies have described the UK's welfare system as a liberal regime that spends modestly on their public pension system, however, because of insufficient supplementary and public pension benefits, means-tested benefits have played the primary role in providing a safety net for retirees (Esping-Anderson, 1999; Meyer, 2007). At least 20 percent of pensioners claimed means-tested pension benefits in 2006 (OECD, 2009). Therefore, in order to close the coverage and benefits gaps, the UK began incentivizing low-pay and middle-income workers to facilitate participation

rates in occupational and private pension programs. Starting in 2012, employers were required to enroll all their employees into the occupational auto-enrollment (AE) pension program, where before 2012, enrollment typically depended upon company size (ISSA, 2013). To facilitate continued stable management of public system costs, parametric reforms were then implemented through increases to retirement age and an increase in the pre-conditions to qualify for means-tested benefits.

Upon entrance into the extended privatization pension (EPP) reform cluster, the Japanese pension system was comprised of two parts: a public pension system (first pillar and second pillar) and a private pension system (second pillar and third pillar) (Kashiwase et al., 2012). It is often considered unique, since it resembles most continental European countries' programs and, at the same time, it is often considered as a small welfare state due to its low spending (Esping-Andersen, 1990, 1999; Estévez-Abe, 2008). Within the public pension system there were two programs: the National Pension Insurance (NPI) program, a basic means-tested pension program introduced in 1985, and the Employees Pension Insurance (EPI) program, an income replacement program that covered both the public and private sectors (OECD, 2012). Since the EPI program covers private sector income, it is uniquely classified as a second-pillar public program. The private pension system consisted of three second-pillar programs: a DB program, a voluntary DC

program, and the Employee Pension Fund (EPF); it also consisted of one third-pillar program, individual DC plans. Historically, early on in the post-World War II period Japan had already implemented voluntary DB-based occupational pension programs, including the Employee Pension Fund (EPF) program and the Tax-Qualified Pension Scheme (TQPS) program; where individuals were incentivized to join through tax exemptions (Hofäcker, Hess, & König, 2016; Estevez-ABE, 2008). However, the CRP saw the rise of a series of economic hardships for the Japanese economy. The “lost decade” undermined the fiscal capabilities of the Japanese pension system, and coupled with the 1997 Asian financial crisis, the Japanese government responded by scheduling pension reforms once every five years in an attempt to ensure the long-term financial sustainability of their system (ISSA, 1998). One particular way the government tried to bolster Japanese financial markets was by extending private pension programs. However, during these economic crises existing DB pension systems forced companies to pay benefits they could not afford. Therefore, in 2001, the government took steps with sponsored companies to transition them from DB programs instead over to newly established DC pension plans (Estevez-ABE, 2008). Starting in 2004, these DC plans were expanded to cover private sector employees, private sector employees without corporate pension programs, and self-employed workers (Estevez-ABE, 2008; OECD, 2012). This shifted Japan from the labor-

activated pension (LAP) reform cluster to the extended privatization pension (EPP) reform cluster. In 2006 Japan's baby-boomers began to retire *en masse*, putting more strain on the public pension system. Therefore, DC plans were further expanded and incentivized through the introduction of employer-based non-taxable contributions (ISSA, 2006). By the following year, DC plan coverage had increased by 51 percent (ISSA, 2008). Over this period of time, in tandem with the expansion of DC programs, Japan implemented comprehensive public pension reforms to stabilize costs. This included gradual increases to the required contribution rate from 13.58 to 18.3 percent between 2005 and 2017 (ISSA, 2004). In addition, pension indexation was changed from wage-based indexation to CPI-based indexation.

In the early 1990s, Italy implemented pension reforms that were classified as extensive retrenchment pension (ERP) reforms. Traditionally, Italy's earnings-related PAYG pension program provided generous benefits to individuals, with a 72 percent on average income replacement rate. However, this level of expenditure became too burdensome on the Italian economy by the start of the CRP. With the introduction of an NDC program in 1995, public pension expenditure was sharply reduced (Bisetti & Favero, 2014; Jessoula, 2018). Therefore, in order to compensate for reduced pension benefits, the government began development of a supplementary funded (DC) pension program (OECD, 2009). In 2008 Italy radically transformed the structure of

their pension program from a single pillar to a three-pillar pension system defined by: a public means-tested pension program, a compulsory public pension program (PAYG), and a compulsory private employee and self-employed (INPS) program (first pillar); a compulsory *Tfr* severance-pay program (mainly for regular workers before 2008) (second pillar); and a tax-incentivized individual pension plan through life insurance contracts (PIP) program (third pillar) (OECD, 2011). This shifted Italy from the extensive retrenchment pension reform cluster to the extended privatization pension (ERP) cluster. Attempts to stabilize pension costs increased the overall role of supplementary pension programs in Italy's pension system, in particular the government paid attention to the existing *Tfr* (*Trattamento di fine rapporto* or *Tfr*) program. The *Tfr* program provided lump sum payments to employees at the time when they retired or at the end of their contract; however, this was only limited to regular workers, as atypical workers were not entitled to these pension plans (Ebbinghaus, 2011). In 2007 (Law 279/2007), a comprehensive reform of Italy's pension systems was passed that would introduce tax reductions to incentivize investment in private pension funds; additionally, in 2008, the government implemented the *Tfr* program as a compulsory DC supplementary system for workers who started after 1996 (ISSA, 2006). Along with the *Tfr* program, the Italian government introduced four additional prefunded supplementary pension programs: the pre-existing funding (PEF),

the closed funded (CPF), the open funds (OPF), and the individual pension plans through life insurance contracts (PIP) program (OECD, 2007). Where PEF and CPF are second pillar programs and OPF and PIP are third pillar programs. By the end of 2008, the CPF and OPF programs grew significantly, by 64 and 69 percent respectively (Ebbinghaus, 2011). Italy also implemented comprehensive public pension reforms in this same period to stabilize costs; with reforms passed in 2009, 2010 and 2012. This included gradual increases to the retirement age from 64 to 66.3 years old; the contribution rate from 32.7 to 33 percent; and to the required contribution period from 37 to 42.6 years by the end of the CRP in 2015 (ISSA, 2009, 2010, 2012).

At the beginning of the CRP, the Dutch pension system had three established pillars: a flat-rate pension program (AOW), based on a required 50-years residential period, and a social assistance program (first pillar); a quasi-mandatory subsidized occupational pension (DC) program (second pillar); and a tax-subsidized voluntary private pension (third pillar). Where the combination of the first and second pillar programs created a pension system with both Beveridgean and Bismarckian roots respectively (Knoef et al., 2016). The first pillar *Algemene Ouderdomswet* (AOW) public pension program provided flat pension benefits to all residents who had lived in the Netherlands based on their period of residency; with qualification for maximum benefits occurring if the individual had lived within the Netherlands for fifty years

between the ages of 15 and 65 years old. Their second pillar occupational pension program was a DC program that covered nearly 90 percent of wage earners (OECD, 2015). Even though the Dutch pension system had maintained relatively stable public pension expenditure over the CRP, with a high rate of total occupational pension coverage, this system was still far from perfect (de Bresser & Knoef, 2015). The Dutch occupational pension program - a wage-based pension program - was introduced in the early 1950s, and was originally based on breadwinner principles (Anderson, 2011). Thus, the program inherently discriminated against women, particularly married women, and part-time workers (Ebbinghaus, 2011). Since the highly organized interest groups of important social actors within Dutch society played an oversized role in the policymaking process, this resulted in a program that remained largely true to the original discriminatory structure it was initially designed with (Anderson, 2011). In 2007, the government enacted a reform to regulate the Dutch occupational pension program with three aims: transparency, access, and universal coverage (ISSA, 2007). By its implementation in 2008, this new reform required occupational pension funds to accept all employees who were 21 years or older; notably, this removed the program's ability to discriminate against part-time workers (ISSA, 2008). In recent pension reforms, the government had shifted more responsibility to individuals by implementing a third pillar mandatory individual pension program. Due to labor market

changes and demographic aging, the Dutch government had also been making efforts to parametrically reform the public pension system to maintain stable expenditures. With a scheduled increase to the retirement age from 65 to 66 years old in 2020 for both the AOW and occupational pension programs (ISSA, 2012).

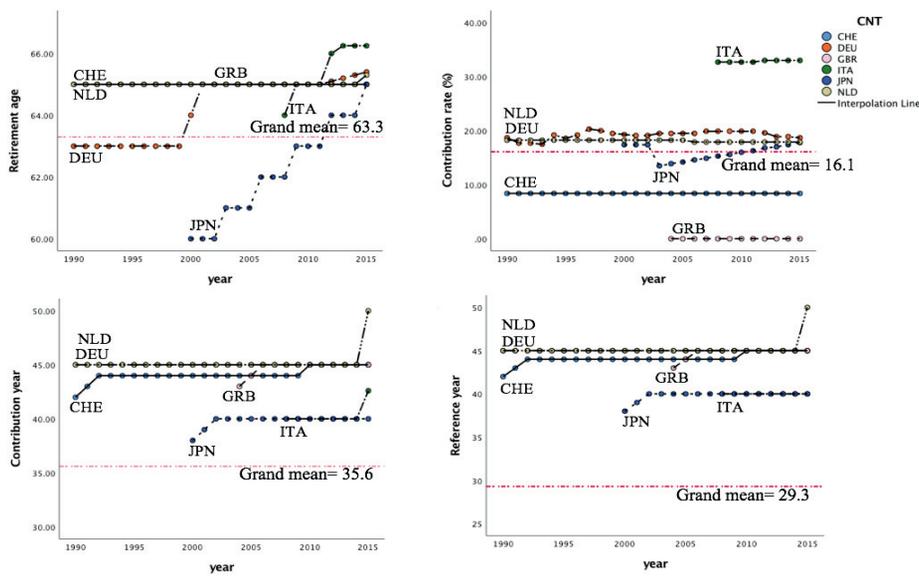


Figure 21: Retirement age, contribution rate, contribution year and reference year in the extended privatization pension (EPP) reform cluster.

Figure 21 shows that all countries in this cluster have increased their required retirement age to qualify for full benefits. In particular, Japan increased their retirement age from 60 in 2001 to 65 years old in 2015. Also, the contribution period and the reference period for these countries was

reformed to the point where both had become defined by a life-long work period.

With regard to early retirement policy, the German pension system allowed individuals to retire up to 3 years before the required retirement age for full benefits, however, since the 1990s, an early retirement penalty of 0.3 percent of total benefits per month of early retirement had been implemented (ISSA, 2001) (figure 22).

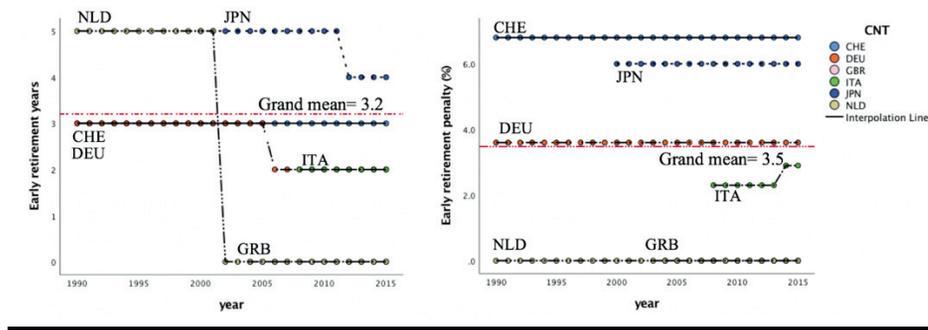


Figure 22: The maximum allowed early retirement years and early retirement penalty in the extended privatization pension (EPP) reform cluster.

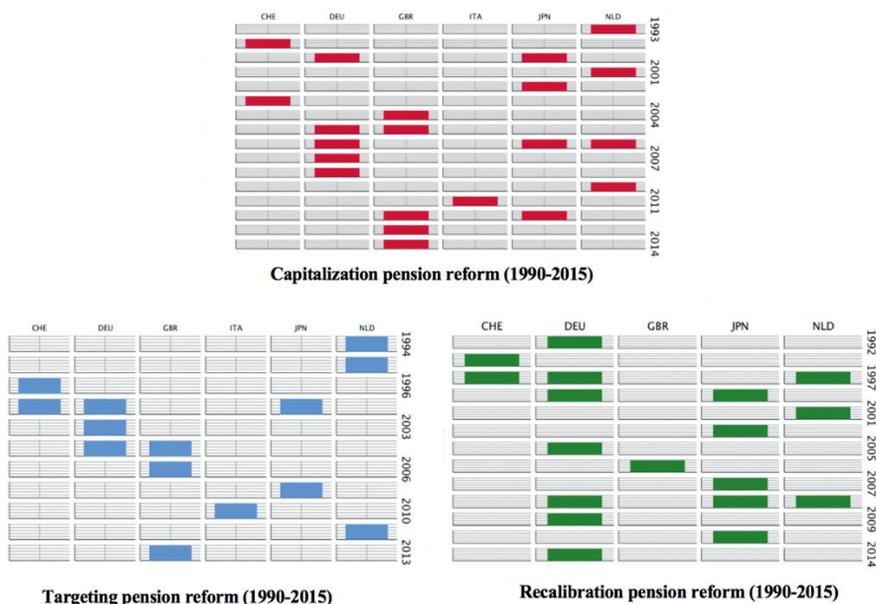


Figure 23: Capitalization, targeting and recalibration reform in the extended privatization pension (EPP) reform cluster.

As figure 23 illustrate, compared to other clusters, countries in the extended privatization pension (EPP) reform cluster implemented capitalization reforms with the highest frequency. In the case of Germany alone, four capitalization reforms were implemented during this period. In 2001 Germany implemented the *Riester Rente*, where employees may contribute a portion of their net wage to a fully funded program and, additionally, may receive tax-credits as an incentive (Bonin, 2009; Berner, 2006). Additional expansionary pension reforms often accompanied these programs. For instance, childcare related work qualifies parents for annual pension credits for the first three years of the child’s life.

3.1.3 Latecomer Structural Pension (LSP) Reforms

The latecomer structural pension (LSP) reform cluster, is a classification of reforms that significantly modify the inherent structure of a pension system, through a high degree of structural pension reform or privatization, with minor changes to its defining parameters. Before a reform of this type was implemented, all of these countries' pension systems were entirely public. From the perspective of the contributor, contribution rates remain static. However, using capitalization reforms, part of the responsibility of benefits is passed from the government to the market. These reforms expanded coverage to target populations that had not been previously covered through state sponsored pension systems alone; for example, expansion of coverage from only government employees and state-owned enterprises (SEOs) to private companies and farmers.

