THE AGING-INEQUALITY NEXUS: THE DOMESTIC SAVINGS CHANNEL AND THRESHOLD EFFECTS IN ASIA-PACIFIC COUNTRIES

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UNIVERSITI SAINS MALAYSIA

2024

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by

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Thesis submitted in fulfilment of the requirements
for the degree of
Doctor of Philosophy

May 2024

ACKNOWLEDGEMENT

First and foremost, I would like to thank my supervisors, Associate Professor Dr. Goh Soo Khoon and Dr. Law Chee Hong, for their guidance and continuous support throughout my Ph. D research experience. I have very much appreciated their enlightening commentary during hours of discussions throughout the completion of the thesis. I have also appreciated their efforts in providing guidance on publication and manuscript formatting. I am genuinely thankful for their excellent mentorship in my thesis-writing journey. I thank Professor Wong Kyoi Nyen from Sunway University for his insightful feedback and suggestions on improving my thesis. My sincere gratitude goes out to Associate Professor Dr. Tang Chor Foon and Dr. Dayang Haszelinna binti Abang Ali for their fruitful feedback on my earlier draft during the research progress update session that has helped enhance the merit of the thesis.

I wish to extend my gratitude to Universiti Sains Malaysia and the Ministry of Higher Education (MOHE) Malaysia for the provision of financial support in the pursuit of my Doctorate studies, which were partly provided by the Fundamental Research Grant Scheme (FRGS) (203/PSOSIAL/6711781). I wish to thank all who made it possible for me to receive the FRGS grant, which was used to cover my expenses for several econometrics workshops (i.e., Long Panel Data Analysis, Time Series Data Analysis, Short Course on VAR, VECM, & ARDL Models). The funds helped support my expenses for several conferences I have attended, namely the Dynamic Structural Econometrics Conference 2022 and the Feng Chia International Conference 2023.

In no particular order, special thanks go to the staff and faculty of the Center for Policy Research (CPR), USM; and the administration staff of the Institute of Postgraduate Studies (IPS), USM. Any problems or issues throughout my doctoral journey were eased with their help and guidance. Moreover, three papers were produced for this thesis, and one has been successfully accepted for publication in *Economic Systems*, while the others remain under review.

Lastly, I would like to thank my family, friends, and relatives for all the encouragement and support I have received in the past two and a half years, whether emotional or financial, in helping me complete my thesis. My foremost dedication goes to my loving parents, Mrs. Mahbobah Kassaly and Mr. Shaik Saffarudin; without whom I would not be the person today. My next word of dedication goes to my beloved siblings, Raeesah Shaik, Asim Shaik, and Asif Shaik; with whom my years of silly arguments and constant joy brings huge depth of meaning to life. To my best friend friend, Zam Ramdzam for his emotional support and our constantly motivating and meaningful catch-up conversations. To Azimah Suleiman, for her unwavering support that got me through the final lap of my doctoral journey. To the strongest women in my life whose strength and determination has no bounds: Ms. Rehana, Mrs. Marjaan, and in loving memory, Mrs. Hamidah. Thank you to all for being there for me throughout this momentous milestone of my life.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
A-ARDL	Augmented autoregressive distributed lag
ARDL	Autoregressive distributed lag
BPG	Breusch-Pagan-Godfrey
CADF	Cross-sectionally augmented Dicky-Fuller
CCT	Conspicuous consumption theory
CIPS	Cross-sectionally augmented IPS
CPI	Consumer Price Index
CD	Cross-sectional dependence
DDEP65	Growth of the elderly dependency ratio (Aging intensity)
DEP65	The elderly dependency ratio
DPT	Dynamic panel threshold
DPTK	Dynamic panel threshold kink
EU	European Union
GDP	Gross Domestic Product
GDS	Gross Domestic Savings
GMM	Generalized method of moments
IPS	Im, Pesaran, and Shin
JB	Jarque-Bera
LCH	Life cycle hypothesis
LLC	Levin, Lin, and Chu
LM	Lagrange Multiplier
MPF	Mandatory Provident Fund
OECD	Organization for Economic Cooperation and Development
PIH	Permanent income hypothesis
PP	Phillips-Peron
PWT	Penn World Table
RIF	Recentered influence function
SWIID	Standardized World Income Inequality Database

HUBUNGAN PENUAAN - KETAKSAMAAN PENDAPATAN: SALURAN SIMPANAN DOMESTIK DAN KESAN UFUK DI NEGARA ASIA-PASIFIK

ABSTRAK

Secara umumnya, ketaksamaan pendapatan kini meningkat serentak bersama peningkatan populasi tua, walaupun pada kadar yang berbeza dalam kalangan negara-negara Asia-Pasifik. Oleh yang demikian, masih belum dipastikan sama ada manifestasi penuaan penduduk yang sedang berlaku menyulitkan usaha mengurangkan jurang ketaksamaan pendapatan. Selain itu, penyelidikan empirikal yang memberi tumpuan kepada simpanan domestik masih tidak mendapat tumpuan sepatutnya sebagai satu mekanisme perantaraan yang berpotensi untuk menjelaskan hubungan antara proses penuaan dan ketaksamaan pendapatan. Tesis ini mengutamakan tiga objektif untuk menjawab persoalan-persoalan ini. Pertama, kajian ini menggunakan ujian Augmented Autoregressive Distributed Lag (A-ARDL) untuk meneliti sama ada wujud satu hubungan jangka masa panjang antara proses penuaan dan ketidaksamaan pendapatan. Keputusan ujian ini mengesahkan bahawa fenomena penuaan dan ketaksamaan pendapatan wujud bersama untuk negara tua (aged) dan super-tua (super-aged). Khususnya, pemeriksaan empirikal menunjukkan bahawa penuaan penduduk memburukkan lagi ketaksamaan pendapatan di Australia, New Zealand, Jepun, dan China, sementara Hong Kong menunjukkan penstabilan ketaksamaan pendapatan. Seterusnya, objektif kedua adalah untuk memeriksa peranan simpanan domestik sebagai mekanisme perantaraan dalam hubungan antara penuaan penduduk dan ketaksamaan pendapatan sambil mengambil kira kesan globalisasi sosial. Keputusan analisis ini menunjukkan bahawa penuaan merupakan satu penentu simpanan yang kritikal di negara tua dan

