TRANSRESEARCH CONSORTIUM

WORKING PAPER SERIES

2021 number 8

Silver Tsunami: The Political Demography of Aging Populations

Nicholas Stowell
Claremont Graduate University

ABSTRACT

This paper examines the effect of rapid demographic aging on political instability. It demonstrates that rich and middle-income countries around the world have recently entered a novel phase of demographic transition in which the trajectories of total age dependency ratios have inverted and are now rapidly expanding. Through an empirical analysis of 39 countries from 1970 to 2018, I demonstrate that this inversion causes tremendous political instability. In doing so, I show that declining fertility, which was for centuries a boon to stability and economic development, is now having the opposite effect. Further, I demonstrate that policy attempts to mitigate the economic impact of aging societies are also politically destabilizing and thus suggest that there is no clear and effective legislative response to this crisis. In doing so, I argue that rapid demographic aging may be one of the most significant political and economic issues of the next fifty years.

Introduction

The old maxim that "demography is destiny" is commonly attributed to 18th century French philosopher Auguste Comte. The global history of demographic transition over the past several hundred years seems to agree with this statement. Throughout that history, through wars and famine, technological advancement and economic development, demographic currents have been an underlying driving force, just below the surface, just out of view. While they do not precisely determine political outcomes, broad global demographic trends set the stage upon which social and political behavior occurs. Birthrates and deathrates shape the field of play; they affect demographic structure, determine the composition of labor forces, affect the availability of resources, and shape the decisions of individuals and governments. Demography may not precisely equate to destiny, but it is certainly destiny adjacent.

Demographic tides do not ebb and flow like ocean tides. Yet like ocean tides, they do move through time in powerful and predictable, but unstoppable ways with effects felt by all, reverberating through the entire global system. A new, massive demographic wave is approaching. This wave has already hit the shores of many rich and middle-income countries, and will soon hit much of the rest of the world. It is a wave of elderly retirees heretofore unseen in human history—a silver tsunami. Like an ocean tsunami, its impact is poised to cause tremendous disruption. And like an ocean tsunami, it is predictable, yet unavoidable. All we can do is brace for it and seek ways to mitigate its most devastating effects.

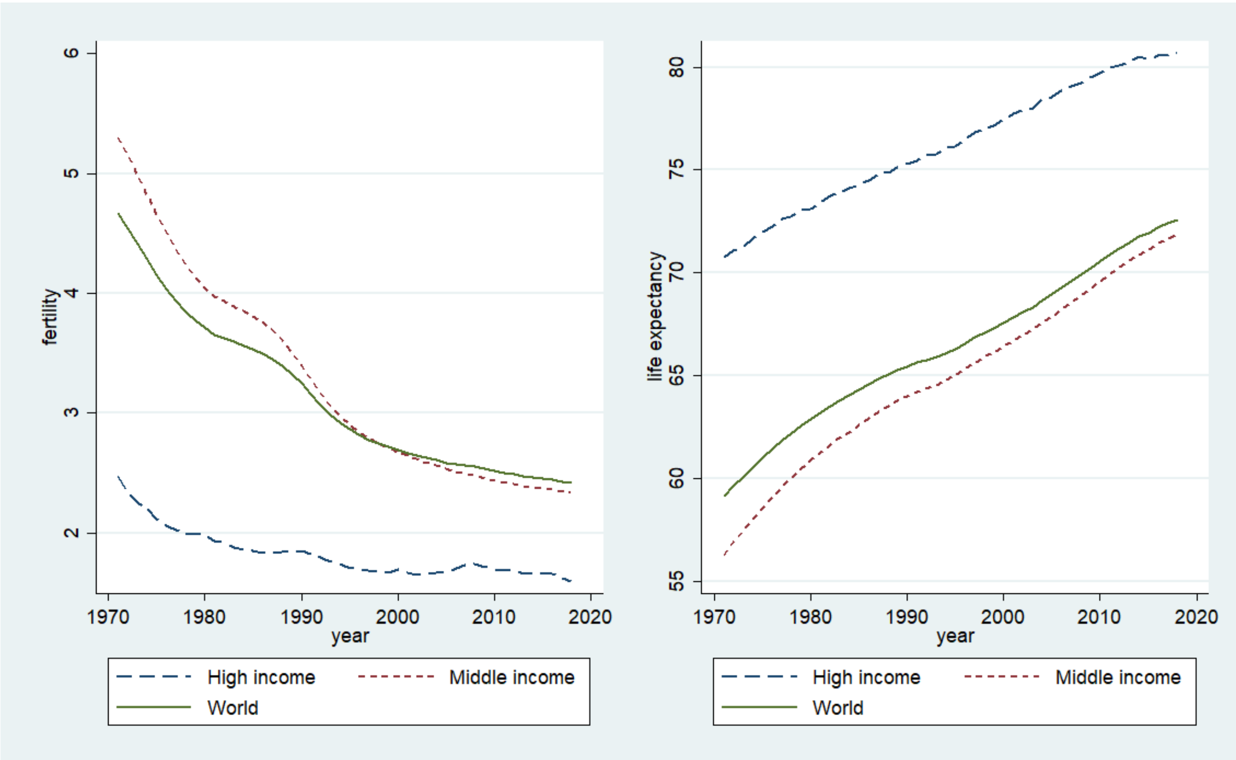
In this paper, I explore the political implications of rapid demographic aging. I show that this new phase of demographic transition, in which total age dependency reverses course and begins to rise, for the first time driven by increasing longevity in the context of low and stable fertility, is a politically destabilizing force. Further, I argue that there is little that even the most capable governments can do dampen the destabilizing consequences of this demographic wave once it arrives. Rather, by examining the political effects of economic policy geared toward compelling elderly populations to postpone retirement, I show that the most common policy response to demographic aging is itself politically destabilizing. In doing so, I argue that the crisis of rapid demographic aging is a particularly wicked problem.