Unlike other clusters, all the reforms that were categorized into this cluster were legislated in countries that had transitioned from centrally planned economies to widespread market-based economies (during the 1990s) since the inception of their original pension programs. Structurally, their pension institutions were heavily Bismarckian, where pension benefits were tied to a worker's earnings; however, these systems were highly non-egalitarian, regardless of their identification as communist welfare states (Palier, 2010). For example, most of those who were insured were employees of the state, but

this left large swaths of the population – particularly farmers – uninsured. Additionally, for insured groups, these pension systems were highly generous - infamous for their “cradle-to-grave” benefits (Xia, 2015). However, once these countries began shifting from centrally planned economies, soaring unemployment put pressure on inherited pension systems. One way that unemployment materialized was in the transition of ownership from state owned enterprises to privately owned enterprises. Pension sustainability was endangered by an influx of retirees as well as increases to unemployment benefits. With ballooning pension expenditures these countries turned to structural-based reforms as a countermeasure (and in the context of this work, latecomer structural pension (LSP) reforms). When private companies began downsizing the number of employees to reduce overhead costs, this applied market pressures on the remaining SOEs to follow suit. One downsizing strategy used by SOEs was to provide early retirement provisions, however this managed to also exacerbate pension expenditures (Titterton, 2010; Bielecki, Goraus, Hagemeyer, & Tyrowicz, 2016; WB, 1995). In this study, three countries both match this economic framework and then implemented a latecomer structural reform: China, Poland, and the Czech Republic.

China initiated a contributory pension system (PAYG) in the early 1950s – “Labor Insurance Regulation” which aimed at protecting industrial workers in state-owned enterprises against illness, disability and old age. Since the

social and economic reforms in 1978, existing pension systems were radically reshaped; existing social pooling had collapsed with market privatization, its decline linked to China's transition to a market-based economy. One consequence of their collapse was an increase in social unrest due to insufficient pension payments for ensured SOE's retirees. By the 1990s, the dramatic aging of China's population and demographic transitions, as a consequence in part because of the One-Child policy, began to seriously endanger the existing pension system (Béland & Yu, 2004). These forced the government to undertake structural pension reforms even at the consequence of considerable transition costs. Following the publication of *Averting the Old Age Crisis*, a pension reform strategy guide for the world, the World Bank additionally prepared a pension reform program specifically meant for China in 1995. After accepting the policy, the Chinese State Council issued Document NO.6, a structural pension reform, that shifted China's system from PAYG to an Notionally defined contribution program in 1997. Notionally defined contribution (NDC) programs are earnings-based pension programs composed of a PAYG principle and a mandatory individual contribution (OECD, 2005). For China, the total contribution rate is 28 percent shared between employers (20%) and employees (8%) (Liu & Sun, 2016). To widen the social safety net, a new targeting-based non-contributory pension system

was established that covered urban residents who were not employed and rural residents beginning in 2009.

Poland introduced their pension system in 1927, and post-World War II, had a very centralized government shaped largely by Soviet influence (ChŁoń-Domińczak & Strzelecki, 2013). Poland's transition towards to a market-based economy was marked by an extremely hardships, notably soaring unemployment, severe public debts and hyperinflation beginning in 1990 (Hagemejer, 1999). Their pension system thus was highly generous but also very non-egalitarian; boasting a retirement age of 60 and an employer-only contribution system. Similar to China, the Polish pension system only covered state sector employees (Égert, 2013; Wiktorow, 2007). After shifting to a market-based economy in the early 1990s, pension systems began to experience extreme financial challenges. One in particular being spiking double-digit unemployment in the late 1990s and early-to-mid 2000s, reducing the number of contributors to the pension system (OECD, 2009). In 1999, following the guidance of the World Bank, the Polish government restructured their existing PAYG system into a two pillared program (often labeled as NDC): PAYG, and a privatized mandatory employer and employee contribution system that established individual-defined contribution accounts. The proportion of total contributions split between the first and second pillar is 12.2 and 7.3 percent respectively (Égert, 2013).

The Czech Republic introduced a PAYG pension system in 1995, but its rapid transformation into a market-based economy, shortly after the peaceful dissolution of Czechoslovakia in 1993, opened it to dramatic privatization (Müller, 2002). By 1997 privatization of SOEs had reached upwards of 70 to 80 percent (Mertlik, 2019). With increasing privatization, the government intended to reduce state responsibility by implementing supplementary private pension systems, and also reduced minimum government subsidies (Brom & Orenstein, 1994).

In short, a pattern can be drawn from the economic transitions to market-based economies by China, Poland, and the Czech Republic, and their use of structural pension reforms to compensate for the economic hardships immediately following those transitions. Notice, parametric pension reforms are not commonly found in this cluster (figure 24).

While the average retirement age is 63.3 years old in these countries, China and the Czech Republic have a relatively low retirement age. Although the Czech Republic has increased the retirement age at a rate of two months per year since 1996, its retirement age only just reached the average in 2015.

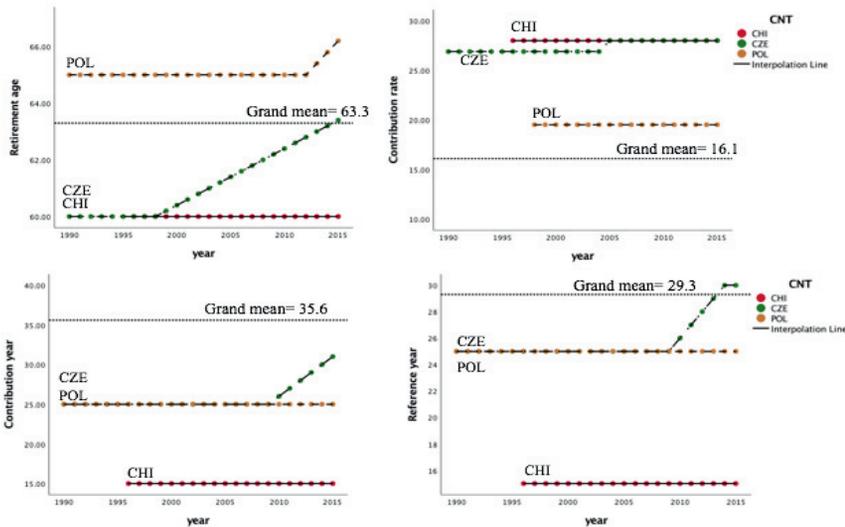


Figure 24. Retirement age, required contribution years, contribution rate and reference years among the latecomer structural pension (LSP) reforms.

However, the contribution rate is high in this cluster and it has remained unchanged, with the exception of the Czech Republic which increased their contribution rate by 2 per cent from 26 percent to 28 percent in 2005. Since early retirement age is relatively low compared to the grand-mean in this cluster, early retirement related reforms were extensive with the exception of China.

Except for China, the Czech Republic and Poland gradually made efforts to raise their early retirement age (figure 25). For instance, Poland's allowable early retirement age was 5 years with a 5.5 percent penalty per year in the 1990s, but it was entirely abolished in 2010. The Czech Republic gradually increased their early retirement penalty beginning in the 2000s even though the allowed early retirement age remained unchanged.

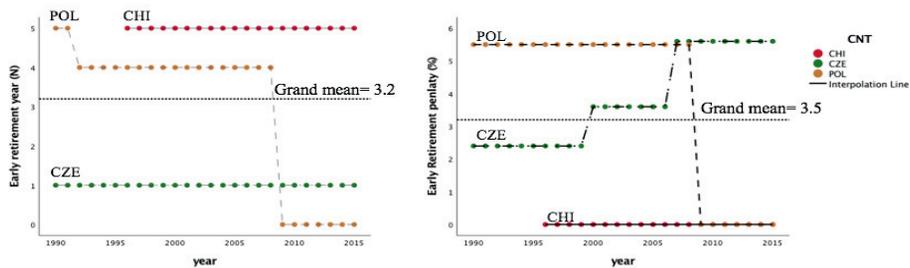


Figure 25. The maximum allowed early retirement age and early retirement penalty reforms in the latecomer structural pension (LSP) cluster.

Notably, three countries have favored the adoption of structural pension reforms or privatization pension reforms. China (1997) and Poland (1999) implemented Notional Defined Contribution arrangements (NDC). The Czech Republic also made a particular effort to privatize its pension system in early 1997 and also 2013. Capitalization pension reforms have gained attention since the early 1990s, in part because of problems with an increasing number of unprotected citizens and a change to a market-driven economy (figure 26).

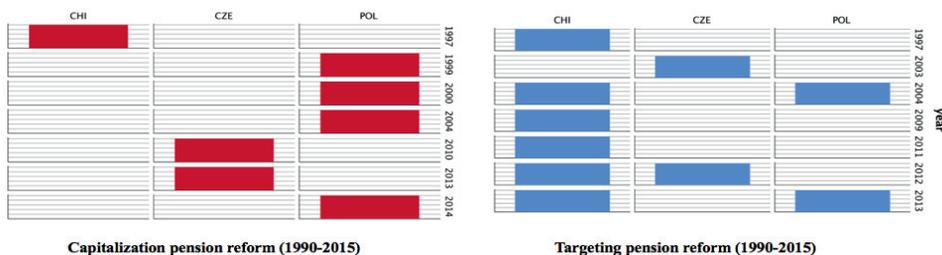


Figure 26. Capitalization and Targeting pension reforms in the latecomer structural pension (LSP) cluster.

With claims for social insurance being a central-pressing issue (WB, 1994) because of less political support, instead of introducing NDC however, the Czech Republic introduced state-contributory supplementary private pension insurance (*penzijní přípojištění se státním příspěvkem*) in 1994, as a funded personal pension system (ISSA, 1993) ⁴⁵. Further in 2013, the government made additional modifications to this supplementary private pension system. With a mandatory contribution of 3 percent of wages being taken out from public pension contributions and transferred to private pension accounts, but this was abandoned shortly after in 2014 (ISSA, 2014; Wang, Williamson, & Cansoy, 2016).

Since all three countries have instituted a non-egalitarian pension system, which largely excluded the farmer and other non-SOE-based employment, in order to legitimize this privatization pension reform, these countries also implemented expansionary pension reforms (Yi, 2015). Mainly using targeting-based pension reforms to cover those who were excluded from the system. China extended coverage of their public pension system to rural areas using government subsidies in 2009 (Y. Liu, Yang, Zheng, Jiang, & Gu, 2019). Poland also introduced a means and pension-tested non-contributory pension in 2013. Yet, even with the emergence of new social risks in the post-

⁴⁵ This reform was not classified as a capitalization pension reform in 1994. At the time of its introduction, the program was rolled-out without a supplementary tax incentives program, and it was not mandatory.

industrialized age, recalibration pension reforms were not utilized by any of the countries in this cluster; even though this reform type was designed to compensate for these risks⁴⁶.

3.1.4 Extensive Retrenchment Pension (ERP) Reforms

The extensive retrenchment pension (ERP) reform cluster is a reform classification for reform legislation that significantly retrenched inherent pension systems through significant parametric reforms including increases to retirement age and or contribution rate; with means-tested programs additionally added to compensate low-income groups. The existing pension structures in this cluster were often considered to have imbalanced cost structures: with low-contributions but high-benefits. However, inherited public pension programs in this cluster left considerable numbers of individuals with insufficient resources to live because of eligibility requirements. Therefore, additional expansionary reforms served as

⁴⁶ As opposed to other clusters, the Latecomer Structural Pension reform cluster lacks recalibration or targeting pension reforms. Reforms in this cluster tend to lack particular incentives or subsidies for atypical workers and vulnerable occupational groups (e.g. *migrant workers*). Thus, LSP reforms may increase wealth inequality among old-aged individuals and how income is distributed.

compensation in order to supplement for people over the age 65 and vulnerable working groups with very low or exclusive contributory pensions.

Of all the clusters, the extensive retrenchment pension (ERP) reform cluster is composed of pension systems that are noticeably more fragmented, with generous but asymmetric financing structures (i.e. low contributions requirements but high pension benefits). A fragmented coverage structure left a large number of people ineligible for benefits (e.g. the elderly and low-income groups). Radical demographic aging combined with post-industrial labor market changes had the severest impact on pension programs in this cluster. Five countries implemented reforms that match the reform features and themes of extensive retrenchment pension (ERP) reforms: Italy (1990-2007), Korea, Greece, France, and Sweden (1990-1996).

Before the 1990s, Greece had a highly generous pension system. Structurally, the Greek pension system was designed with an unbalanced pension structure, with high levels of generosity relative to required contributions (Featherstone, 2005). The standard retirement age was 55 for public sector workers and 60 years old for private sector workers, with a generous replacement rate of 70 percent (EC, 2015). The imbalances of the Greek pension system led to reforms starting in the late 1990s (ISSA, 2009). The replacement rate was reduced by 40 percent in 2010 (law 3863). In addition, the Greek pension system was originally highly fragmented. Worker

pensions were not managed by one single fund, with the three largest funds being: the IKA for private sector employers, the TEBE for non-agriculture self-employment, and the OGA for farmers (Angelaki & Carrera, 2015). However, a non-centralized system was problematic. Fragmentation gave rise to large groups of individuals that were excluded from these pension systems. With EU membership, member countries were forced to pledge their commitment to a cohesive society outlined by the EMU (European Monetary Union). To comply with these requirements Greece introduced an income-tested pension criterion for new benefits to increase the number of people covered by their pension system.

Italy has a long history of pension programs with their first program introduced in 1919. One key feature of all pension systems before the 1990s was their highly generous mandatory PAYG public pension; these programs provided on average about 72 percent of pre-retirement income to retired individuals (OECD, 2005). However, these benefits were highly dependent upon employment status. Under the umbrella of the Italian public pension system, workers were actually covered by a number of sub-pension systems divided based on employment status. For instance, standard workers were insured by the general pension system and received benefits up to a maximum of 80 percent of their earnings based on their last five years of income. Once this highly fragmented and unbalanced system collided with the challenges

associated with old and new social risks, the Italian government was forced to radically retrench their programs to curb the rising cost of pension systems. Organizations that pressured Italy to undertake reforms were the EMU (European Monetary Union) and the OMC (Open Method of Cooperation) (Kim, 2014). Italy frequently reformed their pension system, with some notable reforms implemented in 1992, 1995, 1997, 2004, 2007, 2009, 2010 and 2014; these reforms raised the contribution rate and retirement age, reduced pension benefits, and introduced an NDC program (OECD, 2005, ISSA, 2003, 2010, 2014). Means-tested supplemental pension systems were introduced for those over the age of 65 to tackle old age poverty. Additionally these pension reforms started unifying Italy's initially fragmented system and extensively reduced pension benefits (Brugiavini & Peracchi, 2011).