super-tua. Australia, New Zealand, Jepun, dan China menunjukkan hubungan simpanan domestik-penuaan yang negatif. Penurunan ketara simpanan domestik yang disebabkan oleh proses penuaan mungkin dapat menjelaskan peningkatan jurang ketaksamaan pendapatan. Sebaliknya, Hong Kong menunjukkan hubungkait positif antara nisbah tanggungan tua dan simpanan domestik. Penuaan penduduk di Hong Kong yang membawa kepada penambahbaikan simpanan mungkin telah membantu dalam usaha menstabilkan ketaksamaan pendapatan. Tambahan pula, hasil kajian mencadangkan bahawa globalisasi sosial adalah penghalang kepada simpanan jangka masa panjang. Hal ini mengesahkan prospek penggunaan yang ketara (conspicuous consumption) di Asia-Pasifik. Oleh itu, satu pendekatan menyeluruh diperlukan untuk menguruskan hubungan rumit antara penuaan populasi, ketaksamaan pendapatan, dan simpanan domestik. Objektif terakhir adalah untuk menentukan nilai ufuk keamatan penuaan dan kesan terhadap ketaksamaan pendapatan berdasarkan kaedah regresi dynamic panel threshold kind (DPTK). Hasil keputusan mengesahkan wujudnya satu nilai ufuk sekitar 1.4 peratus dan ia menunjukkan bahawa hubungan penuaan dan ketaksamaan pendapatan dicirikan oleh satu keluk U terbalik. Keputusan ini memberi gambaran bahawa ketaksamaan pendapatan mungkin stabil selepas nilai ufuk yang ditentukan dan adalah konsisten dengan model kitaran hayat yang mengambil kira ketidakpastian masa depan.

THE AGING-INEQUALITY NEXUS: THE DOMESTIC SAVINGS CHANNEL AND THRESHOLD EFFECTS IN ASIA-PACIFIC COUNTRIES

ABSTRACT

Income inequality has generally exhibited an increasing trend, albeit at varying rates among Asia-Pacific countries, during a concurrent boom in the elderly population. As such, the connection between the rising prevalence of the aging population and the slow progress in alleviating income inequality remains unclear. Moreover, there is a lack of empirical analysis focusing on domestic savings as a potential transmission mechanism within the aging-inequality nexus. To address these questions, this study sets forth three primary objectives. First, the study investigates whether a long-term relationship exists between aging and income inequality using the Augmented Autoregressive Distributed Lag (A-ARDL) bounds test. The key findings confirm that aging coexists with income inequality in advanced aging economies. Empirical evidence indicates that population aging exacerbates income inequality in Australia, New Zealand, Japan, and China. Conversely, the aging process in Hong Kong appears to moderate inequality. The second objective explores the role of domestic savings as a transmission mechanism in the relationship between aging and income inequality, while also considering the effects of social globalization. The results reveal that aging significantly influences savings behaviors in aged and super-aged countries. Australia, New Zealand, Japan, and China display a negative relationship between aging and savings, whereas Hong Kong shows a positive correlation between the older dependency ratio and domestic saving. This finding suggests that the notable decline in domestic savings due to aging may account for the worsening income distribution in the first group of

countries. In contrast, aging has led to improvements in savings in Hong Kong, which may have contributed to efforts to alleviate inequality. Additionally, the findings imply that social globalization acts as a deterrent to long-term saving behavior, confirming the trend toward conspicuous consumption in the Asia-Pacific region. Therefore, a comprehensive approach is necessary to navigate the complexities of the relationship between population aging, income inequality, and domestic savings. Finally, the third objective seeks to determine the threshold value of aging intensity and its subsequent impact on income inequality using the Dynamic Panel Threshold Kink (DPTK) regression method. The findings confirm the existence of a threshold value of 1.4% and indicate that the aging-inequality nexus is characterized by an inverted-U curve. These results align with the proposed modified life cycle model that includes precautionary motives, which suggests that income inequality may stabilize beyond this identified threshold value.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The Asia-Pacific is a diverse geographical region that stretches from the Mongolian north to the southern tip of New Zealand, with land stretching across Iran in the West up to Kiribati in the east (see Figure 1). A balanced regional representation of countries chosen for the various analyses in this thesis is reflected in Table 1, consistent with the United Nation's (UN) classification of Asia-Pacific member states.[1] The Asia-Pacific's strategic geographic location has paved the way for the region to undergo numerous cultural, economic, and social developments. This has primarily been attributed to its resource-rich status and the consequent dynamism has allowed it to flourish and dominate the world stage.[2] Despite the regions' immense growth potential, sustainability remains a point of contention in the Asia-Pacific.