An Aging Crisis?

Demographic aging is poised to become a major political and economic challenges in the coming decades. For over two centuries, the world—and particularly high-income countries—has seen a tremendous increase in life expectancy accompanied by a simultaneous decline in fertility (figure 1). In just the past 45 years, global life expectancy at birth has increased from 59 years to 72 years. At the same time, global fertility has fallen by nearly half, from 4.7 births per woman to 2.4 births per woman (World Development Indicators, 2020).

Combined, these two demographic forces are driving an unprecedented demographic aging of societies throughout the developed world. There are currently more than 700 million people worldwide over the age of 65. This trend shows no sign of stopping. If it continues, this number will increase to 1.5 billion within 30 years. At least 20 percent of the populations in the WWII allied countries will be over 65 years of age by 2050 (Leuprecht, 2015). Given the low, often sub-replacement fertility rates throughout the developed world, the combined effect will lead to exponential increases in old-age dependency ratios—the ratio of people over the age of 65 to working-age populations. By 2050, Europe's old-age dependency ratio is expected to be over 0.5, while North America's is expected to be over 0.4. Japan, the oldest country in the world, will have an old-age dependency ratio over 0.8, with Korea and Spain not far behind at 0.79 and 0.78 respectively (UN ECOSOC, 2019). The prospect of nearly 80 percent of a country's population being beyond working age is indeed cause for concern.

Figure 1. Fertility and life expectancy for high income countries, middle income countries, and the world from 1971 to 2018. Source: World Bank.



One consequence of expanding old-age dependency in the context of low fertility is the contraction of the labor force. For example, China—one of the fastest aging societies—is expected to see its working-age population shrink by 79 million by 2035 (Sheen, 2013). A smaller workforce naturally means less aggregate productivity, less economic growth, and less tax revenue for governments to allocate, all else being equal. It also means increasing demand for health care, rising per capita and total health care costs, and increasing demand for retirement, social security, and public pensions. Governments faced with shrinking revenue and increased demand for social services will need to find a way to care for their seniors. The increased demand for elder care may crowd out other spending, including education, military, infrastructure, and other investments. We are already beginning to see throughout advanced economies a net intergenerational transfer upward toward older generations for the first time in history (Lee & Mason, 2011). To the extent that investment in youth and young adults fosters human capital—a key driver of economic growth—this unsustainable upward transfer can only further stifle aggregate productivity and further reduce the tax revenue available to governments.