The French pension system deeply reflected the Bismarckian tradition of social insurance, and the main goal of their pension system was to guarantee income security for their workers (Palier & Thelen, 2010; Schludi, 2005). However, the French pension system was fragmented based on employment status (Palier & Thelen, 2010; Schludi, 2005). However, French pension systems are highly divided and separated according to employment status (Schludi, 2003)⁴⁷. Moreover, this divided pension system provided unequal

⁴⁷ The 'régime général' covers private sector, public sector, and self-employed workers. This program only covers 65 percent of private sector employees, 20 percent of public sector employees, and 12 percent of self-employed workers (Naczyk & Palier, 2011; OECD, 2011).

benefits and coverage, with minimal coordination between systems (OECD, 2009). For instance, public sector employee pension benefits were double those of private sector employees, while private management employee benefits were double those of self-employed benefits (OECD, 2012). France offered an average replacement rate of about 60 percent, much higher when compared to other countries in Europe (e.g. the UK offers 22 percent, Germany 38 percent). This high replacement rate was directly linked with the financial conditions (sustainability) of the French pension system. A large number of elderly individuals did not qualify for contributory pension systems at all or they received very low benefits. Early on in the implementation of the French system, spending was supported by high post-war economic growth, high rates of employment, and social insurance transfers that supported social solidarity (Palier, 2013). Demographic developments and rising unemployment enlarged the gap between revenues and expenditures. Even though increasing the required pension contribution rate was a politically unfeasible strategy to deal with the fiscal crises in France during the CRP, France frequently reformed its pension system. Notable reforms were implemented in 1993, 2003, 2006, 2007, 2010 and 2014, that raised the

The distinguishing between worker types added additional financial burdens onto this system in the post-industrialized era.

standard retirement age and also retrenched benefits by restricting who qualified for full pension benefits (OECD, 2005, ISSA, 2003, 2010, 2014).

Korea introduced its first pension program, the National Pension Scheme (NPS), in 1988. The late adoption of their pension program is important because fundamentally its structure is similar to the pension programs of other countries that had implemented systems much earlier (S. S. Kim, 2013). By 1988, similar programs were already beginning to face problems with sustainability and non-universal coverage; nevertheless, this structure was still adopted. It too became a program with low required contributions, but high benefits. In its initial stages, the contribution rate was 6 percent but the income replacement rate was set as 70 percent (Kim, 2014). Coverage was mainly limited to employed individuals, and while nominally universal coverage was adopted at the end of 1990s, it still left large populations of elderly ineligible (ISSA, 2001). Korea is one of the fastest aging countries in the world, and as a consequence of this unprecedented aging, the required contribution rate was increased from its original 6 percent to 9 percent in 1998. The replacement rate was also reduced from 70 to 45 percent. Expansionary pension reforms were also implemented alongside these retrenchment policies to improve general program coverage⁴⁸. For instance,

⁴⁸ The proportion of insured by NPS was 57.0% for working age group between 15 and 64 (source: Statistical data base, National Pension Service).

the Korean government strengthened social security income by introducing the Basic Old-Age Pension program; a tax-financed program that is proportionally subsidized by the central and local governments. The government has also increased accessibility to pension benefits by providing pension credits for individuals that provide child care.

Sweden belonged to the extensive retrenchment pension reform cluster between 1990 and 1998. In the 1990s, Sweden experienced a severe economic crisis that resulted in a skyrocketing unemployment rate (2 percent to 12.5 percent between 1990 to 1993) (OECD, 2005). This crisis triggered extensive pension policy reforms that were designed to reduce the financial burden on the state. During this period of time, Sweden's inherited pension systems were quite generous since pension benefits were citizenship-based and income replacement-based. Most notably, existing basic pension systems were abolished and overhauled; being instead replaced by a minimum pension supplement program, that required various income tested supplements. In 1999, Sweden then shifted to the labor-activated pension (LAP) reform cluster.

As figure 27 illustrates, all the countries in this cluster have extensively reformed their existing pension systems.

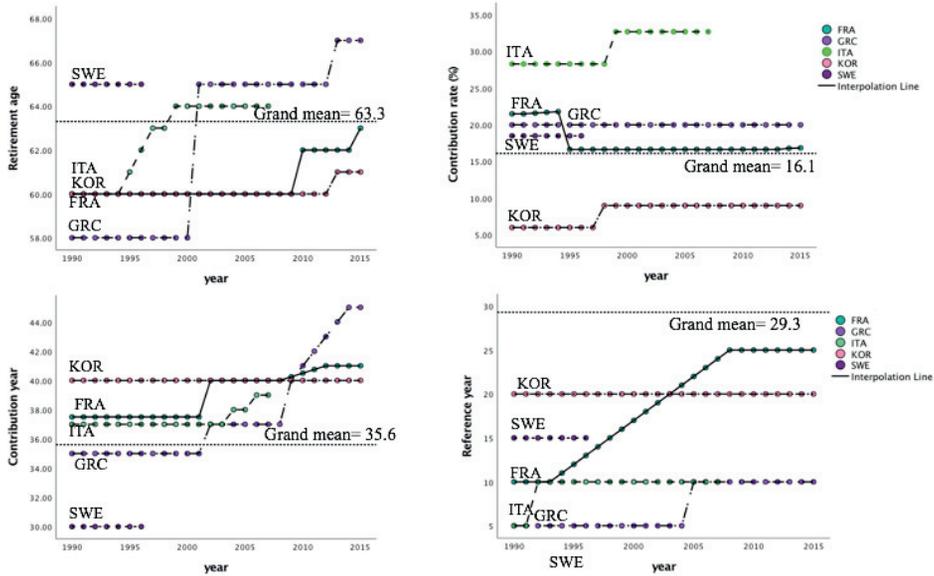


Figure 27. Retirement age, contribution rate, contribution years and reference years modification in the extensive retrenchment pension (ERP) reform cluster.

For France, since the 1990s the required full contribution period increased from 37.5 to 43.5 years in 2010. To apply for full pension benefits, pensioners have either completed the full contribution period or waited until age 67 to retire, even though the normal retirement age is 63. In Greece the retirement age increased from 58 to 67 years old, whereas Italy increased its retirement age from age 60 to 64 years old. Korea raised their retirement age from 60 to 65 years old in one-year increments, and increased their contribution rate by 50 percent in 1998 (6 to 9 percent) (figure 28)⁴⁹.

⁴⁹ For Korea, the maximum allowed number of years an individual may retire was 5 years before the standard retirement age. The early retirement penalty was 5 percent per year from

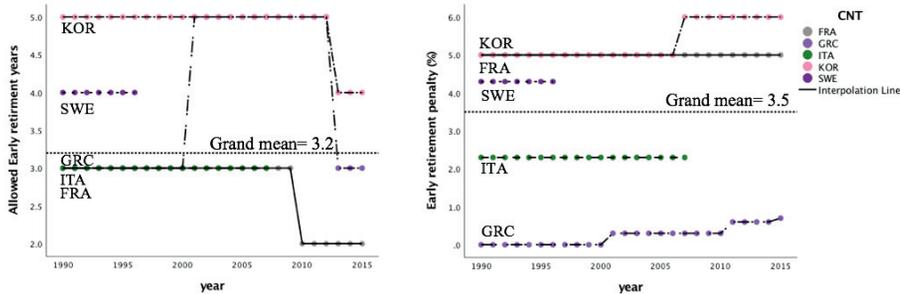


Figure 28. Allowed early retirement years and early retirement penalty in the extensive retrenchment pension Reform (ERP) cluster.

Despite extensive retrenchment reforms, expansionary reforms, particularly targeting reforms, were implemented in all the countries in this cluster. For instance, The Korean government introduced the Basic Old-Age Pension in 2007 to provide pension benefits to elderly individuals who were ineligible for the NPS.

1988 to 2007. The penalty rate was increased from 5 percent to 6 percent per year. However, penalties were phased-in according to the maximum and the minimum retirement year. This study used Korea's first year penalty rate of 6 percent per year based on ISSA data. (Note: this study referenced data from ISSA. According to the Korean early retirement penalty reform laws implemented in 1998 and 2007, a penalty was phased in based on the number of early retirement years. This actual per year penalty is then calculated using a base penalty rate, and is then multiplied by the number of years an individual retired early. For example, if an individual retires early by one year, the early retirement penalty is 6 percent, 12 percent for two years, and 18 percent for three years (NPS, 2008).

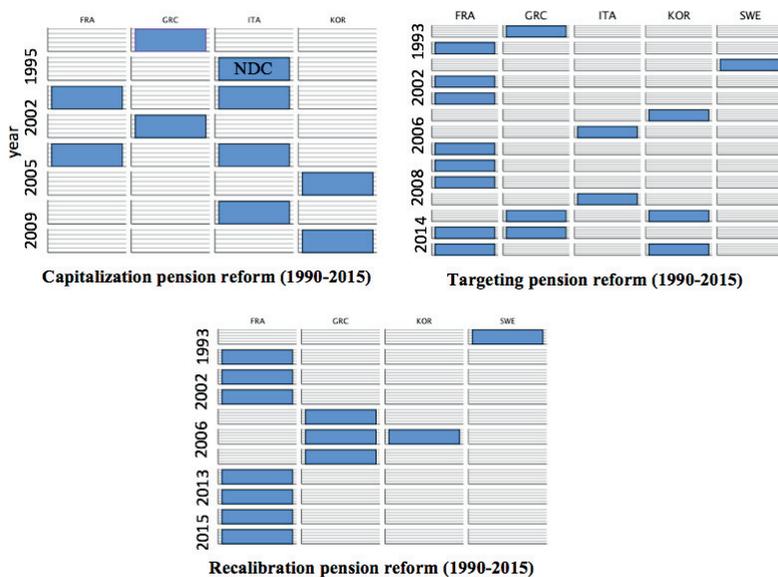


Figure 29 Capitalization, Targeting and Recalibration pension reform in extensive retrenchment pension reform (ERP) cluster.

3.1.5 Summary

The central aim of this section was to identify the distinctions and similarities between the four pension reform clusters introduced by this study. It is possible now to understand how pension reform groupings with similar structures responded to different financial sustainability problems. An additional benefit of this study’s methodology is the ability to analyze the differences in responses on a country level to these challenges, depending on their socio-economic and political background, and pension’s institutional structure. One result of this study was understanding the fluidity countries

have to change which pension reform cluster they belong to depending on their policy responses. Some countries belonged to multiple different pension reform clusters over the CRP (1990 - 2015), shifting from one cluster to another cluster depending on their pension reform policy (figure 30). One example of a cluster shift is Sweden, shifting from the extensive retrenchment pension (ERP) reform cluster to the labor-activated pension reform (LAP) cluster in 1997. In total, four countries out of the 15 examined in this study shifted to a different cluster at least once during the CRP.

Each pension reform cluster addressed pension sustainability issues using different pension reform policy tools. Labor-activated pension (LAP) reforms tackled pension sustainability problems that arose from an imbalance in the pension dependency ratio, where number contributors were insufficient compared to the number of beneficiaries. These reforms increased labor supply through parametric reforms that incentivized workers near retirement to stay in the workforce or to re-enter it. Extended privatization pension (EPP) reforms generally expanded mandatory private and occupational pension programs to provide near-universal coverage. These reforms attempted to directly link the pension benefits of each individual to the amount they contribute to the system. Latecomer structural pension (LSP) reforms transformed existing DB pension systems into NDC or private systems. These countries recently transitioned from centrally-planned economies to market-

based economies and, therefore, their attempts to reform their pension systems only began during the CRP.

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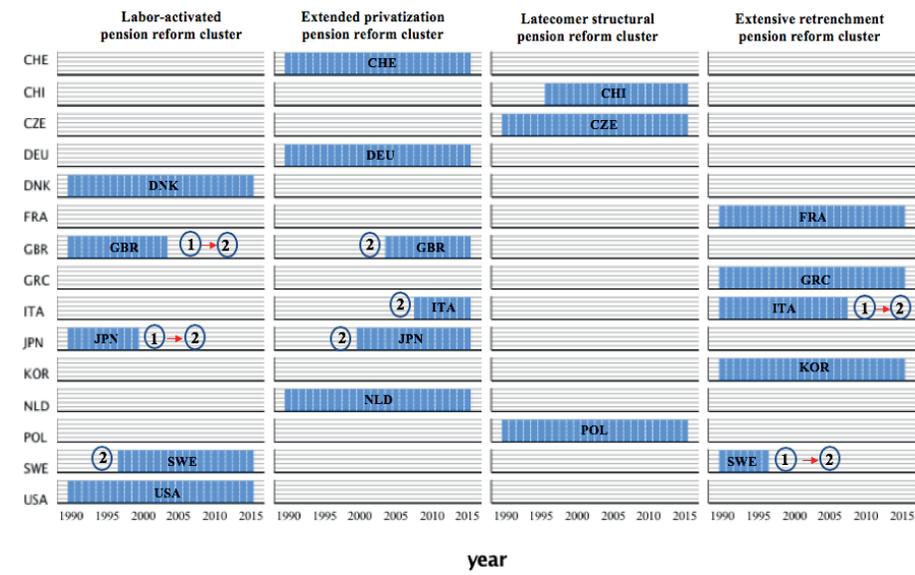


Figure 30. A bar-chart representation of the four pension reform clusters and the associated countries that belong to them. The proportion of the bar that is blue corresponds to the period of time that a country belonged to a particular pension reform cluster during the CRP (1990 - 2015). Some countries belonged to multiple pension reform clusters. Red arrows denote shifts from one cluster to another cluster. The numbers denote what order of clusters a country belonged to, starting with the number ①.

Extensive retrenchment pension (ERP) reforms were intended for countries with highly fragmented and asymmetric financial structures that were defined by low contribution rates but high pension benefits. This cluster is defined by parametric reforms that rebalanced the ratio between contributions and benefits, and united these pension systems into a smaller number of larger programs that covered more occupational groups. The pension reform clusters introduced in this study represent different reform policy techniques responding to similar old and new social risks. This study emphasizes that pensions' institutional structures are not static, they dynamically respond to macro-level socio-economic changes using pension

reform policy tools. In the following section each pension reform cluster's effects on pension expenditure and generosity will be explored.

4.1 Mixed Effect Model Analytical Results

The previous section explored the different pension reform characteristics of each cluster and used classification as a tool to understand pension reform policy. This section uses linear mixed-effect models (LMMs) to estimate how pension reforms have affected pension effort. An understanding of the macro-socioeconomic background for each cluster will aid in this process and improve this study's ability to identify critical trends (figure 31).