Figure 1: The geographical coverage of the Asia-Pacific

Source: UNESCAP 2024

[1] https://www.un.org/dgacm/en/content/regional-groups
[2] https://climatepromise.undp.org/research-and-reports/regional-snapshot-asia-and-pacific

Table 1: Regional Classification of Asia-Pacific Member States

Region	Countries
East Asia	China, Hong Kong, Japan, South Korea
Central Asia	Kazakhstan, Kyrgyzstan,
South Asia	Bangladesh, India, Pakistan, Sri Lanka
Southeast Asia	Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam
The Pacific	Australia, New Zealand
West Asia	Cyprus, Iran, Jordan, Türkiye

The early 2000s saw countries worldwide introducing measures to target and achieve zero poverty without much consideration for inequality and its potential for social and economic damage. International standards and goals set up in 2000, such as the Millennium Development Goals, failed to account for inequality.[3] Eventually, countries began recognizing that high inequality levels were unsustainable to ensure growth and a significant economic hindrance, requiring further attention. In response, the Sustainable Development Goal (SDG) No. 10, one of the 17 goals established in 2015 by the United Nations, targets specifically the reduction of inequality within and among countries. Despite efforts at the international level to mitigate the impact of income inequality, the United Nations Development Programme (UNDP) reports that inequality in the Asia-Pacific continues to rise and remain at high levels.[4] Moreover, the IMF (2021) even argues that the COVID-19 pandemic may have exacerbated inequality outcomes for most countries in the region.

Income inequality has been defined as a measure of the discrepancy in wealth, status, or opportunity between groups or people. Various measurement indices of inequality have been introduced over the years, which observe the increase in the proportion of the wealthy population relative to those at the bottom of the income

[3] https://www.developmentpathways.co.uk/wp-content/uploads/2022/03/UNDP-RBAP-Inequality-and-Social-Security-in-Asia-Pacific-2022-compressed.pdf
[4] https://www.developmentpathways.co.uk/publications/inequality-social-security-asia-pacific/

distribution. The more common proxies of income inequality – the Gini coefficient, the growth incidence curve, the one or five percent share of the top income percentile in a population, the Robin Hood index, the quintile ratio, and Theil's entropy index – have primarily attempted to measure the rich-poor income discrepancy (Kanbur et al., 2014). The inherent difficulty of choosing a specific inequality index has led researchers to opt for certain measures based on logistical convenience, familiarity, and methodological persuasions of each measure (De Maio, 2007; Mukhopadhyay & Sengupta, 2021). As such, the Gini coefficient remains the most popular index of inequality used in analytical research since its introduction by Italian sociologist Corrado Gini (De Maio, 2007; Farris, 2010).

Income inequality remains relevant regionally and globally, especially as the income gap widens within and among countries (Dabla-Norris *et al.*, 2015). According to the UNDP, the Asia-Pacific region has seen a general increase in income inequality since the 1990s despite underreporting remaining prevalent in the region (Kidd *et al*., 2022). Despite the Pacific region reporting the second lowest rate of inequality (lowest only to Europe), its Asian half is characterized by high levels of inequality comparable to countries in the Americas, where inequality has been a prevalent issue.[5] Specifically, Southeast Asia has witnessed a general rise in inequality, while some moderating influence has been observed in Thailand and Malaysia. Meanwhile, inequality increased in India and Bangladesh but declined in Turkïye, Iran, and Pakistan. Among a sample of 61 Asian and Pacific countries, the UNDP reports that at least 40 percent of countries, including the vastly populous China and India, had

[5] https://www.developmentpathways.co.uk/wp-content/uploads/2022/03/UNDP-RBAP-Inequality-and-Social-Security-in-Asia-Pacific-2022-compressed.pdf

inequality levels greater than 40 percent, which is considerably high for the region.[6] Even Japan, which has not seen social concern in its locality over income inequality, may soon see a change in opinion as the aging population takes effect. This is because both net and market Gini coefficient has risen substantially according to the Japanese labor ministry based on 2021 data.[7] The disproportionate rise of inequality has often been attributed to the top earners traditionally, especially since the wealthy control a significant portion of the cumulative income share – the top 10 percent of earners in South Korea and Singapore dominated as much as 45 percent and 14 percent of the total income share (Bird *et al*., 2011). As such, researchers have turned to various determinants of income inequality such as population changes and indirect drivers, such as savings and globalization, to explain the undeterred rise in inequality in the Asia-Pacific region.

The recent decades have seen a rise in the influence of population dynamics. The Institute for Global Environmental Strategies reports that more than half of the global population resides in the Asia-Pacific, with China and India forming the mammoth's share of it.[8] Thus, demographic transitions can represent a critical turning point for the Asia-Pacific and can have spillover effects on the greater macro economy. Demographic transition is a long-term phenomenon that occurs over several generations: the first phase involves a rise in the dependency ratio due to the relatively high births and mortality rates paired with reduced life expectancy (Cruz & Ahmed, 2016). In fact, a boom in the youth population can be expected when the mortality rates decline faster than the fertility rates. An increase in the share of younger people

[6] https://www.developmentpathways.co.uk/wp-content/uploads/2022/03/UNDP-RBAP-Inequality-and-Social-Security-in-Asia-Pacific-2022-compressed.pdf
[7] https://www.asahi.com/ajw/articles/14987598
[8] https://www.iges.or.jp/en/publication_documents/pub/policyreport/en/154/3_overview.pdf

and improvements in human capital that lead to increased incomes can help incentivize a short-term increase in the working population. Concomitantly, the mortality and fertility rates are expected to decline, mainly due to the increased working population opting to bear fewer children, thus contributing to a decrease in the dependency ratio, allowing for the second demographic transition to occur (Cruz & Ahmed, 2016). The third stage is the longest phase, which sees the fertility rate falling beyond the population's replacement rate. At the same time, life expectancy improvements allow the elderly population to live longer, increasing the dependency ratio (Guest & McDonald, 2001). This rising trend of the average age of the population is known as the aging population. As the global population's median age rises, the future demographic structure can be expected to feature a disproportionately higher number of the elderly than today (Cheal, 2000).