If the simple shuffling of existing resources from other programs toward retirees is unsustainable, what other options do governments have? To borrow or print money to fight the aging crisis is also unsustainable. Two policy options that appear to make economic sense are to expand immigration and to compel workers to postpone retirement. Each option could slow the contraction of labor forces, but neither is likely to stop the reversal of dependency trajectories. Further, immigration and retirement reform are notoriously unpopular and often politically toxic, calling into question whether they are politically feasible at the scale required to make a meaningful impact.

Broadly, the crisis of rapid demographic aging is poised to be a significant political and economic issue throughout the developed world over the coming decades. While the existing literature is relatively clear on the economic impacts, little research has been conducted on the political effects of demographic aging. Further, what research there is tends to consist of theoretical propositions and forecasts. As the silver tsunami is a new phenomenon, we can only now begin to empirically examine its political implications. That is my aim with this paper. I argue that the silver tsunami—the reversal of a country's age-dependency trajectory driven by increasing longevity in the context of low, stable fertility—is a politically destabilizing force. Additionally, I argue that government efforts to compel their aging populations to postpone retirement are further destabilizing. Pandemics have been a constant feature in history, from the earliest recorded pandemics to the present, the consequences and responses to these pandemics have shaped the course of human history. Pandemics have caused widespread death and health crisis, altered life-expectancy, exposed underlying socio-economic inequities, caused economic turmoil and created opportunities for conflict, but at the same time past pandemics have also created opportunities for advancements in public health through innovation, breakthroughs in medicine, technology, changes in governance structures and innovation in sanitary infrastructures. Pandemics have also unleashed government response, where capable governments have responded swiftly to counter the crises. If history is our guide, then how a society responds to these pandemics will have lasting implications for its future. Not all pandemics are created equal, and they have varied in their economic impacts, impact on demographics, social structures and politics; but there is a common thread, pandemics in general have affected marginalized groups of the population most severely throughout history and have also served as missed opportunities for creating economically vibrant and equitable societies.

Phases of Demographic Transition

Prior to the industrial revolution, most of the world experienced both high fertility and high mortality rates. In this period, fertility—the number of children born per woman—was purely a function of fluctuating mortality rates, entirely unaffected by economic considerations (Landry, 1987). Mortality—particularly child mortality—was extremely high, which necessitated many childbirths per woman. Throughout the pre-industrial phase, the size of the global population remained relatively static, though there were significant fluctuations. Such fluctuations throughout this period were attributed primarily to wars and pandemics, generally followed by temporary booms in fertility (Organski & Kugler, 1980).

Declining Mortality

The world saw a tremendous explosion of its population in the 20th century. It took 50,000 years for the global human population to reach one billion. In contrast, it took only 25 years for the world to add its most recent two billion people (United Nations Department of Economics and Social Affairs Population Division, 2011). Ushered in by the industrial revolution, this explosion of population began around 1800 in Europe and spread to Latin America by the turn of the twentieth century. Driven largely by vaccinations, hygiene, the use of soap, and improved nutrition, mortality and particularly child mortality fell precipitously. However, fertility rates remained high, causing the meteoric rise in the global population. Much of Africa remains in this demographic phase.

Declining Fertility

Eventually fertility began a natural decline, initiating a new phase of demographic transition. This was partly a natural response to falling child mortality; as more children survive birth and early childhood, demand for childbirth declines contributing to the lagged effect of fewer aggregate births (Landry, 1987). In addition, there were economic factors unrelated to child mortality which contributed to a decline in fertility. First, as societies developed economically through the industrial revolution and the 19th century, productivity and incomes rose. At the same time, women began to enter the industrial workforces across Europe and other Western countries. These parallel phenomena increased the opportunity costs of bearing children. Higher marginal returns on education further increased the opportunity costs of bearing children, which contributed to the aggregate trend of forestalling the decision to have children until later in life. This led to a further reduction in aggregate fertility throughout this demographic phase (Lee R. , 2003).