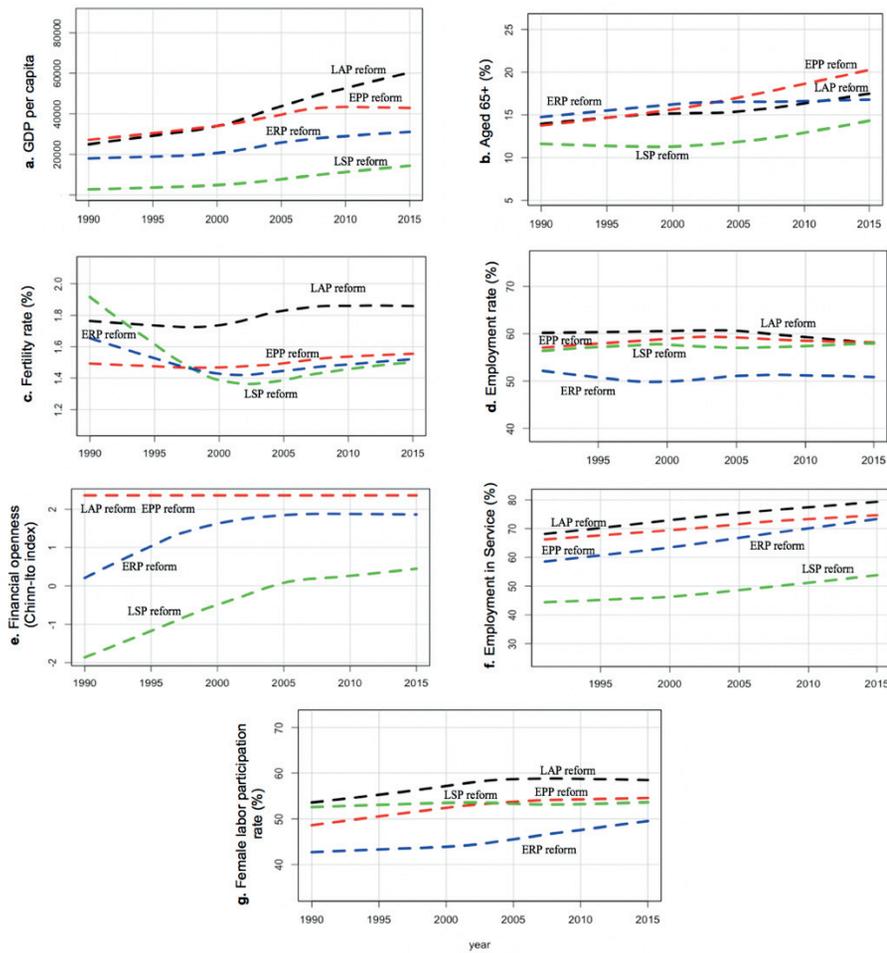


Figure 31. Macro-socioeconomic background among four pension reform clusters in CRP from 1990 to 2015.

a. GDP per capita; b. aged 65+ population (%); c. Fertility rate (%); d. Employment rate (%); e. Financial openness; f. Employment in services; g. Female labor participation rate (%)

Legend: (LAP) Labor-activated pension reform (LAP)=black; (ERP) Extensive retrenchment pension reform=blue; (LSP) Latecomer structural pension reform=green; (EPP) Extended privatization pension reform=orange;

The labor-activated pension (LAP) reform cluster is generally composed of advanced welfare states that experienced the highest unemployment rates and most pressing demographic changes prior to the CRP. However, their transition into the CRP has been met with significant GDP

growth and high employment rates. At the same time, this cluster is facing the highest level of new social risks in regions like: women's labor participation, employment in services and economic openness. In response to new social risks, most of the countries in this cluster made significant reforms meant to mitigate their effects (Tepe & Vanhuysse, 2010). One metric reflective of these efforts may be fertility rate, which remains the highest among the clusters in this study (see figure B). In response to these socio-economic conditions and existing pension systems, reforms in the LAP cluster significantly modified pension parameters. These are a combination of public and supplementary private pension systems, that sustain a pension system by maintaining a larger base of workers in the labor market to continue contributing. The parameters usually reformed to achieve this goal are delays to retirement age, penalties to early retirement, an increase to means-tested requirements, or the linking of pension benefits to contributions. To incentivize participation in the labor market, expansionary reforms, targeting and recalibration reforms, were used to increase the number of contributors to a pension system by either lowering eligibility requirements or bringing workers back into the market.

The extended privatization pension reform (EPP) cluster is very similar in its Marco-socio-economic structure to the labor-activated pension (LAP) reform cluster, in that it is defined by developed nations that

experienced drastic macro-socio-economic changes before the CRP. However, in the CRP this cluster had the highest levels of aged 65 years and older individuals, coupled with moderately high economic growth. Growth compared to the labor activated pension reform cluster may have been lower due to this aging. When a higher proportion of a total population is elderly, a larger proportion of economic expenses must be spent on retirement care. However, another additional feature of this cluster's socio-economics is lower birth rates. Some new social risks of interest that have had a particular effect on this cluster are increasing service sector employment rates and higher economic openness. For instance, as mentioned in chapter four (section 1.2), macro-socio-economic changes in the post-industrial era have resulted in an increased economic openness (globalization), and these increases tend to increase the proportion of service-sector and atypical employment. According to prior studies, countries with a higher degree of economic openness tend to spend more on pension systems to incentivize workers to either move to their country or remain in their country (e.g. Compensation Theory) (Pampel & Williamson, 1985, 1989; Tabellini, 2000; Tepe and Vanhuyse, 2009). Even though this cluster has a socio-economic background that is considerably similar to the LAP cluster, there are still some key differences. The extended privatization pension (EPP) reform cluster employed various parametric pension reforms and, at the same time, required and incentivized enrollment

in occupational or individual pension programs. This was in conjunction with existing public pension systems. These reforms are designed to shift the responsibility of financing retirement from states to private entities and individuals. However, in order to compensate disadvantaged groups and unpaid workers, various expansionary pension reforms were also implemented in tandem; for example, means-tested pension benefits, tax reductions or earnings-related subsidies to employers, employees or individuals. Additionally, reforms in the extended privatization pension (EPP) reform cluster not only added supplementary programs to their existing public pension systems, but in return balanced system costs, and the existing system was then modified parametrically; particularly these reforms typically increased retirement age, the required number of contribution years, and reference years to access full pension benefits.

The latecomer structural pension (LSP) reform cluster is composed of countries that had transitioned from centrally planned economies to widespread market-based economies at the inception of their original pension programs. Their transition to market based-economies was not smooth and this was reflected in their relatively slow economic growth (% GDP per capita). Structural changes are not the only facet that describe the struggles these countries have had during the CRP; demographic issues have also played an outsized role in their economies. Not only had their relative populations aged,

but at same time, there was a dramatic drop in their fertility rates. New social risks have been reflected in their rising proportion of service sector employment and the swift opening of their economies. This cluster turned to structural-based reforms as a countermeasure to the ballooning pension expenditures that ensued because of these different macro-socio-economic hardships. Reforms in the latecomer structural pension (LSP) reform cluster significantly modified the inherent structure of their pension systems, through a high degree of structural pension reform or privatization, with minor changes to their defining parameters. From the perspective of the contributor, contribution rates remained static. However, using capitalization reforms, part of the responsibility of benefits was passed from the government to the market. These reforms expanded coverage to target populations that had not been previously covered through state sponsored pension systems alone; for example, expansion of coverage from only government employees and state-owned enterprises to private companies and farmers. Yet, even with the emergence of new social risks in the post-industrialized age, recalibration pension reforms were not utilized by any of the countries in this cluster; even though this reform type was designed to compensate for these risks.

The extensive retrenchment pension (ERP) reform cluster, is composed of countries that demographically aged the most, and experienced the greatest long-term economic hardships because of economic crises during

the CRP. An additionally critical issue was the decline of birth rates in these countries. New social risks also added stress to their economic hardships with increases in atypical workers, women's labor participation rates, and serious issues with low employment rates. Radical demographic aging combined with post-industrial labor market changes had the severest impact on pension programs in this cluster. The extensive retrenchment pension (ERP) cluster significantly retrenched inherent pension systems through significant parametric reforms including increases to retirement age and or contribution rate; means-tested programs were additionally added to compensate for low-income groups. The existing pension structures in this cluster were often considered to have imbalanced cost structures: with low-contributions but high-benefits. Fragmented coverage left large numbers of people ineligible for benefits (e.g. the elderly and low-income groups). Therefore, additional expansionary reforms served as compensation in order to supplement these programs for people over the age 65 and vulnerable working groups with very low or exclusive contributory pensions.

Each pension reform clusters' socio-economic backgrounds provide insight into the underlying indicators that are correlated with their adoption of different pension reform policies. The following section aims to demonstrate how pension reform clusters statistically affect pension expenditure and pension generosity based on a Linear Mixed Effect Model (LMM).

4.1.1 Pension Expenditure

Table 16. The effects of pension reform clusters on pension expenditure, model 1 only considers pension reform cluster variables, model 2 only considers socio-influential factors, and model 3 considers both pension reform clusters and socio-influential factors.

Variables	Model 1	Model 2	Model 3
Fixed effects			
Labor-activated pension (LAP) reform (ref. extensive retrenchment pension reform)	-0.870 (-3.129) **		-0.506 (-2.674) **
Extended privatization pension (EPP) reform (ref. extensive retrenchment pension reform)	0.521 (1.774)		0.3034 (1.543)
Latecomer structural pension (LSP) reform (ref. extensive retrenchment pension reform)	-1.258 (-0.538)		3.951 (1.989)
GDP per capita (<i>log</i>)		-0.842 (-3.843) ***	-0.937 (-4.189) ***
Financial openness: Chinn-Ito index		0.350 (4.938) ***	0.453 (6.580) ***
Aged 65+ Population (%)		0.158 (4.594) ***	0.104 (3.126) ***
Fertility rate (%)		2.034 (6.304) ***	2.507 (7.256) ***
employment rate (%)		-0.274 (-12.610) ***	-0.274 (-13.409) ***
Women labor participation rate (%)		0.092 (4.102) ***	0.109 (5.150) ***
Employment in Services (%)		0.199 (7.062) ***	0.197 (7.176) ***
Left-wing partisanship (ref. center)		-0.023 (-0.171)	-0.070 (-0.577)
Right-wing partisanship (ref. center)		-0.026 (-0.248)	-0.158 (-1.544)
Intercept	6.901 (6.402) ***	8.355 (3.478) ***	7.878 (3.193) **

Random effects (countries)			
Intercept	13.035	10.308	8.648
Std. Dev.	3.610	3.211	2.941
Model fit			
AIC	1060.822	784.395	722.037
BIC	1182.474	924.094	872.497
N	374	358	350

*Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.*

Three models are examined in this study and are labeled as models 1, 2, and 3 (table 16). Model 1 is only executed using the parameters from the pension reform clusters generated in this study, model 2 is only executed using parameterized socio-influential factors (control variables) gathered from previous works (e.g. demographic, macro-economic and political factors), and model 3 accounts for both the effects of the pension reform clusters and the socio-influential factors. Specifically, model 3 is a combination of model 1 and model 2, taking into consideration how pension reform clusters in combination with a set of defined control variables affect pension expenditure. The goal is determining if pension reform clusters have unique effects on pension expenditure, thus model 3 is an extensive examination of the effect of the clusters in model 1 when outside effects are more strictly controlled. Model 1 found statistically significant observable differences between the pension reform clusters, therefore model 3 is used to confirm the validity of those results. When model 3 was applied, relative reductions in pension expenditure

by the labor-activated pension (LAP) reform cluster, compared to the reference pension reform cluster (extensive retrenchment pension reform), were still statistically significant; confirming the results of model 1. Note, that the statistical estimations in this study used a goodness-of-fit test that compared Akaike Information Criterion (AIC) values, an often-used method for model selection, between the three models, where a lower score is indicative of a model that better represents a distribution (Hurvich & Tsai, 1991). Comparing all three models, model 3 (full-model, AIC=722.037) had an improved goodness-of-fit compared to the AIC scores of models 1 and 2 (AIC=1060.822; AIC=784.395). Again, confirming that model 3 validates the assumption ‘that each cluster uniquely affects pension expenditure’.

The estimates for pension expenditure from the LMMs used in this study are shown in table 16; the results express how each pension reform cluster affects pension expenditure relative to a chosen reference cluster, the extensive retrenchment pension reform cluster. This modeling technique is used to confirm whether each cluster has a unique effect on pension expenditure.

Model 1, using the previously mentioned reference cluster, found a negative relationship between pension expenditure with respect to the labor-activated and latecomer structural pension reform clusters; meaning these two clusters reduced pension expenditure compared to the extensive retrenchment

pension reform cluster. Notably, the labor-activated pension (LAP) reform cluster statistically significantly reduced pension expenditure ($\beta=-0.870$, $P< 0.01$).

Model 2 explored how the methods of previous studies drove pension policy output with socio-influential factors. This study confirms the effects of socio-influential factors on pension expenditure. The results from analysis of these control variables are consistent with previous works: GDP per capita, financial openness (with respect to compensation theory), the percentage of the age 65+ population, employment rate, and also political factors (Cameron, 1978; Rodrik, 1998; Garrette & Mitchell, 2001; Avelino et al, 2005; Tepe & Vanhuyse, 2009). In the case of GDP per capita, an increase in GDP per capita ($\beta=-0.842$, $P< 0.001$) was correlated to a reduction in pension expenditure.

Model 3 confirmed the results of model 1, that the labor-activated pension (LAP) reform cluster statistically reduced pension expenditure relative to the reference pension reform cluster (extensive retrenchment pension reform cluster) ($\beta=-0.506$, $P< 0.01$). While the effects are more moderate than model 1, the statistical effects and direction are consistent between model 3 and model 1. There could be a number of reasons why this cluster was successful at reducing expenditure more than the reference cluster. It was reported previously in chapter 4 (2.2) that the retirement age for this

cluster had the highest average (64.8 years old) by the end of the CRP. High retirement age forces longer participation in the labor market, and at the same time, reduces the effective period that a pensioner can be dependent on the system (i.e. increases the work-to-dependency ratio). This reform leads to a reduction in the payout to pensioners, and increases the period they must contribute through income tax revenues (OECD, 2013). The results in table 16 match with the discussion in chapter 4 (2.2). Five countries implemented pension reforms that match the reform features and themes of labor-activated pension reform (LAP)s: Denmark, Sweden (1997-2015), Japan (1990-2000), the UK (1990-2003), and the US. Although there were considerable demographic and labor market pressures, Sweden and Japan successfully reduced pension expenditure during the CRP. The other countries in this cluster also maintained either stable expenditure, or expenditure that only slightly increased over this period.

In model 3, some coefficients of the control variables used in this study are consistent with a number of existing studies (Tepe & Vanhuyse, 2010). In the case of economic growth, increases in GDP per capita ($\beta = -0.937$, $P < 0.001$) were correlated to relative reductions in pension expenditure. This confirms the possible explanation that relative declines in pension expenditure are correlated to the rapid growth of advanced welfare states, and how new revenue is spent within an economy. This study argues that in order to respond

to the emergence of new social risks, advanced welfare states need to implement and expand other welfare programs.