The Asia-Pacific, which is currently observing an elderly population trend of one in seven ratio in 2022, is expected to rise to one for every four people by 2050.[9] With population aging gaining prominence globally, an aging classification can help reconcile the varying impact of intensity of the older population in a country, especially since the UN predicts that the elderly will surpass a colossal 1.3 billion in number by 2050 in the Asia-Pacific alone. Specifically, the OECD/WHO (2020) classifies a country as an aging state if the elderly population (people aged 65 years and greater) is within the 7-14% range. A range of 15% to 20% is then identified as an aged society, while those with an older person's share above 21% are categorized as super-aged. Based on this measure, projection estimates reveal that by 2050, ten

[9] https://repository.unescap.org/rest/bitstreams/0aeae6b6-f480-43c6-9c8c-dfe81bfec6cf/retrieve

countries in the Asia Pacific[10] will be classified as aging societies, five[11] will be identified as aged, and eleven[12] countries are expected to become super-aged (OECD/WHO, 2020). The expected rapid aging transition is consistent with the UN Economic and Social Commission for Asia and the Pacific report that the aging window for developing Asia-Pacific countries has become much shorter than their developed counterparts.[13] (OECD/WHO, 2020). Thus, using classifications for the aging process to understand the severity of population projections can help countries formulate pre-emptive measures to counter the negative consequences of the greying process at their respective stages. This is especially critical considering the drastic evolutionary changes in population demographics in recent decades have raised concerns because of the implied aging repercussions on income inequality.

Income inequality has become closely associated with population changes. For instance, Asian miracle economies such as Hong Kong, South Korea, and Singapore, which experienced immense economic growth as the baby boomer generation entered the workforce in the 1960s, helped to cushion the income distribution (Jain-Chandra *et al*., 2016). However, the benefits ended as the baby boomer generation retired, impacting savings and growth negatively and leading to an increase in income inequality (Kang & Rudolf, 2016). Moreover, countries such as India, Bangladesh, Indonesia, and China, which represent Asia's most heavily populated nations with 70 percent of the regional population residing here, saw an upward movement by 4.3, 4.6, 8.2, and 9.6 percentage points in the Gini coefficient between the four-year intervals

[10] Philippines, Mongolia, India, Myanmar, Nepal, Cambodia, Fiji, Lao PDR, Solomon Islands, Pakistan
[11] Korea DPR, Viet Nam, Malaysia, Indonesia, Bangladesh
[12] Japan, South Korea, Hong Kong, Singapore, Macau, Thailand, New Zealand, China, Australia, Sri Lanka, Brunei Darussalam
[13] https://www.unescap.org/resources/ageing-asia-and-pacific-overview

of 1990-1994 and 2010-2014, respectively.[14] Hence, more emphasis on the drivers of income inequality, particularly population changes, is needed to prepare the appropriate response to rising inequality.

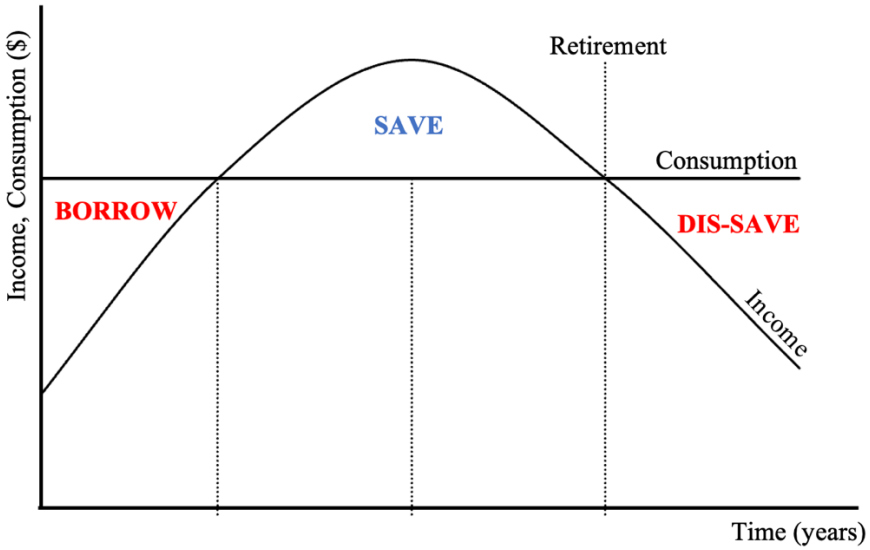
Savings, when viewed as an underlying channel, can help shed light on the dual problem of the aging population and rising inequality that the Asia-Pacific has begun to face in recent decades. Savings have traditionally been considered a support system for sustainable growth, especially for developing countries that have historically experienced wide savings disparities (Boateng *et al*., 2019). Thus, increases in the savings rate can help improve growth and reduce financial vulnerabilities by providing a hedge against global economic shocks. The need for savings has been underscored by the increased prevalence of global uncertainties, such as the recurring financial crises and, more recently, the COVID-19 epidemic. Thus, savings serve as a vital safety net for households, governments, and corporations alike and aid in counteracting unexpected future global developments.