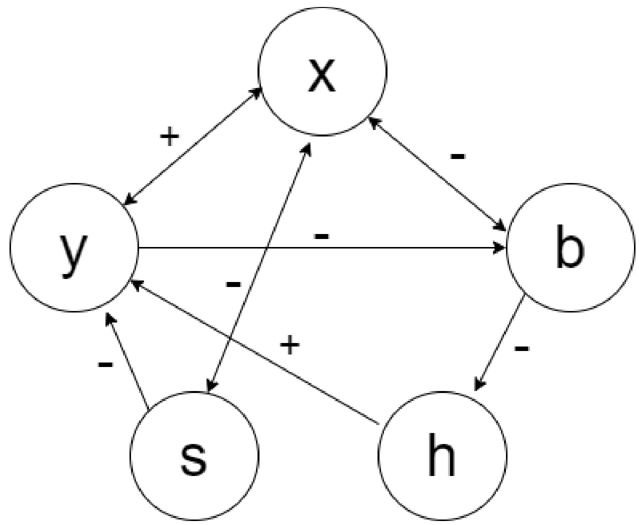
The literature points to significant desirable effects of this demographic phase with respect to economic and human development, political capacity, and—crucially—political stability. Declining fertility necessarily reduces the relative number of child dependents. This frees societies to increase their investment in health and education, potentially leading to a virtuous cycle of economic development, reduced fertility, increased human capital and further economic development (Feng, Kugler, & Zak, 2000; Kugler T. , 2016).

The key research paradigm linking fertility to political and economic outcomes is known as the Politics of Fertility and Economic Development (POFED) (Feng, Kugler, & Zak, 2000; Abdollahian, Kugler, Nicholson, & Oh, 2010; Yang, 2016). POFED formally and empirically demonstrates the complex, dynamic interactions between fertility, political capacity, human capital, economic development, and political instability. Among the key implications of POFED is that reduced fertility leads to increases in human capital and political capacity, which in turn contribute to increased economic growth and reduced political instability. The theoretical causal mechanism through which this occurs is as follows: lower birth rates (b) lead to relatively fewer children as a proportion of the total population. This allows for greater investment in each child, generating human capital (h), which is a crucial determinant of economic development (y).

Figure 2 offers a conceptual map of the complex, dynamic relationships between these factors. POFED argues that fertility has a net—albeit indirect—effect on political instability through its direct negative effects on political capacity and human development. Falling fertility contributes to economic prosperity and stable polity, which contributes further to falling fertility in a virtuous circle.

Regarding the mechanisms underlying the potential prosperity associated with declining fertility in this phase of demographic transition, it is instructive to think in terms of labor forces and dependent populations. Declining fertility necessarily leads to a subsequent shrinking of the youth-dependent cohort—the proportion of a population that is below the common working age and is thus dependent on others to help meet their daily needs. While longevity and life expectancy do increase through this demographic phase, the shrinking of the youth dependent cohort more than compensates for the concurrent expansion of the elderly dependent population. As such, total dependency falls precipitously, and the relative size of the economically active population expands. This may lead to a demographic dividend—an opportunity for significant economic growth as the relative size of the workforce expands—for those countries with the capacity to employ the newly expanding labor force (Bloom, Canning, & Sevilla, 2003; Feng, Kugler, & Zak, The Politics of Fertility and Economic Development, 2000). Some suggest that labor force growth associated with this demographic phase has accounted for most of the historical economic expansion of the developed world since the industrial revolution (Hewitt, 2002; Leuprecht, 2015). If so, what is to be expected as the flow of new labor and economic activity suddenly reverses course and begins to wane?

Figure 2. Conceptual map of the POFED model (Yang, 2016), where x represents political capacity, y represents income per capita, b represents fertility, h represents human capital, and s represents political instability. The arrows represent the direction of causality, the (+) and (-) represent the theoretical and empirical direction of effects.