Financial openness was correlated to an increase in pension expenditure ($\beta = 0.453$, $P < 0.001$). Prior studies have reported largely inconsistent conclusions regarding the relationship between financial openness and welfare expenditure (or pension expenditure), because of two major competing theories: compensation theory and efficiency theory (Kim, 2007; Wibbels, 2006; Haggard, 2005; Castells, 2004; Castells, 1996; Swank, 2001). As mentioned in chapter four (section 4.2), macro-socio-economic changes in the post-industrial era have resulted in an increased economic openness (globalization), and these increases tend to increase the proportion of service-sector and atypical employment. A possible explanation for the increase in pension expenditure could be as a response to increasing global competition. From Compensation Theory, countries with a higher degree of economic openness tend to spend more on pension systems to incentivize workers to either move to their country or remain in their country.

The strongest and most consistent effect on pension expenditure corresponds to increases in the percentage of the aged 65+ population ($\beta = 0.104$, $P < 0.001$). When a higher proportion of the total population is elderly, then a larger proportion of economic expense must be spent on retirement; specific to this study, countries with an aged 65+ population higher

than the total average offered more pension program resources. This also confirmed the previous section that countries like Italy, Greece, Japan, and France show a particular linear relationship between two indications. This relationship is also consistent with previous works (e.g. Pampel & Williamson, 1985, 1989; Tabellini, 2000; Tepe and Vanhuysse, 2009).

This study found that fertility rates were also significantly correlated to pension expenditure ($\beta=2.507$, $P< 0.001$). Specifically, countries with higher fertility rates see increases in their pension expenditure on average, holding all other variables constant. One possible explanation could be that advanced welfare states may spend more on social benefits, including pension benefits, to incentivize individuals to start families. Therefore, countries like Sweden, Denmark, Switzerland and France that have made efforts to increase their fertility rate since the mid of 2000s, they also have higher corresponding pension expenditure (Figure 31, appendices).

For employment rate, as it increases, pension expenditure decreases ($\beta=-0.274$, $P< 0.001$). For all public pension systems, especially for PAYG systems, governments pay benefits to the current population of retirees using the contributions generated from the payroll taxes of those currently employed; therefore, if the employment rate increases faster relative to the retirement rate, more revenue is available to pay for the system. Meaning the government needs to spend less additional capital to sustain the system. These

results are in line with previous studies (e.g. Wolf, et al., 2008; Ross, 2000). As a result, countries with higher employment rates are likely to spend less than countries with lower employment rates. In contrast, increases to service-based employment is statistically significantly related to increases in pension expenditure ($\beta = 0.197$, $P < 0.001$). As the proportion of service sector employment increases relative to the total labor population, pension expenditure also increases.

Increases in female employment rates are correlated to increases in pension expenditure ($\beta = 0.109$, $P < 0.001$). One possible explanation is that female workers are generally employed to a higher degree than men in service-based jobs, this increases the likelihood that they would be a burden on the pension system. In addition, female employees experience a much larger degree of job interruptions or reduced working hours due to factors like childbirth and parenting. This means they are more frequently disqualified from employment-based private pension programs and are a larger burden on welfare systems. Countries with higher labor participation rates of women may spend more than countries with lower women's labor participation rates.

This study found no evidence of a significant relationship between government ideology and pension expenditure. Prior studies' estimates on the role of political effects on pension policy are inconsistent. Some studies confirmed Pierson's core concept of "blame avoidance" by arguing that

partisan effects on total social spending were statistically significant before the 1990s. However this phenomenon effectively disappeared between 1990 and 2002 (Kown & Pontusson 2010). Some studies argued that the different roles of political parties corresponded to the old politics of “power resource theory”; while others insisted that globalization had diminished the partisan divide on social spending issues (e.g. Huber & Stephens, 2001a; Jahn, 2006; Rueda, 2007; Amable et al., 2006). From Pierson’s core concept of “blame avoidance”, politicians tend to retrench programs by using indirect pension reform processes instead of cutting pension expenditure directly.

4.1.2 Pension Generosity

To examine how pension reform clusters have affected pension generosity, this study used the same statistical analysis procedure that it performed for pension expenditure. These results are in table 17, and they express the pension reform cluster effects on pension generosity with respect to a chosen reference cluster; in this study the extensive retrenchment pension reform cluster.

Table 17. The effect of pension reform clusters on pension generosity, model 1 only considers pension reform cluster variables, model 2 only considers socio-influential factors, and model 3 considers both pension reform clusters and socio-influential factors.

Variables	Model 1	Model 2	Model 3
Labor-activated pension (LAP) reform <i>(ref. extensive retrenchment pension reform)</i>	-2.328 (-1.096)		-2.564 (-1.105)
Extended privatization pension (EPP) reform <i>(ref. extensive retrenchment pension reform)</i>	-1.262 (-5.641) ***		-9.667 (-4.011) ***
Latecomer structural pension (LSP) reform <i>(ref. extensive retrenchment pension reform)</i>	-3.437 (-0.358)		-6.155 (-0.522)
GDP per capita (<i>log</i>)		12.504 (5.479) ***	13.474 (4.993) ***
Financial openness (Chinn-Ito index)		-1.089 (-1.344)	-1.766 (-2.085) *
Aged 65+ Population (%)		-1.104 (-0.399)	-0.077 (-0.191)
employment rate (%)		-0.155 (-0.634)	-0.186 (-0.747)
Fertility rate (%)		-5.429 (-1.541)	-8.543 (-2.050) *
Female labor participation rate (%)		0.575 (2.247) *	0.410 (1.579)
Employment in Services (%)		-0.865 (-3.037) **	-0.879 (-2.784) **
Government (Left) <i>(ref. center)</i>		3.521 (2.359) *	3.630 (2.394) *
Government (Right) <i>(ref. center)</i>		2.663 (2.166) *	3.119 (2.447) *
Intercept	6.249 (13.199) ***	-16.472 (-0.693)	-11.131 (-0.412)
Random effects (CNT)			
Intercept	215.14	246.97	233.47
Std. Dev.	14.668	15.715	15.280
AIC	2469.142	2406/262	2299.455

*Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.*

From Model 1, for pension generosity, a negative relationship between the reference cluster and the labor-activated, extended privatization and latecomer structural pension reform clusters was found; meaning all three of these clusters reduced pension generosity more when compared to the extensive retrenchment pension reform cluster. Notably, reforms in the extended privatization pension (EPP) reform cluster statistically significantly reduced their pension generosity ($\beta = -1.126$, $P < 0.001$).

In Model 2, using the estimates of socio-influential factors (including socio-economic, political and institutional factors), the results from the analysis of these control variables was consistent with previous works: GDP per capita, and female labor participation (Tepe & Vanhuysse, 2009; Zohlhofer et al, 2013; Wolf et al, 2014).

In model 3, this study examined the effect of pension reform clusters on pension generosity by including all selected control variables. Model 3 confirmed the results of model 1, that all three pension reform clusters reduced pension generosity compared to the reference cluster. When the whole population is analyzed in model 3, the statistical effects and direction are consistent between model 3 and model 1. The extended privatization pension (EPP) reform cluster still significantly reduced pension generosity relative to

the reference pension reform cluster (extensive retrenchment pension reform cluster) ($\beta=-9.667$, $P< 0.001$). The extended privatization pension (EPP) reform cluster created a more direct link between pension benefits and an individual's pension contributions by shifting to mandatory enrollment in occupational or individual pension programs. In addition, pension systems in this cluster are designed with relatively small public pension expenditure in comparison to programs in other clusters. As indicated in chapter four (section 2.2), Even though targeting and recalibration pension reforms play a compensatory role in income security, pension benefits fall short of expectations because of their insufficient coverage of an increasing number of atypical workers. This study confirms the results of existing findings that shifts from DB programs to DC programs (mandatory) tend to have adverse effects on pension income security levels (M. Tepe & Vanhuyse, 2010; ILO, 2017; Kennett & O'Connor, 2013; Kwon & Pontusson, 2010).

Regarding the effects of social economic and political factors on pension generosity, the findings in this study are very much in the line with prior studies (Scruggs & James, 2006; Kwon & Pontusson, 2010; Schokkaert, Devolder, Hindriks, & Vandenbroucke, 2018; M. Tepe & Vanhuyse, 2010; Wolf, Zohlnhöfer, & Wenzelburger, 2014). An increase in GDP per capita ($\beta=12.474$, $P< 0.001$) was correlated to an increase in pension generosity. It suggests that countries with higher GDP per capita would have

higher pension generosity. In contrast, financial openness was correlated to a decrease in pension generosity ($\beta=-1.766$, $P< 0.05$). As mentioned in chapter four (section 2.2), macro-socio-economic changes in the post-industrial era have resulted in an increased economic openness (globalization), and these increases tend to increase the proportion of service-sector and atypical employment. It is reasonable to assume that countries with higher financial openness would retrench their replacement rates. Using similar logic, service-based employment has a statistically significant negative impact on pension generosity ($\beta=-0.879$, $P< 0.01$) because of inadequate contribution records.

With respect to political factors, compared to centrist political ideologies, both left and right-wing political parties prefer increasing pension generosity ($\beta=3.630$, $P< 0.05$; $\beta=3.119$, $P< 0.05$). From Pierson's core concept of "blame avoidance", because welfare programs are popular, politicians are forced to retrench programs through indirect means, such as increases to the retirement age, or to refrain entirely from retrenchment (Jensen & Mortensen, 2014; Pierson, 1996). The relationship between political ideology and pension generosity has been largely neglected in prior studies. Only a few quantitative studies have examined pension generosity, however, their conclusions are mixed and or are contradictory (e.g. Hicks & Freeman, 2009; Häusermann, 2010; M. S. Tepe & Vanhuyse, 2012; Fernández, 2012; Wolf, Zohlnhöfer, & Wenzelburger, 2014).

This study properly characterized the duality of pension reforms: pension retrenchment and pension expansion. Following, this study then analyzed the response to pension reforms using two variables: pension expenditure and pension generosity. This section provides quantitative evidence that labor-activated pension reform (LAP)s significantly decrease pension expenditure, and that extended privatization pension (EPP) reforms reduce pension generosity relative to the reference pension reform cluster (extensive retrenchment pension reform cluster). Both pension reform types significantly address pension sustainability problems, but the level of the retrenchment that extended privatization pension (EPP) reforms cause risk providing inadequate pension benefits to at-risk groups. Regarding socio-economic and political factors, this study is in line with prior studies.

Chapter Five: Conclusion

1.1 Research Summary of Findings

This study started by exploring the pension reform policy from two broad conceptualizations: contractionary and expansionary pension reforms. Specifically, pension reform variables include: insurance (e.g. parametric pension reforms), capitalization (e.g. DB to DC shifts), targeting (e.g. means-tested), and recalibration (e.g. pension credits). Using unsupervised statistical methods, hierarchical clustering and *K*-means cluster analysis, this study grouped pension reforms into different pension reform clusters based on the two previously mentioned conceptualizations. From these clusters, this study performed a more comprehensive analysis of pension reforms trajectories and investigated their effects on pension efforts in terms of pension expenditure and pension generosity during the period of 1990 to 2015 (CRP). Conventionally, previous studies used socio-influential factors look at welfare programs from a macro perspective (e.g. socio-economic, institutional, and political factors) to characterize pension policy output changes, with a heavy emphasis on pension expenditure. This study compiled both expansionary and retrenchment pension reform programs, and then answered three research

questions. How are pension reform variables clustered into different groups? How have different pension reform clusters affected pension expenditure? How have different pension reform clusters affected pension generosity? To evaluate pension reform effectiveness, this study uses Linear Mixed Effect Modeling.

Cluster Analysis categorizes pension reforms into four pension reform clusters: labor-activated pension (LAP) reforms, extended privatization pension (EPP) reforms, latecomer structural pension (LSP) reforms and extensive retrenchment pension (ERP) reforms. Each pension reform cluster is characterized by a theme that reflects the institutional legacies and macro-socio-economic changes of those pension reforms. The labor-activated pension (LAP) reform cluster consists of various parametric pension reforms that encourage individuals near retirement age to continue working or re-enter the workforce, thus increasing labor supply. Targeting and recalibration reforms incentivize participation in the labor market by lowering pension eligibility requirements. The extended privatization pension (EPP) reform cluster shifts enrollment in occupational or individual pension programs from voluntary to mandatory, and these programs then work in conjunction with existing public pension systems. In order to compensate disadvantaged groups and unpaid workers, various expansionary pension reforms were also implemented in tandem with contractionary reforms. Latecomer structural

pension (LSP) reforms modify inherited pension structures through a high degree of structural or privatization pension reforms. This cluster passes the responsibility of funding pension programs from the government to the individual. The extensive retrenchment pension (ERP) reform cluster retrenches inherited asymmetric pension systems through radical parametric reforms, then means-tested programs are additionally added to compensate low-income groups and impoverished elderly. Pension reform clusters are characterized to varying degrees using pension reform types including Insurance, Capitalization, Targeting and Recalibration.

This study properly characterized the duality of pension reforms: pension retrenchment and pension expansion. Following, this study then analyzed the response to pension reforms using two variables: pension expenditure and pension generosity. It then identified and classified pension reforms based on their similarities into four different pension reform clusters. This study provides quantitative evidence that labor-activated pension reforms (LAP) significantly decrease pension expenditure, and that extended privatization pension (EPP) reforms reduce pension generosity relative to the reference pension reform cluster (extensive retrenchment pension reform (ERP) cluster). Both pension reform types significantly address pension sustainability problems, but the level of the retrenchment that extended

privatization pension (EPP) reforms cause risk providing inadequate pension benefits to at-risk groups.

1.2 Theoretical Implications

There are four theoretical implications that can be summarized in this dissertation: that pension reforms are the key to understanding pension effort (pension expenditure and pension generosity), that contractionary and expansionary pension reform policies should be studied together, that East-Asian countries should be included in comparative policy analysis, and that policy classifications should consider the process of policy change, from a dynamic perspective rather than static characteristics.

Traditionally, the consequence of analyzing pension effort (particularly expenditure) from a broader socio-influential-factor-based perspective is a focus on retrenchment-based pension policy, that is rooted in the inherited theories of the welfare state crisis. Often, welfare expenditure and pension expenditure by relation, have been traditionally broken into three socio-influential factors: socio-economic, political and institutional factors. This study addressed that pension reform – the tool used to modify pension effort - is the linchpin that will ultimately define pension policy output. This study statistically provided that pension reform is the policy instrument necessary to restructure the existing policy architecture of pension systems that define

pension expenditure and generosity. Thus, the omission of pension reform analysis has potentially violated the research outcomes of prior works, that up to this point have resulted in ineffective policy changes.