Savings have often been represented as a critical mechanism that informs the determination of income and has become the core of the life-cycle hypothesis (LCH) introduced by economists Franco Modigliani and Richard Brumberg (1954). The LCH operates based on rational individuals wanting to ensure non-disruptive consumption (i.e., smoothing of consumption) subject to their expected lifetime income (Aghevli *et al*., 1990). In other words, individuals borrow in the early pre-career years to fund their education, save the bulk of their earnings during their working years, and spend down

[14] https://www.unescap.org/publications/inequality-asia-and-pacific-era-2030-agenda-sustainable-development

the accumulated savings (i.e., dis-save) upon retirement to ensure their consumption patterns remain unchanged (see Figure 2 below for a graphical illustration of the life cycle model). Alternatively, savings also serve as a channel for the provision of bequests and have significant implications on inherited wealth due to its nature as a counter to income shocks caused by future uncertainties. In addition, the LCH can be used to reflect the interconnectedness between demographic changes and income inequality: the income dispersion of any group of individuals will increase as they age due to the differences in wealth accumulation across their lifetimes, which leads to intensifying income inequality as the population ages (Chen *et al.*, 2017). Thus, the magnitude of savings behavior is clearly impacted by the intensity of the aging population present in a country (Modigliani & Brumberg, 1954).

Figure 2: The life cycle model



Source: Wolla (2014)

The amalgamation of aging, savings, and income inequality has been driven in part by global forces. The controversiality of globalization has often been tied to its distributional implication, primarily because it benefits capital holders over laborers

and high-skilled workers over their low-skilled counterparts (Potrafke, 2015). Yet, the adoption of trade liberalization measures in economic policies among countries in Asia and the Pacific has been crucial in allowing for the region to attain significant economic milestones, where a major share of industrial production (i.e., mining of natural resources, industrial and agricultural activities) resides in the region.[15] While economic globalization has been at the forefront of academic debate, the past several years have seen a shift in attention to globalization that emphasizes its human interaction aspect. Particularly, social globalization, which is used to describe the dissemination of information and culture through human interaction, has come under greater scrutiny as it has helped improve the interconnectedness between people (Naz, 2023). However, the multifaceted concept related to social globalization has fueled further research on the resultant consequences upon the global economy.

Social globalization can help facilitate the movement of ideas, information, and identities across borders and boundaries (Keohane & Nye, 2000). This phenomenon promotes ideas and lifestyle exchanges and increases access to a wider variety of consumer choices at competitive prices. Therefore, sociologists argue that isomorphism, which is used to describe the mimicry of societal consumption culture, may lead to the dominance of cultural assimilation and increased emphasis on wealth-inducing identities that overshadow traditional family and community values (Keohane & Nye, 2000). In economics, this refers to the imitation of consumption culture that has potential implications on savings and indirectly affects the income distribution. When society embraces foreign cultures that stress frugal consumption culture and improved accessibility of financial knowledge, sustainable spending habits

[15] https://www.iges.or.jp/en/publication_documents/pub/policyreport/en/154/3_overview.pdf

can be cultivated. On the other hand, social globalization can have a contrasting impact when practices pertaining to conspicuous and often, wasteful consumption is adopted by society – savings behavior becomes disincentivized (Chen, 2016). Thus, social globalization can help either improve or worsen the savings outcome and can potentially have trickle-down effects on the income distribution of a population.

1.2 Problem Statements

Countries in the Asia-Pacific have seen immense growth and sustained a greater magnitude of poverty-reduction efforts but at the expense of rising income inequality. Income inequality is often used to understand the extent of unequal distribution of income throughout a population (IMF, 2019). Despite its ability to propel growth in human capital investment and induce innovational advancements, especially relevant for developing and emerging countries, elevated levels of inequality can instead hinder growth-sustaining and poverty-reducing efforts (Jain-Chandra *et al*., 2016). In fact, Dabla-Norris *et al*. (2015) find evidence of a robust association between growth and inequality, whereby increases in the share of the wealthy at the expense of the poor worsen growth outcomes. As a result, inequality can spur political uncertainty, worsen accessibility to credit channels, and constrain entrepreneurship, human capital investment, and healthcare (Jain-Chandra *et al*., 2016).

Furthermore, inequality forces are more likely to reward high-skill workers at the expense of their low-skill counterparts, prefer capital-holders over labor workers, and tend to favor urban and coastal regions and disregard rural areas (Zhuang, 2018).

As a result, the share of labor income declines, high-skill premiums become prevalent, and wealth disparity widens, fueling an increase in income inequality. Worsening income inequality is detrimental because it results in the decline of the middle-class population as it wedges people disproportionately toward either the top or bottom of the income distribution. The hollowing out of the middle-class group is detrimental to the economy as this population segment has the best potential to drive sustainable and lasting growth (Zhuang, 2018). Hence, the United Nations introduced the tenth Sustainable Development Goal (SDG), which is targeted to raise the income growth of the bottom 40 income strata progressively above the national average income growth by 2030 to address potential issues arising from income inequality. The establishment of the SDG is timely considering the rapid evolution of the inequality frontier alongside population changes in the Asia-Pacific.

The rapid acceleration of the aging process among developing and emerging countries in the Asia-Pacific when compared to other developed counterparts is concerning. China experienced an increase in the number of elderly by five percent within a 30-year time frame, a feat that Japan took 40 years to accomplish (Hu *et al*., 2021). This occurrence is evidence of a shorter timing window of the aging process in the Asia-Pacific. Such drastic changes in the population structure can threaten a country's working population and economic growth by hindering the growth momentum in developing nations before they attain developed status. For example, developing Asian countries like Thailand have begun their aging transition despite being middle-income states (OECD/WHO, 2020). As a result, income inequality further widens between developed and developing countries. The stalling of economic progress due to aging is particularly worrying because the elderly in China, India, and

Indonesia are expected to reach a staggering 233 million, 133 million, and 28 million, respectively, by 2030 – with more than twice the older population living in developing regions than in the developed world (Hewitt, 2002).