Stable Fertility and Increasing Longevity

For generations, the key assertions of the POFED model fit historical data across rich and middle-income countries. Reduced fertility indeed meant that a smaller proportion of the population was dependent upon the economically active population for its survival. However, the same driver of reduced dependency ratios is now beginning to lead much of the world into a new demographic phase. For most rich and middle-income countries, the fertility-prosperity relationship that POFED uncovered may longer hold.

As fertility stabilizes at low, often sub-replacement levels, and life expectancies continue to increase, more people are aging out of the labor pool than the numbers of children aging into it. Total dependency ratios are now beginning to reverse course, for the first time driven by the relative expansion of elderly dependent populations. Further, whereas children can be invested in, educated, and trained to eventually become productive taxpayers, the wave of elderly dependents carry with them little such potential. As one author puts it "the risk in this transition is that low dependency ratios are temporary. After two generations, dependency ratios rise because such a large percentage of the population is elderly—at which point there is no going back to low dependency ratios" (Libicki, Shatz, & Taylor, 2011).

The literature suggests a double economic impact of aging populations whereby supply of government revenue decreases simultaneous with an increasing demand for public services (Sheen, 2013). On the supply side, larger elderly dependent populations should lead to reduced government revenue. Simply put, shrinking workforces, composed of increasingly older workers, should lead to less productivity, less economic growth, and less tax revenue (Hewitt, 2002). In such situations, people tend to work less, defect to lower tax jurisdictions, and migrate to the underground economy, further hampering government revenue (Sheiner, 2014). As expanding retiree populations spend down their savings, total savings rates should diminish, further contributing to slowed economic growth (Hewitt, 2002; Haas, 2007; Sheiner, 2014). This leads some analysts to project that economic growth rates in rich countries may soon grind to a near halt. It is projected that, "in the absence of longer working lives, growth rates in the European Union after 2025 will average just 0.5 percent a year…and 0.6 percent in Japan. For its part, the U.S. is projected to grow by an average of 1.4 percent per year" (Goldstone, Marshall, & Root, 2015, p. 242).

While the supply of government revenue is expected to shrink, the demand for government services is expected to grow. On average, more than one third of a person's medical costs are incurred after reaching 85 years of age. In the U.S., this implies that per capita health expenditure will have increased by 20 percent between 2000 and 2030 notwithstanding other factors (Libicki, Shatz, & Taylor, 2011). In addition to increasing per-capita health expenditure, the size of elderly populations is increasing exponentially as a proportion of the population in most countries. Thus, aggregate demand for public services is expected to soar in terms of both cost and volume. In response, we are already beginning to see an unsustainable intergenerational upward transfer of resources (Lee & Mason, 2011). The increasing demand for health care, elder care, and long-term care is fed at the expense of younger generations. This upward intergenerational transfer of resources is eating into investment in education and human capital—drivers of economic growth.

Government Response to the Aging Crisis

How are governments expected to respond in the face of rapid demographic aging? The literature suggests several options, each with substantial theoretical drawbacks regarding economic development and therefore political stability. As previously mentioned, governments are already transferring resources away from younger cohorts and toward elder care at unsustainable rates. Moving resources away from other programs can only get a country so far in the face of ever-growing waves of retirees. Therefore, governments must necessarily find alternative means of feeding the increasing demand for public services in the face of shrinking per capita tax revenue.

Scheiner (2014) argues that the fiscal burden of elder care falls primarily on the state and argues that increased deficits are a likely outcome. However, borrowing at the volume necessary to fund the expected increase in demand for public services associated with aging populations would likely lead to increased interest rates, which may crowd out investment and further reduce economic growth (Haas, 2007). As demonstrated by the POFED research, economic growth is a key to mitigating political instability. Therefore, borrowing at the level required to keep up with an exponential demand for public services would likely be politically destabilizing.

Another option is for governments to expand immigration to bolster the labor force, increase the tax base, and offset demographic aging. Yet the expansion of immigration has two problems. First, it would have to be expanded by orders of magnitude in most countries to offset losses to the labor market due to aging (Haas, 2007). Second, immigration reform is often met with fierce popular resistance. For example, 2018 saw violent anti-immigrant protests in eastern Germany following the inflow of one million immigrants and refugees (Neuman, 2018). Similar violent clashes have occurred throughout Europe and the United States in response to immigration reform attempts. Regardless of one's moral stance on immigration, that it is a politically charged issue is undeniable.