Pension reform research has been primarily focused on retrenchment policies up to this point, the step necessary to create a broader conceptualization of these policies is to also consider expansionary policies too. The world as it was during the welfare state crisis is not the same world that it is now in a post-industrial era. Contemporary welfare states are now confronting both pressures of old and new social risks. Pension policy reforms now reflect these two forms of social risks and now are comprised of two interconnected components, retrenchment and expansionary reforms. Both retrenchment and expansionary pension reform policies in the CRP can be sufficiently understood when a multidimensional framework is utilized. Accordingly, examining how both contractionary and expansionary pension reforms affected both pension expenditure and pension generosity provides a comparative analysis that advocates for further pension reform policy research.

In mainstream comparative social policy literature, welfare policy has been traditionally formulated with references to only “advanced” welfare states, referring exclusively to western industrialized nations (Walker & Wong, 2013). The argument for excluding other countries, and of particular interest

East Asian countries, is that welfare policy is less developed in these regions. In reality, this argument is outdated because there are a number of affluent East Asian economies. This study differs from preceding research because of its inclusion of China, Japan, and Korea into its analysis. While Japan and Korea are in fact OECD countries they are not generally included in comparative welfare studies. The same socio-economic transformations that have preceded the challenges to pension reforms in western countries have been recently observed in these three East Asian countries. Additionally, these countries are all well represented by Bismarckian and Beveridgean pension system types, further justifying their inclusion. While China may have a significantly different political structure from OECD countries, it is the second world's largest economy since it has transitioned to a market-based economy. Therefore, its political structure is not justification for exclusion from this study. Inclusion will allow researchers to determine if it is empirically different, and thus compensate or address those differences more effectively in future research. Therefore, it is important to emphasize the inclusion of these three East Asian countries in this study, and into future works on pension reform and other related subjects.

In comparative social policy, the new institutional perspective requires a rigorous classification methodology that considers the policy change process rather than static policy characteristics. The first method is referred to as the

dynamic perspective and the latter is referred to as the static perspective. Policy classification is useful in comparative analyses for conceptualizing the commonalities between policies, and as a means of categorization for empirical comparisons. Conventionally comparative welfare state studies have relied on static perspective-based analyses (e.g. history matters or inertia of institutions) for classifying homogeneities and differences of welfare policies across different countries. The drawback of the static perspective is that it ignores policy changes regardless of degree (e.g. incremental or radical changes) (Streeck and Thelen, 2005). New institutionalism influenced this study to classify social policy implementation into three periods: the Welfare Expansion Period (WEP), the Welfare Retrenchment Period (WRP), and the Compound Reform Period (CRP). During the WEP, the post-war industrialization of the world gave birth to pension policies that were distinctly either Bismarckian or Beveridgean typed. During the WRP, countries were solely focused on combating the economic fallout of the various crises that defined the 1970s; therefore, the inherited Bismarckian and Beveridgean systems born in the WEP were retrenched, shifting most systems toward Bismarckian-centric policy structures. During the CRP, in response to both old and new social risks, both contractionary and expansionary pension reform policies were adopted that combined the advantages of both Bismarckian and Beveridgean pension structures. A common example is Bismarckian welfare

states introducing means-tested associated benefits (Palier, 2010). A consequence of decades of pension reforms are that Bismarckian and Beveridgean pension systems no longer exist in their original forms, and have converged into one spectrum of policies. These shifts in social policy are consequential and critical to understanding how future policies may be implemented. Rather than conceptualizing social policies independently of these changes (static perspectives), conditioning comparative policy studies with the added nuance of change strengthens future policy understanding (dynamic perspectives). This study uses the new institutional perspective to influence this study's classification of pension reforms into four reform clusters, these clusters are used to explore the facets of pension reform policies during the CRP (1990-2015).

1.3 Policy Implications

Each pension reform cluster contains pros and cons but they share in the common pursuit of pension sustainability. The extended privatization pension (EPP) reform cluster statistically reduced pension generosity relative to the reference pension reform cluster (extensive retrenchment pension reform cluster). Pension reforms in this cluster were designed with the highest frequency of capitalization-typed reforms; These reforms typically tightened eligibility rules, and or changed the indexation of pension benefits. This study

demonstrated that extended privatization pension (EPP) reforms deteriorated pension benefits. Typically, when pension benefits are cut, this has serious negative consequences on pension benefit adequacy, necessary for maintaining a reasonable standard of living in old age. ‘Pensions play a key role in old-age financial security’ because one significant function of a pension system is to smooth consumption, and reduce the risk of poverty in old age (Barr, Lindbeck, & Diamond, 2006; Schokkaert, Devolder, Hindriks, & Vandenbroucke, 2020; Hong, 2005). A main function of a government is to minimize poverty. Post-industrialization has changed the labor market, and now, there is a substantial population of long-term unemployed and atypical workers. These groups are confronted with high levels of job insecurity, and tend to be excluded from either traditional existing public pension systems, or second and third pillar pension systems (A. Grech, 2015; Buccioli & Beetsma, 2011; Han & Woo, 2014). Under current socio-economic circumstances, plausible outcomes of enacting extended privatization pension (EPP) reforms may be stagnated pension coverage, deteriorated pension benefits, and increased gender and income inequality. In future pension reforms, policymakers need to explicitly design their policies around these new profiles who, if not considered more carefully, are at higher risk of poverty in this post-industrialized global economy. The most sensible means of doing this is if

policymakers avoid reducing benefits for these groups when legislating future pension reforms.

The labor-activated pension reform (LAP) cluster effectively reduced pension expenditure, but had no effect on pension generosity. This type of pension reform is designed to maintain a larger base of workers in the labor market. This was done by either incentivizing labor market participation and or moving back the allowable retirement age for full benefits. This effectively shortens the period of time that retirees can claim benefits, and increases the number of effective pension program contributors; thus, pension expenditure becomes more sustainable. However, there are potential issues that may arise from requiring older individuals to continue working or return to the workforce. Job discrimination based on age, and or an increased risk of job insecurity are serious issues that currently exist for older workers. A successful and sustainable pension reform that uses this methodology may require a broader strategy. If older individuals are going to be required to work, there need to be available jobs for these individuals; otherwise this policy is not effective. Policymakers may need to provide supporting labor protection policies that reduce these risks and increase support for elderly workers.

Take Korea as an example. Korea's initial pension structure was highly fragmented with asymmetric financial structures that required low-level contributions, but in return paid high-level pension benefits. Korea is facing a

critical decline in their birthrate and, with it, increasing demographic aging. In addition, women's labor participation is increasing and the proportion of atypical workers (e.g. self-employed individuals) who generally experience insufficient public pension coverage has grown. Once the impact of old and new social risks began to significantly cripple this initial system, Korea adopted extensive retrenchment pension reforms (ERP) to rebalance it. These ERP reforms only impacted individuals who were already covered under the previous system, and created a stricter eligibility criteria for who could qualify after these reforms were passed. The consequence was that only a limited number of individuals were covered and those who did receive coverage were less so than before. In addition, as mentioned earlier in chapter 4 (3.2), the trajectory of pension effort associated with this cluster is characterized by radically decreasing pension generosity, and continued increases in pension expenditure. Extensive retrenchment pension reforms have a high risk of providing inadequate pension benefits to at-risk groups without seriously resolving issues with program expenditure. Since ERP reforms do not sufficiently meet the needs of the Korean pension system, the next step is to look at alternative clusters to resolve these issues. Extended privatization pension reforms (EPP) generally supplement pension benefits by adopting a market-based pension component. However, adopting a reform from this cluster will also likely result in stagnated pension coverage, deteriorated

pension benefits, and increased gender and income inequality. Adoption of a latecomer structural pension reform (LSP) (e.g. NDC) is also not realistic, because there are a large number of atypical workers in Korea (e.g. self-employed, part-time workers) who are unable to shoulder considerable financial burdens (double payment issues). This study suggests that adopting a labor-activated pension reform (LAP) may benefit the Korean pension system the most. LAP reforms are a combination of public and supplementary private pension systems, that sustain a pension system by maintaining a larger base of workers in the labor market to continue contributing. This is carried out through parametric reforms. The parameters usually reformed to achieve this goal are delays to retirement age, penalties to early retirement, and an increase to means-tested requirements. To incentivize participation in the labor market, expansionary reforms, targeting and recalibration reforms, are used to increase the number of contributors to a pension system. This is done by lowering eligibility requirements or bringing workers back into the market. Parametric reforms may prove to be an effective way at curbing the costs of the Korean pension system, while the means-tested incentives provide more generous benefits to the growing population of at-risk individuals. One of the main parametric policies used in Korea to offset costs has been to increase active aging through increases in the retirement age. However, there are potential issues that may arise from requiring older individuals to continue

working or return to the workforce. Job discrimination based on age, and or an increased risk of job insecurity are serious issues that currently exist for older workers. A successful and sustainable pension reform that uses this methodology may require a broader strategy. If older individuals are going to be required to work, there need to be available jobs for these individuals; otherwise this policy is not effective. The Korean policy response has insufficiently addressed this issue because policymakers also need to provide available jobs for those who are forced to continue working. Policymakers may need to provide supporting labor protection policies that reduce these risks and increase support for elderly workers.

1.4 Research Limitations

There are limitations to this study. One inherent limitation is the lack of an organized and centralized source of pension datasets for all of the countries used in this study. Pension reform datasets were primarily collected from the International Social Security Association (ISSA), Mutual Information System on Social Protection (MISSOC), the Social Security Administration (SSA), and the OECD. Since this study analyzes pension reform policies from an annual basis, due to incomplete datasets some legislation years and implementation years are not available and or may not be accurately reported. When coding the early retirement penalty rate in this

study, generally the average penalty was used. In the case of Korea, this was much more difficult because the penalty rate is calculated proportionally to the amount of years an individual retires early. For simplicity, the penalty for an individual who retired one year early was used, and may under represent this variable in the study. More detailed, accurate, and uniform datasets are necessary for year-by-year analysis to be more robust in future studies. A more representative pension reform dataset allows for the large-scale examination of both pension reforms and comparative studies of welfare states since pension reforms are generally the largest part of welfare programs.

Second, this study statistically conceptualized and compared pension reforms. Because of the relatively large scale of this study, it is limited in its ability to provide an in-depth analysis of pension reform performance for each country. This limitation could be addressed by future studies that explore the social and financial objectives linked to various pension reforms over the CRP.

Third, this study concludes that the increasing pressures of new and old social risks faced by contemporary welfare states during the CRP has triggered an onset of increasingly complex pension reforms (Häusermann, 2010a). While countries must improve pension sustainability in response to older social risks like an aging population, social protections are also necessary in the post-industrialized world. This study has conceptualized the duality of pension reform dynamics with the terms “retrenchment” and

“expansion”. However, in the context of pension reform theory, while this study provides a fuller picture of pension reforms, the use of a binary distinction may still over-simplify fundamental principles that could not be captured. Alternative means of classification are needed to further this field of study. Due to data limitations, pension generosity was examined using income replacement rate. Income replacement rate is currently the only metric that is consistently reported among all the countries in this study. Until metrics that represent a more realistic version of the replacement rate become accessible, this study is limited to this single metric.

Fourth, Pension reform policies may have little immediate effect on pension output, however, it is significant to examine its cumulative effect overtime. Because of the timeframe and limitations of available data, this study only provided a short to medium term analysis of pension reform dynamics. Pension reform needs to be examined from a medium and long-term perspective.

Fifth, pension reforms are diverse and dynamic, this study uses unsupervised cluster analysis to sort pension reform variables into homogeneous groups, which differ from each other. Using both hierarchical and *K*-means cluster analysis enables this study to choose an optimal number of pension reform clusters. However, this is “optimal” in a limited sense because of the arbitrary nature of both methods (i.e. arbitrary number of

clusters). A model-based approach will be necessary for fully justifying an optimal number of clusters.

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Appendix A.

1. Glossary of pension reform variables

Table A. Definition of pension reform variables and associated examples.

Pension Reform Variables	Definitions and examples
Retirement Age	<p>Retirement age refers to the legal age that an individual may retire and receive full benefits.</p> <p><u>Examples:</u> (1). In 2013, Poland began increasing the legal retirement age by four months each year. (2). Germany increased their retirement age from 65 to 67 years old by one month each year starting in 2007.</p>
Contribution Rate	<p>Contribution rate is the percentage of an employer's or employee's income that is contributed to a public pension system.</p> <p><u>Examples:</u> (1). Greece increased their contribution rate from 28.3 percent to 32.7 percent in 1999, and then to 33 percent in 2012. (2). Korea increased their contribution rate by three percent in 1998.</p>
Contribution Period	<p>Contribution period is defined as the required number of years that an individual must contribute to a pension program to receive full pension benefits.</p> <p><u>Examples:</u> (1). France increased their required contribution period from 37.5 to 40 years in 2002; this was then increased three months each year starting in 2009. By 2015 it was 41 years. (2). The Czech Republic began increasing their required contribution period from 25 years to an entire-working-life period (45 years) beginning in 2010, by one year each year.</p>
Early Retirement Years (maximum allowed years)	<p>The maximum number of years an individual may retire before the required retirement age.</p> <p><u>Examples:</u> (1). France reduced their maximum early retirement years from three to two years in 2010. (2). Greece increased their maximum early retirement age from three to five years in 2001.</p>
Early Retirement Penalty	<p>The penalty to eligible benefits associated with early retirement.</p> <p><u>Examples:</u> (1). In 2007, Germany increased their maximum early retirement years from 60 to 63 years old, but also added an associated 0.3 percent early retirement penalty for each month of early retirement.</p>

	(2). Denmark introduced a 9.6 percent early retirement penalty in 1990.
	Reference period is the period of time that a pension program uses to calculate an individual's full pension benefits.
Reference Period	<p><u>Examples:</u></p> <p>(1). Japan modified their reference period from 35 years to 40 years starting in 2002, adding one year each year.</p> <p>(2). France changed their reference period from an individual's 10 best years of wages to a 25 year period beginning in 1993.</p>
	Pension indexation is a method of benefits adjustment that scales an individual's pension benefits to account for inflation.
Pension Indexation	<p><u>Examples:</u></p> <p>(1). The Czech Republic shifted their indexation method from wage-based indexation to a combination of wage and CPI-based indexation in 1990.</p> <p>(2). Japan shifted their pension indexation method from wage-based to CPI-based indexation in 2001.</p>
	Capitalization refers to pension policy shifts from a defined benefits (DB) program to a defined contributions (DC) or a notional defined contributions (NDC) program. This includes the addition of a mandatory and or a voluntary funded pension system.
Capitalization	<p><u>Examples:</u></p> <p>(1). Denmark introduced the Special Pension program in 1997. This included a compulsory savings clause, where an individual must contribute at least one percent of their earnings.</p> <p>(2). China added an NDC program to their PAYG pension system in 1997.</p>
	Targeting refers to expansionary pension reforms to benefits for elderly and vulnerable groups. These reforms typically implement flat pension benefits or means-tested pension benefits. This also includes rules that relax pension contribution requirements for these groups.
Targeting	<p><u>Examples:</u></p> <p>(1). Korea began implementing a targeting-based pension reform in 2008 that modified their elderly pension benefits.</p> <p>(2). Germany introduced a targeting reform in 2004 that created a minimum income to old age pensioners provision through a means-tested program.</p>
	Recalibration refers to pension reforms that modify pension system eligibility criterias, to account for members of society who are not actively participating in the labor market.
Recalibration	<p><u>Examples:</u></p> <p>(1). Switzerland created a recalibration-based reform that created joint ownership of pension benefits between spouses in 1995.</p> <p>(2). Germany created a recalibration-based reform that provided pension contribution credits to mothers that remain home for childcare reasons in 2000.</p>

Note: Data is collected from ISSA's country profiles, MISSOC's comparative tables, and the OECD's *Pension at a Glance* report.