The consequences of population aging require undue attention primarily because savings have often served the role of a support system, especially in mitigating future uncertainties and as an insurance mechanism against income shocks. This holds for the relatively large older population that now requires financial support typically backed by payroll deductions and taxes, which is instead strained due to the resulting decline in the working population (Banister *et al*., 2010). Such a shift of resources towards the older population at the expense of the working population may worsen inequalities across different generations.

Furthermore, global development has been known to cause economic imbalances and affect cross-country savings. Accelerated globalization that fuels the exchange of lifestyle and culture due to the influence of the media and technological growth has led to evolutionary consumption cultures that are either modeled after frugal and prudent societies or wasteful, conspicuous, and identity-driven economies. Such cross-border transfer of information and knowledge sharing, commonly referred to as social globalization, may deter savings habits if the desire to emulate the lifestyle and conspicuous consumption practices of foreign cultures dominates the promotion of frugal spending. On the other hand, globalization shocks that drastically alter lifestyle to emphasize material wealth over familial and community ties risk worsening the savings outcome (Keohane & Nye, 2000).

In sum, there is a rising need to address the anticipated income inequality and rapid aging trends while accounting for their concurrent consequences. Here, sustainability needs to be at the forefront of future policymaking decisions as the culmination of aging and income inequality are expected to shape the socio-economical and geopolitical scenes over the next several decades. Consequently, this thesis can be used as a benchmark to identify the potential impact of aging on inequality alleviation efforts and by extension, the effectiveness, objectivity, and applicability of the SDG No. 10 in the Asia-Pacific.

1.3 Research Questions

This study will attempt to uncover the answers to the following questions:

1. What is the long-run impact and consensus regarding the aging-inequality nexus?
2. How does domestic savings respond to population aging and social globalization in the long run?
3. What is the threshold value that results in a differential influence on the aging-inequality nexus?

1.4 Objectives of the Study

This thesis aims to understand the aging-inequality nexus in the Asia-Pacific region, examine the effects of the aging process on domestic savings while controlling for social globalization, and determine the threshold effects of aging on income inequality. Specifically, this thesis aims to determine the presence and impact of a long-run relationship between aging and income inequality, examine the domestic savings transmission channel for advanced aging countries, and identify the threshold value of aging and the corresponding impact on income inequality. The detail of each objective is outlined below:

(i) To empirically determine the presence of the long-run nexus for the aging-inequality relationship and the impact of aging on income inequality.

(ii) To determine the impact of population aging and social globalization on the savings behavior in the long run.

(iii) To identify the threshold level of aging and the corresponding impact on income inequality.

1.5 Significances of the Study

The surge in the aging population and the simultaneous rise in income inequality is deeply concerning, especially since recent empirical undertakings have yet to attain a consensus. A positive relation holds for most countries (Kang & Rudolf, 2016; Chen *et al*., 2017; Dong *et al*., 2018; Hwang *et al*., 2021; Zhang *et al*., 2021), while others find that aging either ameliorates (Alimi *et al*., 2017) or has little to no

impact on income inequality (see Andriopoulou *et al*., 2017; Chong & Ka, 2019). Hence, as the world acclimatizes to the simultaneous manifestation of the rapid aging phenomenon and soaring income inequality, there is an urgent need to determine the aging-inequality nexus, especially for the Asia-Pacific region. Therein, this study contributes by using time series analysis to explore the relationship between aging and income inequality for several countries in the Asia-Pacific region. The use of time series analysis can help provide policy recommendations that are tailored specifically to the country analyzed. To achieve this, this study uses the augmented autoregressive distributed lag (A-ARDL) cointegration approach to examine whether population aging has a long-run effect on income inequality based on the chosen Asia-Pacific countries at various stages of the aging process. This includes countries that are aging (such as Indonesia, Singapore, and Thailand), aged (such as China, Hong Kong, South Korea, Australia, and New Zealand), and super-aged (such as Japan) nations. The findings can shed light on the income inequality patterns based on the extent of the intensity of elderly population share (i.e., aging, aged, or super-aged societies) of the chosen countries in the Asia-Pacific region.

Furthermore, the prominent theory behind the aging-inequality nexus, commonly called the life cycle model, highlights the importance of the savings mechanism. More specifically, the life cycle hypothesis (LCH) implies that a rise in the elderly population is expected to result in lower savings, which drives the income gap further relative to the working population, coinciding with higher levels of income inequality. However, as older people anticipate living longer than previous generations and expect uncertainty in their children's earnings, they adjust current consumption to increase savings to insure against the possibility of their offspring’s future income

shock (Boar, 2020). This phenomenon is referred to as precautionary savings. As a result, the elderly do not dissave (as expected by the LCH) until much later in life due to altruistic motives (Danziger *et al*., 1982). Hence, examining the domestic savings channel can help understand whether the life cycle model or the precautionary effects is the more likely savings scenario in the Asia-Pacific. Consequently, this thesis aims to enhance the literature on domestic savings as a transmission mechanism to explain the aging-inequality relationship, which is an area that has yet to receive much attention.