Governments can also increase their official retirement age or restructure public pension systems to incentivize the postponement of retirement. This is perhaps the soundest policy response to the aging crisis from an economic perspective (Lee R. , 2014; Libicki & Taylor, 2011). Many countries, including the U.S., currently have pension rules that may incentivize early retirement or penalize working later into life. Such rules tend to include low mandatory retirement ages, lax disability rules, and pension benefits that are no higher for those who postpone retirement than for those who do choose to work longer. Such rules, if changed, may compel the average worker to work later into life.

The U.S. social security policy highlights the potentially disjointed relationship between life expectancy and retirement policy. When the Social Security Act was signed into law in 1935, retired workers could receive their full benefits upon reaching the age of 65. At that time, life expectancy at birth was only 62 years, and roughly six percent of the population was over the age of 65 (Social Security Administration). Today, life expectancy in the United States is over 78 years, and more than 16 percent of the U.S. population is over the age of 65. Yet the age at which retirees can draw full social security benefits has only increased to 67, and retirees are still able to receive most of their benefits at age 65. This widening gap between the official retirement age and life expectancy can naturally be seen to cause tremendous fiscal pressure on governments in the absence of substantial reform geared toward the postponement of retirement.

Aging and Political Instability

What then are the implications of rapid demographic aging on political instability? Like the relationship between aging and economic growth, the literature on the political effects of demographic aging is mostly theoretical. This is to be expected given that the inversion of total dependency trajectories throughout countries of the developed world is a relatively new phenomenon. That said, the literature does project considerable destabilizing effects of rapid demographic aging.

Slowdowns in productivity growth are expected to increase pressure on governments to borrow and run fiscal deficits. Such deficits, run by many countries simultaneously, could increase global financial instability (Hewitt, 2002; Lee R. , 2014). As seen in the 2008 global financial crisis, instability in global finance tends to contribute to domestic political instability. The literature argues that the most important effects of that crisis were political and social, leading to increasing political polarization and the rise of extremist populism culminating in Brexit and the rise of Donald Trump—perhaps the most polarizing president in U.S. history (Mukunda, 2018).

In addition to fostering instability in the global financial system, within-country heterogeneity in preparedness for retirement is expected to exacerbate inequality (Lee R. , 2003). Inequality, in turn, is shown to hamper economic growth and contribute to political instability (Feng, 2003). This is yet another of several diverse theoretical paths from the economic effects of aging populations to political instability.

The literature converges around the notion that economic development is a key insulator against political instability (Feng, Kugler, & Zak, 2000; Abdollahian, Kugler, Nicholson, & Oh, 2010; Yang, 2016). This may be especially true for age-related instability. While the U.S. and Europe have been relatively well positioned to grow rich before growing old, there is particular concern for developing countries that are poised to grow old before growing rich. Many such countries—including China and India, which are home to nearly 3 billion people—are poised to experience the closing of their respective "windows of opportunity" and will soon see their age-dependency trajectories reverse course. As one author puts it, "such countries will have a limited amount of time to accelerate their economic growth rates before their advantages disappear; this is the window in which they can grow rich before they grow old. It is unclear how many countries will succeed in this gamble. If they fall short, will they become seriously strained and thus a source of instability?" (Libicki & Taylor, 2011, p. 313). To the extent that the richest countries in the world have been in the throes of this crisis for a decade and have already seen increases in their political instability, the implications for less developed and middle-income countries are grim.

The theoretical pipeline from economic to political consequences of aging populations is clear. Unfortunately, the primary policy responses appear quite difficult to implement. Older populations naturally have more elderly voters, who tend to be more politically active and politically conservative than their younger counterparts. Elderly people are more likely to vote and tend to resist changes to their retirement benefits, social security, and changes to official retirement age (Libicki, Shatz, & Taylor, 2011). Older populations also tend to hold relatively unfavorable views toward immigration (Pew Research Center, 2018), and tend to be more fiscally conservative than younger populations (Desilver, 2014). Therefore, governments of rapidly aging populations may have considerable difficulty doing anything meaningful about it even if they choose to do so. The very nature of demographic aging—building slowly over generations—and the political toxicity of key policy options, make it difficult to muster the political will necessary to combat the crisis.