2. Zero-order correlations

Table B. Zero-order correlations of numeric variables

	EXPEN	RPMR	GDP	WOP	SERV	AGE	EMP	FERTI	OPEN	R_age	CON_Y	CON_R	EARLY_Y	EARLY_P	REFER_Y
EXPEN	1														
RPMR	.230**	1													
GDP	0.089	-0.096	1												
WOP	-.608**	-0.098	.181**	1											
SERV	.168**	-.177**	.784**	-.128*	1										
AGE	.674**	0.025	.584**	-.335**	.622**	1									
EMP	-.826**	-.149**	.123*	.883**	-.211**	-.471**	1								
FERTI	-.179**	-0.076	.270**	.524**	.283**	-.102*	.338**	1							
OPEN	.319**	-.142**	.717**	-.152**	.820**	.730**	-.209**	.141**	1						
R_age	.187**	-.104*	.490**	.182**	.542**	.440**	-0.06	.258**	.481**	1					
CON_Y	.198**	-.173**	.620**	-.354**	.759**	.486**	-.255**	-0.07	.642**	.282**	1				
CON_R	.413**	.404**	-.428**	-.288**	-.520**	0.006	-.281**	-.337**	-.265**	-.347**	-.405**	1			
EARLY_Y	-.151**	0.098	-.199**	.106*	-.288**	-.295**	.195**	-0.07	-.279**	-.145**	-.212**	0.014	1		
EARLY_P	-0.014	-.405**	.284**	0.095	.209**	0.091	0.097	0.028	.182**	.120*	.111*	-.297**	.451**	1	
REFER_Y	-.179**	-.427**	.613**	.291**	.519**	.307**	.307**	.168**	.523**	.536**	.521**	-.428**	-.283**	.179**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Note: EXPEN=pension expenditure; RPMR= mean of male replacement rate; GDP=GDP per capita; WOP=women labor participation rate; AGE= percentage of population aged 65+; SERV=percentage of employment in service sector; EMP = percentage of employment rate; FERTI = fertility rate; OPEN=financial-openness; R_age =male retirement age; Con_Y=contribution years; Con_R=contribution rate, Early_Y=early retirement years, Early_P=early retirement penalty, REFER_Y =references year.

3. Clusters Analysis Descriptive Statistics

Table C. Clusters analysis descriptive statistics – socioeconomic factors

Reform Clusters		Labor-activated Pension (LAP) Reforms	Extended Privatization Pension (EPP) Reforms	Latecomer Structured Pension (LSP) Reforms	Extensive Retrenchment Pension (ERP) Reforms	Between Group and Within Groups
Control Variables						
Socio-economic Factors	GDP per capita	38841 (18389, 64322)	41283 (21019, 88416)	7723.0 (709.4, 22698.9)	23059 (6516, 45413)	F (3, 380) 164.2 ***
	Financial openness (Chinn-Ito index)	2.352 (1.845, 2.360)	2.360 (2.360, 2.360)	-0.081 (-1.910, 2.360)	1.317 (-1.202, 2.360)	F (3, 368) 139***
	Aged 65+ (%)	15.25 (11.87, 19.60)	17.18 (12.73, 26.02)	11.87 (6.331, 17.995)	14.714 (5.232, 19.948)	F (3, 380) 42.07***
	employment rate (%)	59.98 (54.85, 63.78)	58.03 (42.35, 67.18)	57.97 (44.14, 76.06)	50.92 (38.69, 64.81)	F (3, 366) 40.08***
	Fertility rate (%)	1.788 (1.342, 1.920)	1.516 (1.240, 1.920)	1.471 (1.130, 2.070)	1.511 (1.076, 2.130)	F (3, 380) 38.92***
	Female labor participation rate (%)	57.03 (49.63, 61.59)	52.50 (37.78, 62.40)	54.94 (46.44, 72.30)	45.39 (33.56, 63.14)	F (3, 380) 64.93***
	Employment in Services (%)	72.77 (58.68, 79.67)	71.39 (60.55, 81.48)	46.80 (24.31, 59.46)	65.25 (47.68, 76.88)	F (3, 366) 223.9***
Total case		95	114	72	103	

4. Demographic Changes

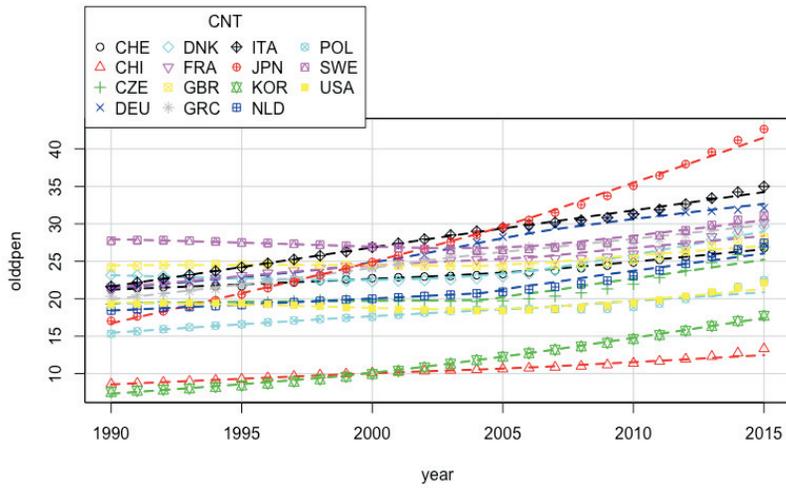


Figure A. The old age dependency ratio

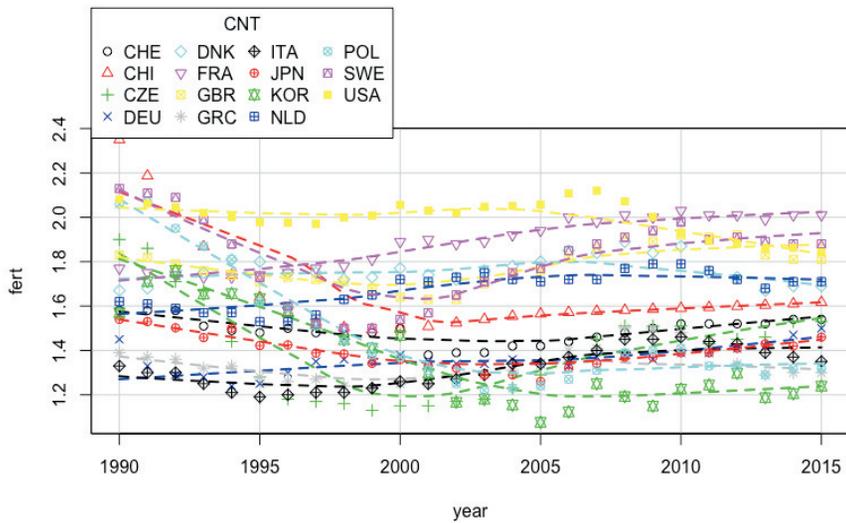


Figure B. Fertility rate among countries during 1990-2015.

Abstract (Korean)

초록

연금개혁 궤적이 연금노력에 미치는 영향

하 미향

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본 연구는 15 개 국가를 대상으로 1990-2015 년 사이 발생한 다양한 연금개혁의 궤적을 군집화하고 이러한 연금개혁궤적 군집이 연금노력(Pension Effort)에 미치는 영향에 대해 분석하고자 한다. 본 연구에서 연금개혁은 축소개혁(Contractionary Reform) 과 확장개혁(Expansionary Reform)을 동시에 고려하며 연금노력(Pension Effort)은 연금지출(Pension Expenditure)과 연금관대성 (Pension Generosity)을 나타낸다. “복지국가의 위기론”의 영향으로 기존 대부분의 연구들은 연금노력(Pension Effort)과 관련하여 주로 거시적 관점에서 사회·경제·정치 영향 요인이 연금지출에 미치는 영향에 대해서만 분석이 이뤄졌다. 특히 핵심적 연금정책수단인 연금개혁에 대한 연구가 부족했으며 연금노력(Pension Effort)에 연금관대성을 살펴본 연구는 많지 않았다. 또한 실질적으로 전통적인 “복지국가 축소론”을 기반으로 분석한 연구들은 脫산업화로 인해 복지정책의 다양한 변화 및 특징을 충분히 포착하지 못했다. 지난 20 세기말부터

舊사회위험(Old Social Risk) 및 新사회위험(New Social Risk)을 동시에 대응하기 위해 많은 국가들은 연금제도의 지속가능성 개선을 위해 축소개혁(Contractionary Reform)뿐만 아니라 확장개혁(Expansionary Reform)도 같이 도입했다. 다시 말해, 기존의 연구들은 크게 두 가지 한계점을 뚜렷하게 나타내고 있었다. 첫째, 거시적 관점에서 분석한 기존연구들은 사회·경제·제도적 영향 요인이 연금노력(Pension Effort)에 미치는 영향과 연금관대성에 대해 연구가 부족하다. 또한 가장 중요한 영향요인 변수인 연금개혁에 대해 분석하지 못했다. 둘째, 기존의 질적 및 양적 비교정책연구들은 주로 연금제도의 정태적(靜態的) 특성만 포착했으며 동태적(動態的) 개혁과정에 대한 연구가 부족했다. 따라서, 동태적(動態的)인 연금개혁이 연금지출과 연금관대성에 대해 어떤 영향을 미치는가에 대한 연구가 시급하고 중요하다.

본 연구는 Häusermann (2010)의 연금개혁을 이론적 기반으로 10 가지 연금개혁 변수를 포함하며 15 개 국가를 대상으로 26 년 동안 연금개혁체적에 대해 분석하고자 한다. 구체적으로 연금개혁 변수는 주로 보험(Insurance), 적립화(Capitalization) (예: DB 에서 DC 로 전환), 표적화(Targeting) (예: Means-Tested)과 再조준화(Recalibration) (예: 연금크레딧 혹은 교육크레딧)를 포함한다. 우선, 군집분석(Cluster Analysis)을 통해서 다양한 축소 및 확장 연금개혁을 연금개혁체적으로 규명하였고, 선형혼합효과모형 (Linear Mixed Effect Model, LMM)을 통해 각 연금개혁체적이 연금노력(Pension Effort), 즉 연금지출(Pension Expenditure)과 연금관대성(Pension Generosity)에 대한 영향을 분석하였다. 분석결과에 따라, 4 가지 연금개혁 체적 유형으로 구분할 수 있다: 노동활성화개혁(Labor-Activated Pension, LAP), 민영화확장개혁(Extended Privatization Pension, EPP)개혁,

후발구조적개혁(Latecomer Structural Pension, LSP) 그리고
긴축연금개혁(Extensive Retrenchment Pension, ERP).

노동활성화개혁(LAP)은 CRP(1990-2015) 기간 이전의 매우 높은
실업률과 급진적인 인구학적 변화를 겪은 선진 복지국가로 구성되어
있다. CRP(1990-2015)기간에 진입하여 GDP 성장과 고용률 증가세를
점차적으로 확인할 수 있지만 新사회위험(New Social risk)에 가장
심각한 국면을 직면하고 있었다. 예를 들어, 높은 여성의 노동시장
참가율, 높은 세계화 지수 및 서비스업의 증가 등 있다. 이러한
舊사회위험(Old Social Risk) 및 新사회위험(New Social Risk)을 대응하기
위해 대부분 국가들은 다양한 모수적연금개혁을 실시했다. 특히 은퇴에
근접한 연령인 개인들은 계속 노동시장에 남을 수 있도록 많은
연금개혁을 노력해왔다. 예를 들어, 은퇴연령을 높이고 조기은퇴 연령
축소 및 조기은퇴의 감액을 강화하여 노동시장 참여를 유발하기 위한
많은 연금개혁을 했다. 동시에 표적화(Targeting)와
再조준화(Recalibration)등 확장개혁(Expansionary Reform)을 통해 연금
수급여건을 낮춤으로써 서비스업을 비롯한 저임금 노동자들의
노동시장 참여를 장려하기 위한 개혁을 실시하였다.

민영화확장개혁(EPP)은 거시적 사회경제 변화를 경험한
선진국으로 노동활성화개혁(LAP) 클러스터와 비슷한 거시적 사회변화
구조를 경험하였다. 이 클러스터는 CRP(1990-2015) 기간에 높은
서비스업 취업률과 더 높은 경제적 개방성을 나타낸다. 또한 65 세 이상
인구 비율이 가장 높고 저출산 문제를 함께 경험하고 있다. 연금개혁
전략은 노동활성화개혁(LAP)의 채택 전략과 뚜렷한 차이가 존재하고
있다. 민영화확장개혁(EPP)은 직업 또는 개인연금의 가입을 자발적
가입에서 강제가입으로 확정하며 기존 공적연금시스템에 대한

축소개혁을 함께 진행해왔다. 저임금 노동자를 보상하기 위하여 자산조사 (Means-Test)를 통해 연금 혜택이나 연금 크레딧 (Pension Credit)과 같은 다양한 확장연금개혁(Expansionary Reform)도 이뤄졌다.

후발구조적개혁(LSP)은 기존의 연금제도는 중앙계획경제에서 광범위한 시장경제로의 이행을 경험한 국가들로 이루어졌다는 독특한 성격을 지닌다. 이러한 국가가 시장경제로 전환한 초기에는 비교적 느리게 경제가 성장하였으며 거시 경제적 전환뿐만 아니라 인구 구조적인 변화도 같이 직면하고 있었다. 또한 빠른 시장경제개방과 脫산업화로 인해 산업구조도 급격한 변화를 겪고 있기 때문에 기존의 연금제도의 골격을 유지하기 힘든 조건에 직면하고 있다. 후발구조적개혁(LSP)은 이처럼 다양한 거시 사회경제적 구조변화로 인해 급등한 연금비용 지출에 대한 대책으로 구조적개혁을 선택하였다. 취약한 집단을 보상하기 위해 여러 표적화(Targeting)와 같은 확장 연금개혁(Expansionary Reform)을 했지만 再조준화(Recalibration) 개혁은 아직 도입되지 않았다.