Recent endeavors in research have turned to various methodological innovations such as dynamic panel models, simulations, and the recentered influence function (RIF) approach to offer a possible explanation for the ambiguity in the aging-inequality literature (Dong *et al*., 2018; Dolls *et al*., 2019; Hwang *et al*., 2021). To the best of our knowledge, this thesis is the first attempt at proposing a threshold effect examination of the aging-inequality nexus that uses a nonlinear framework. To that effect, the inverted-U curve representing the modified life cycle model with precautionary motives is proposed. More precisely, this model implies that an initial rise in the elderly population is expected to coincide with increasing income inequality. However, once a threshold level of aging intensification is reached, older people anticipate living longer. As a result, they adjust current consumption to increase savings for altruistic purposes (the precautionary savings phenomenon) and help stabilize inequality levels. The nonlinear threshold effect examination can highlight between-country differences of high-aging and low-aging intensity on income inequality, which can then be used to provide precise support for implementing old-age policies and inequality alleviation efforts. Thus, the dynamic panel threshold kink

(DPTK) model is utilized to understand the threshold effects present in the aging-inequality nexus. The DPTK provides the additional advantage of allowing for endogenous covariates that accommodate potential reverse causality problems, which past studies concerning aging and income inequality have rarely emphasized. Consequently, the reliability of findings can be established, which provides policymakers in the Asia-Pacific region with critical insights into the threshold value that could stabilize income inequality in an aging population.

Lastly, the global savings pattern is susceptible to globalization waves, especially the social component that encourages consumption. Hence, the role of social globalization as a driver of savings still needs to be ascertained. Hence, accounting for the effect of globalization when examining the domestic savings transmission mechanism can help reveal the long-run savings habits of aging countries. This is further necessitated by the increasing interconnectedness between and across cultures that can significantly impact the consumption and spending behavior of the general population, regardless of borders and boundaries. This study will help inform policymakers on the status of conspicuous consumption in the Asia-Pacific region.

1.6 Organization of the Study

The structure of this thesis is organized into five chapters to understand the mechanisms behind the impact of aging on income inequality. Chapter 1 begins with a background on income inequality, population aging, savings, and social globalization in the context of the Asia-Pacific. Then, this chapter presents the

problem statements, the research questions and objectives, and the importance of this study.

Chapter 2 discusses the long-run relationship between aging and income inequality using the augmented ARDL (A-ARDL) methodology. The results then determine the varying income inequality patterns based on the extent of the intensity of elderly population share (i.e., aging, aged, or super-aged societies) of the chosen countries in the Asia-Pacific region. In addition, the results help to identify significant drivers of income inequality on a country-specific basis. The novel dynamic ARDL simulations are then used to determine the effect of future shocks in aging intensity on income inequality.

Subsequently, in Chapter 3, the transmission channel of population aging to domestic savings is examined in the case of advanced aging countries. Specifically, the long-run impact of population aging on domestic savings is examined using time series analysis to verify whether the life cycle hypothesis or the precautionary savings model applies to the chosen countries. The results are then used to understand the more significant implication of domestic savings on the aging-inequality nexus, presented earlier for similar countries in Chapter 2. Chapter 3 then examines whether social globalization encourages or deters domestic savings. The results are then used to confirm whether frugal or conspicuous consumption persists in the chosen countries.

Chapter 4 then approaches the aging-inequality nexus based on the DPTK method to determine the threshold point of aging intensity and the corresponding differential impact on income inequality using a panel dataset of 22 Asia-Pacific

countries. The use of the DPTK methodology helps to address the lack of threshold examination of the aging-inequality nexus in the literature and to account for possible reverse causality between the chosen variables. In addition, this chapter attempts to verify the validity of the hypothesized inverted-U relationship proposed for the aging-inequality nexus. This chapter empirically confirms the modified precautionary-LCH model, which posits that greater income inequality persists at low-intensity aging levels, consistent with the LCH. However, beyond the determined threshold value, precautionary effects dominate, fueling better savings practices and stabilizing inequality. Chapter 5 provides a summary of the main results, proposes several policy implications, and highlights the limitations of this thesis and suggestions for the direction of future research.

CHAPTER 2

THE RELATIONSHIP BETWEEN POPULATION AGING AND INCOME INEQUALITY IN THE LONG RUN[16]

2.1 Introduction

Income inequality remains relevant regionally and globally, though the trend among countries varies (Dabla-Norris *et al*., 2015). In 2020, average income earners in the top 10 percent of the world population attained 38 times more growth in wealth than those in the bottom 50 percent.[17] The United Nations' Sustainable Development Goal 10 aims to raise and maintain income growth above the national average, specifically for the bottom 40 percent of the population by 2030.[18] The reasons for income inequality include technological change, globalization, human capital attainment, economic change, and evolution in the labor market (Huang *et al*., 2019; Wang *et al*., 2018). Recent studies, however, have increasingly turned to changes in the age structure of a population as a contributor to income inequality (Alimi *et al*., 2017; McCall & Percheski, 2010). Hence, further empirical examination of aging as a crucial mechanism driving income inequality is needed, especially as the age structure of the global population changes at an unprecedented rate.

[16] This core chapter has been published as a journal article in Economic Systems and is now available online at: https://doi.org/10.1016/j.ecosys.2023.101149
[17] https://wir2022.wid.world/www-site/uploads/2021/12/WorldInequalityReport2022_Full_Report.pdf.
[18] https://sdgs.un.org/goals/goal10/.

Because of the declining fertility rate and increasing life expectancy, many countries have become aging, aged, and super-aged societies since the beginning of the twenty-first century.[19] Based on 2020 data, projections estimated that by 2050, ten countries in the Asia-Pacific region would be considered aging, five as aged, and eleven as super-aged (OECD/WHO, 2020).[20] The rapid age transition expected is consistent with the UN Economic and Social Commission for Asia and the Pacific report that the aging window has become much shorter for developing Asia-Pacific countries when compared to their developed counterparts.[21] For example, it took China only 30 years to increase its elderly population by five percent, which Japan took almost 40 years to accomplish (Hu *et al*., 2021).