The Silver Tsunami

The term "silver tsunami" has been used as a simple metaphor to describe the specter of rapid population aging since the 1980s. Like a tsunami, "the aging of the world's population is…large, it is beyond our control, and it is predictable" (Barusch, 2013, p. 182). I use the term in a rather more specific way. I define the silver tsunami as the sudden reversal of trajectory and rapid increase in total age dependency ratios due, for the first time, to increasing longevity in the context of low, stable fertility.

That global life expectancy has generally been increasing for a century is clear. Yet, until quite recently, the subsequent expansion of retiree populations has been more than offset by the aging of youth into the labor pool. This led to generations of year-over-year reduction in the total size of dependent populations relative to the size of labor forces. However, as fertility around the world stabilizes at low levels, and average life expectancies continue to climb, we have begun to see a reversal of that trend (figure 3). This is the silver tsunami—the sudden inversion of trend in dependency, the massive and predictable wave of largely dependent retirees in the context of a shrinking workforce.

Figure 3. Age-dependency structure over time in Japan and Spain. Total dependency falls as youth dependency declines initially, but eventually begins to rise as youth dependency stabilizes at a low rate.

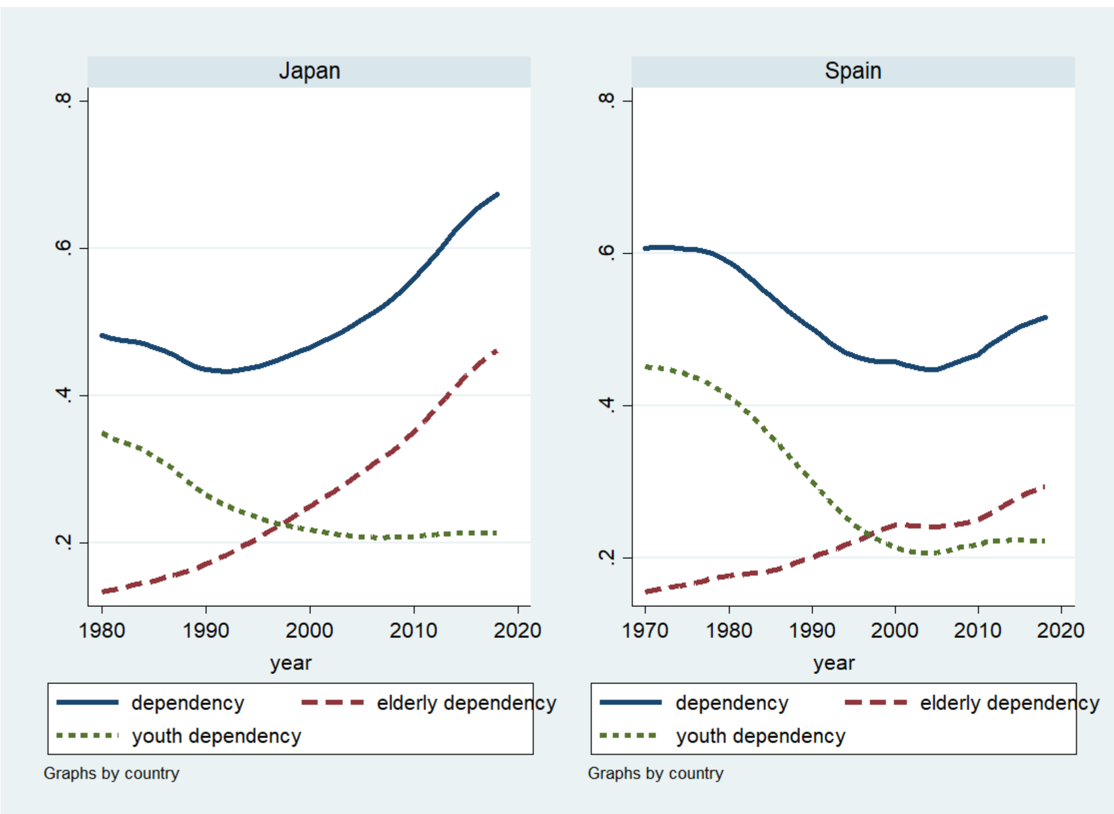
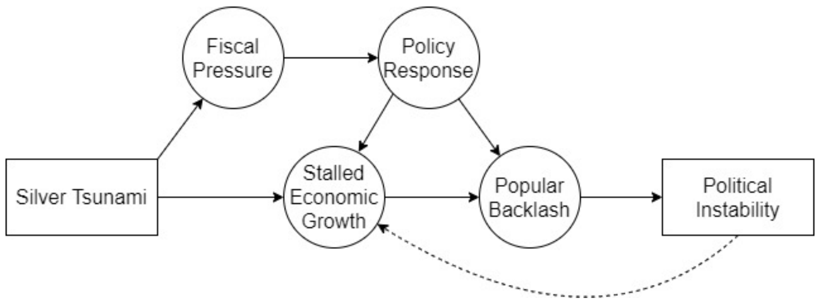