긴축형연금개혁(ERP)은 가장 빠른 고령화를 겪었으며 출산율이 급격히 하락한 것을 경험하고 있는 국가로 구성되었다. 新사회위험(New Social Risk) 역시 비정규직 노동자, 여성 노동시장 참여율 그리고 낮은 취업률을 포함하는 심각한 사회 및 경제적 어려움을 겪고 있다. 긴축형연금개혁(ERP)은 이처럼 점차 늘어나는 新사회위험 (New Social Risk)과 전통적인 ‘고급여, 저분담’ 연금구조의 어려움에 직면하기 때문에 포괄적인 모수개혁을 통해 기존의 관대한 연금시스템을 축소하려고 한다. 저소득 집단과 고령 빈곤층에 대한 자산조사 (Means-test) 와 같은 표적화 (Targeting) 개혁을 통해 노후소득보장의 보조적 역할을 추가하였다.

본 연구는 위에 도출한 4 가지 연금개혁 클러스터를 독립변수로 혼합효과모형(Linear Mixed Effect Model, LMM)에 투입하여 각 연금개혁이 연금노력 (Pension Effort)에 대해 통계적으로 분석하였다. 분석결과, 긴축형연금개혁(ERP)에 비해 노동활성화개혁(LAP)은 통계적으로 연금지출(Pension Expenditure)을 감소시켰으며, 반면에 민영화확장개혁(EPP)은 연금관대성(Pension Generosity)을 통계적으로 감소시켰다. 노동활성화개혁(LAP)의 연금개혁 특징을 보면 은퇴연령과 조기은퇴에 대해 가장 많이 강화했고, 한편 긴축형연금개혁(ERP)은 직업 또는 개인연금 가입을 강제가입으로 확장하여 연금 기여와 혜택 간의 더 직접적인 연결고리를 강조했다.

본 연구의 이론적 함의는 다음과 같다. 첫째, 본 연구는 연금개혁이 연금노력 (연금 지출 및 연금 관대성)에 대한 영향의 가장 핵심적인 변수라고 강조하며 또한 연금개혁은 축소형과 확장형 연금개혁을 함께 연구해야 한다고 주장한다. 둘째, 대부분 기존의 비교연구는 중국, 일본과 한국 등 동아시아 국가들을 제외해왔다. 하지만 비교정책에서 이러한 국가들을 실증적분석을 통해 차이점을 도출하여 미래 연구에서 더 효과적으로 다룰 수 있도록 해야 한다. 셋째, 이 연구는 비교사회정책 연구의 복지정책 및 제도를 분류에 대한 정태적(靜態的)인 관점이 아닌 정책변화를 반영할 수 있는 동태적(動態的)인 관점으로 보는 것을 더 타당하며 심층적으로 분석할 수 있다고 주장한다.

정책적 함의는 다음과 같이 제시하였다. 개혁 클러스터마다 각 장단점이 존재하며 정책 입안가들은 연금개혁 정책을 도입할 때 연금지출과 연금관대성을 모두 고려해야 한다. 특히 脫산업화로 인해 일시적·장기적 실업의 증가, 비정규직고용과 여성고용의 증가 등 新사회위험 및 舊사회위험을 고려해서 미래 연금개혁에서 연금지출과

연금 관대성을 동시에 고려해야한다. 이를 신중하게 고려하지 않으면 脫산업화 이후의 저소득 및 취약계층은 더 높은 노인 빈곤에 직면할 수 있다. 한국 연금개혁의 예를 들면, 긴축형연금개혁(ERP)은 장기적으로 연금지출을 낮추고 또한 자산조사(Means-Test)와 같은 표적화(Targeting)개혁을 통해 사회부조형 연금으로 노인빈곤을 해소할 수 있지만 이러한 포괄적인 축소 개혁은 특히 미래 세대의 저소득층의 심각한 연금부족의 문제를 초래할 수 있다. 또 다른 세 가지 한국의 연금개혁에 대한 시사점을 다음과 같이 제시한다. 민영화확장개혁(EPP)은 주로 개인연금 및 직업연금의 강제가입을 통해 연금의 관대성을 제고하기 때문에 이와 같은 개혁전략을 채택하면 한국의 연금의 보장성을 악화시킬 가능성이 매우 크다. 특히 비전형 노동자와 저소득층의 연금수준을 악화시킬 가능성이 매우 크다. 또한 후발구조적개혁(LSP)은 한국의 연금제도의 현황에 현실적이지 않다고 본다. 한국의 독특한 산업구조 및 脫산업사회적 요구와 수요로 인해 비정규직 노동자의 증가로 많은 가입자가 이중부담(Double Payment)을 직면해야 하는 실정이다. 노동활성화개혁(LAP)은 한국의 공적연금제도를 강화하며 한국의 노인 빈곤 및 新사회위험(New Social Risk) 등 문제를 완화하는데 있어 도움이 될 수 있다고 판단한다.

Keywords:

연금개혁, 연금노력 (pension effort), 확장연금개혁(expansionary pension reform), 축소연금개혁(contractionary pension reform), 군집분석 (cluster analysis), 혼합효과모형 (Linear Mixed Effect Model, LMM)

학번: 2010-30757

Abstract (Chinese)

摘要

养老金改革轨迹对养老金支出和养老金慷慨度的影响

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本论文定量比较分析了 15 个国家在 1990-2015 (compound reform period, CRP: 1990-2015)综合改革期间的养老金改革轨迹, 及其对养老金努力(pension effort)的影响。本文定义了养老金改革包括消减性改革(contractionary pension reform)和扩张性改革(expansionary pension reform), 养老金努力(pension effort)包括养老金支出(pension expenditure)和养老金慷慨度(pension generosity)。受“福利国家危机论”的影响, 现存的大部分相关学术主要分析了宏观社会·经济因素(包括经济, 政治和制度因素)对养老金政策的影响。这些研究集中在研究养老金支出而忽视了对养老金慷慨度的分析。宏观社会经济背景及制度的遗产(institutional legacy)或历史轨迹等对养老金努力(pension effort)影响效应息息相关, 但是本研究认为基于宏观理论并限于养老金支出的传统文献没有充分的分析到后工业社会下(post-industrialization)的养老金改革轨迹和特征。尤其是从 20 世纪末, 为了应对新旧社会风险(old and new social risks)

的压力，综合型养老金改革(compound pension reform)，即消减性改革(contractionary pension reform)和扩张性改革(expansionary pension reform)被纷纷采纳去同时解决养老金财政可持续性和抵御老年贫困的两个问题。本文认为传统文献在研究养老金政策的影响因素中存在两个主要局限性问题：第一，忽视了核心变量-养老金改革对老金支出(pension expenditure)和养老金慷慨度(pension generosity)的影响。第二，现有的定量和定性社会政策比较或聚类研究只从围绕静态角度(static perspective)的政策特征却忽视了政策的动态变化(policy dynamic change)。

本文以 Häusermann (2010)的养老金改革理论为基础，分析了包括消减性改革(contractionary pension reform)和扩张性改革(expansionary pension reform)养老金改革的十个变量：保险参数 (parametric reform 参数改革)，市场化(例如：从DB改革成DC)，目标化(targeting) (例如：经济能力审查：means-tested)，再调整(recalibration) (例如：养老金补贴：pension credits)。为了从统计学上评估分析这些养老金改革对养老金努力(pension effort)对影响效应，本文采用了两种分析方法：K 均值无监督聚类分析(clustering analysis)和线性混合效应模型(linear mixed effect model, LMM)。根据聚类分析(clustering analysis)结果，15 国家在1990-2015 期间的养老金改革可分为四个改革类型：劳动激励改革型(labor-activated pension reform, LAP)，扩展私有化改革型(extended privatization pension reform, EPP)，后发结构改革型(latecomer structural pension reform, LSP)，和激进消减改革型(extensive retrenchment pension reform, ERP)。基于定量统计数据比较分析，线性混合效应模型(linear mixed effect model, LMM)分析结果发现不同的改革轨迹对养老金支出和养老金慷慨度影响不同。

劳动激励改革型(labor-activated pension reform, LAP)是由发达福利国家组成，这些国家在 CRP(1990-2015)之前遭遇过经济衰退和前所未有的失业率增加和人口转变问题，但是在 CRP(1990-2015)的过度期间实现了 GDP 和就业率的总体水平回升。相比于其他的改革类型，这些国家面临着最高水平的社会新风险(new social risks): 女性劳动就业和服务性就业者不断增加。为了应对新旧社会风险(old and new social risks)和减轻养老金财政压力，这些国家采取了大力度的养老金参数改革。主要包括参数改革(例如：延后退休，处罚提前退休等)，鼓励接近退休等人继续工作或重新加入劳动市场。此外利用扩张性的目标化(targeting)和再调整(recalibration)改革鼓励人们参与劳动市场并通过养老金水平等。

扩展私有化改革型(extended privatization pension reform, EPP)的宏观社会经济结构背景和劳动激励改革型(labor-activated pension reform, LAP)比较相似，但是他们的养老金改革决策却大相径庭。在 CRP 前期，这些国家也是经历过宏观经济巨变的发达福利国家。低生育率和最高的老年人口比例，这个改革类型的国家面临养老金支出巨大失衡的压力。另外不规则就业者(atypical worker)和服务性就业者的比例不断上升也威胁着养老金政策的长期可持续性。扩展私有化改革型(extended privatization pension reform, EPP)的主要决策是通过强制性策略提高参加职业和商业养老保险并且采取相对应的公共养老金参数改革方案。扩张型改革(expansionary pension reform)主要是为了弥补弱势和底薪群体，例如，对雇主，雇员或个人就行减税并且给以适当的补贴，经济能力审查的(means-tested)养老金补贴改革也是尤为突出。

后发结构改革型(latecomer structural pension reform cluster, LSP)的国家在养老金改革初期经历了市场经济转型独特社会变化。特别是在市场经济转型初期经济增长还没有真正的崛起，养老金制度不仅面临经济

转型的挑战，人口转变包括人口老龄化和生育率下降问题更是加剧了养老金制度的财政失衡。另外新社会风险(new social risks)和全球化更激化了服务性劳动者的增加。为了扩大政府财政来源和弥补养老金缺口，这些社会背景推动了这些国家以结构改革(structural pension reform)为主线。为弱势群体也提供一定的社会补助，例如，经济能力审查的(means-tested)养老金补贴，但是后发结构改革型(latecomer structural pension reform cluster, LSP)目前缺乏再调整(recalibration)的扩张型改革(expansionary pension reform)。

激进消减改革型(extensive retrenchment pension reform, ERP)在CRP初期面临最严重的老龄化增长和经济危机带来的长期经济困难。人口转变(生育率急剧下降, 老龄化进程加速)更是加剧了养老金的经济持续性问题。同时，这些国家更面临着由迅速的现代化进程所带来的挑战：服务性劳动者，女性劳动市场的参与与日俱增，就业率急剧下降等新社会风险(new social risks)。在这种社会背景下，激进消减改革型(extensive retrenchment pension reform, ERP)采用了大幅度的参数改革(parametric pension reform)为消减现存的养老金财政问题。资格审核(means-tested)的社会救助被采用去补助低收入人群和老人的养老金收入。

本文把以上的四个改革类型作为自变量研究分析了各个改革类型对养老金努力(pension effort: pension expenditure, pension generosity)的影响效果。根据线性混合效应模型(linear mixed effect model, LMM)的分析结果，相对于激进消减改革型 (extensive retrenchment pension reform, ERP), 劳动激励改革型(labor-activated pension reform, LAP)有效的消减了养老金支出；扩展私有化改革型(extended privatization pension reform, EPP)有效的得降低了养老金的慷慨度。相比之下，劳动激励改革型(labor-activated pension reform, LAP)维持了最高标准的养老金退休年龄

和提前退休的最大限制，而扩展私有化改革型(extended privatization pension reform, EPP)则是通过强制参与职业和商业退休金制度加大紧缩养老金和缴费之间的直接关系。

理论层面，第一，本研究强调养老金改革变量是理解养老金努力(pension effort)的关键。第二，1990年以来的养老金改革应该同时考虑消减性改革(contractionary pension reform)和扩张性改革(expansionary pension reform)。第三，从新制度主义的理论角度来看，社会政策比较更应该考虑动态政策变化(pension dynamic change)，不应该只限于静态视角(static perspective)的政策特征。第四，传统的社会政策比较研究文献经常忽略了东亚国家，比如，中国，日本和韩国。本文认为，尤其是比较研究更应该把这些国家包括在内因为通过比较可以更有效的分析这些制度改革决策的差异性。

政策层面，在制定养老金改革方案时需要同时考虑改革对养老金支出和养老金慷慨度影响的利弊。考虑到后工业化所带来的新风险和现存的旧社会风险，在未来的养老金改革方案中养老金长期可持续性需要均衡养老金支出可持续性和慷慨度。以韩国养老金改革为例，激进消减改革型(extensive retrenchment pension reform, ERP)可能有助于控制养老金支出，另外经济审查性的社会补助(means-tested)是可以填充贫穷老人的养老金水平；但是其改革方案很可能让高风险群体(ex. atypical workers, lower income)面临养老金严重不足的问题。由于激进消减改革型(extensive retrenchment pension reform, ERP)不能充分满足韩国养老金制度的需求，本文总结分析了其他三个改革方案的可取性。扩展私有化改革型(extended privatization pension reform, EPP)方案主要是通过市场养老金组成部分来补充养老金福利慷慨水平，但是此改革方案可能导致韩国养老金覆盖率停滞，并恶化高风险群体(ex. atypical workers, lower

income group)的养老金慷慨度并且加剧性别福利水平不平等等问题。后发结构性改革型(latecomer structural pension reform cluster, LSP) (ex. NDC) 方案对于韩国的现状更不现实。由于韩国的独特的工业及劳动市场结构, 绝大部分的非典型就业者 (atypical workers) 会很难负担双重付费 (double payment issue) 问题。采用劳动激励改革型 (labor-activated pension reform, LAP) 方案可以加固韩国的公共养老金体系并有效的提高新型职业 (new career profiles) 人员的养老金覆盖率且减少老年贫困。

关键词:

养老金改革, 消减性改革, 扩张型改革, 养老金努力(pension effort), 养老金支出(pension expenditure), 养老金慷慨度(pension generosity), 无监督聚类分析(unsupervised cluster analysis), 线性混合效应模型(linear mixed effect model, LMM)

学号: 2010-30757