Rapid population aging could have various macroeconomic repercussions in a country, such as a reduction in the labor force, lower economic output with slower growth prospects, and an unsustainable fiscal path (Wang *et al*., 2018). Thus, it is essential to ascertain whether population aging would aggravate income inequality in the long run for countries already transitioning into aging, aged, and super-aged societies. For instance, several miracle Asian economies, such as Hong Kong, South Korea, and Singapore, experienced immense economic growth as the baby boomer generation entered the workforce in the 1960s, cushioning the income distribution (Jain-Chandra *et al*., 2016). However, the growth benefits ended as the baby boomer

[19] A country is classified as aging if those age 65 and older comprise 7-14% of the population. If those age 65 and older comprise 15-20% it is considered aged, and if they comprise more than 21%, it is considered super-aged (OECD/WHO, 2020).
[20] Aging countries: Philippines, Mongolia, India, Myanmar, Nepal, Cambodia, Fiji, Lao PDR, Solomon Islands, and Pakistan. Aged countries: North Korea, Vietnam, Malaysia, Indonesia, and Bangladesh. Super-aged countries: Japan, South Korea, Singapore, Macau, Thailand, New Zealand, China, Hong Kong, Australia, Sri Lanka, and Brunei Darussalam.
[21] https://www.unescap.org/resources/ageing-asia-and-pacific-overview/

generation retired, negatively impacting savings and growth and increasing income inequality (Kang & Rudolf, 2016).

Our study makes two contributions to the literature. First, at present, limited consensus on the impact of aging on income inequality in numerous countries has been reached in the literature, so this chapter adds to this stream by empirically examining whether population aging has a long-run effect on income inequality in several Asia-Pacific countries that are considered to be aging (e.g., Indonesia, Singapore, and Thailand), aged (e.g., China, Hong Kong, South Korea, Australia, and New Zealand), and super-aged (e.g., Japan). The findings shed light on income inequality patterns based on the intensity of the share of the elderly population (i.e., aging, aged, or super-aged societies) in these Asian-Pacific countries.

The second contribution is methodological, as we perform the augmented autoregressive distributed lag (A-ARDL) bounds test for cointegration analysis with annual time-series data from the Asia-Pacific countries studied to investigate the links between aging and income inequality, subject to the control variables selected. Prior empirical research on this topic is based on panel data and cross-sectional analyses, which involve pooled data that could obscure how country-based differences drive the variables of concern. On the other hand, time series allows the determination of individual characteristics specific to a particular country, allowing for the removal of insignificant drivers of income inequality from the model. Hence, identifying the significant contributors to income inequality specific to a country can help produce better policy-making decisions for that country. Therefore, a time-series analysis allows the examination of significant drivers of income inequality on a country-

specific basis. In addition, using a comparative approach based on the results of a time-series analysis has yet to receive much attention in the literature on the relationship between aging and inequality.

This core chapter is structured as follows. Section 2.2 reviews the literature. Section 2.3 discusses the conceptual framework behind the drivers of income inequality. Section 2.4 describes the methodology, including the empirical model, data, and sources. Section 2.5 presents our results. Section 2.6 concludes.

2.2 Literature Review

The impact of aging on income inequality has received considerable attention due to its increased prevalence among developed, developing, and emerging economies. Reviewing past studies shows that the empirical research on the aging-income inequality nexus initially focused on understanding inequality in earnings, income, and consumption using cohort analysis. This methodology has typically examined the Life Cycle Hypothesis (LCH) and the Permanent Income Hypothesis, which suggest that an aging cohort fuels greater inequality (Deaton & Paxson, 1994; Ohtake & Saito, 1998). In addition, the focus at this stage was solely on developed countries (Jäntti, 1997) and utilized mainly time-series of cross-sectional analyses due to data limitations (Deaton & Paxson, 1994). Subsequently, the research on the aging-inequality relationship began receiving greater interest as several countries began aging earlier than expected. For instance, Hong and Kim (2012) analyze the patterns of income inequality of a 1986-2006 cohort in South Korea to confirm the implications of the LCH, whereby within-cohort inequality increases with age. The authors find

that the observed increase in inequality is owed to imbalanced earnings and unequal allocation of pension funds, which largely overwhelmed the moderating effects of public transfers.

Kang and Rudolf (2016) emulate the work by Deaton and Paxson (1994) to investigate the effect of population age structure on income and consumption inequality in South Korea. They concluded that income inequality showed a slight upward movement or stagnation while consumption inequality declined unambiguously over time. The opposing pattern observed in income and consumption inequality may be due to an effective income tax rate, increased public transfers, and the better reliability of financial services via greater access to the credit market and reduced liquidity constraints for the masses.

The significant influence of macroeconomic variables such as inflation, unemployment rate, economic growth, and the labor market channel in the aging-inequality nexus has been established in some studies. According to Faik (2012), who deploys the OLS method on German data from 1983 until 2009, aging reduces income inequality through lower inflation, greater economic growth rates, and lower instances of the unemployment rate, *ceteris paribus*. However, the author notes that the exogenous impact of aging yields a positive association with income inequality based on data forecasting up to the year 2060. Labor market transmission is another channel that links aging to income inequality. Wang *et al*. (2018) use a panel data analysis of 69 countries and find that aging leads to increased income inequality because of the labor share reduction that occurs via labor supply restrictions and a decline in labor productivity. Drosdowski *et al*. (2015) use survey data from Germany to examine the