Figure 4 offers a visual representation of the theoretical ties between the silver tsunami and political instability. While the path from the rapid aging of society to political instability is multi-pronged, the theoretical result is clear: the silver tsunami is expected to be politically destabilizing.

Figure 4. Flowchart depicting the theoretical causal mechanisms from the Silver Tsunami to Political Instability.



Methodology

Based on the theoretical link between the silver tsunami and political instability outlined above, I test two related hypotheses:

> H_1: The inversion and rapid rise of a country's total age dependency trajectory, driven by an expansion of its elderly dependent cohort, contributes positively to political instability.
>
> H_2: The increase of a country's average effective retirement age in response to rising old-age dependency contributes positively to political instability.

The aim of the first hypothesis is to test the direct effect of the silver tsunami itself. I expect that an expanding elderly cohort is only destabilizing insofar as it drives the silver tsunami, the reversal of trajectory and sudden rise in total age dependency, but not before. The second hypothesis is meant to test the effects of policy efforts to compel people to work later into life in response to this phase of demographic transition. When taken as a whole, these hypotheses are constructed to test the destabilizing effects of the silver tsunami and policy response thereto.

Political Instability

The outcome of interest to this research is political instability. To measure instability, I use the weighted conflict index (WCI) from the Cross-national Time Series (CNTS) data set (Cross-National Time-Series Data Archive: CNTS Data Archive, 2020). The weighted conflict index (WCI) is a weighted composite index of assassinations, general strikes, terrorism and guerrilla warfare, government crises, purges, riots, revolutions, and anti-government demonstrations. It is commonly used as an index of political instability (Leon, 2014; Torgler & Frey, 2013; Abdollahian, Nicholson, Nickens, & Baranick, 2009). While I do not expect the aging of societies to cause significant incidence of assassinations, guerrilla warfare, or revolutions in the developed world, I do suspect that the silver tsunami could contribute causally to mostly non-violent incidents of political instability such as anti-government demonstrations, strikes, and government crises.

Dependency: Total, Old-age, and Youth

To capture the relative level and trajectory of elderly population sizes, I use the age dependency ratio (% of working-age population) variable from the World Bank's World Development Indicators (WDI) data set. This variable is "the ratio of dependents—people younger than 15 or older than 64—to the working-age population" (World Development Indicators, 2020).

Dependency represents the sum of youth dependency and old-age dependency. While my focus is the impact of expanding elderly populations, I utilize total dependency because I expect the destabilizing impacts of expanding elderly cohorts to exist only insofar as elderly cohorts are expanding faster than youth cohorts are shrinking. So long as shrinking youth cohorts compensate for expanding elderly cohorts such that total dependency continues to fall, I do not expect aging populations to contribute to political instability. Therefore, if I were to focus purely on old-age dependency, I may miss the key causal mechanism underlying the relationship between demographic aging and political instability.

Given that I conceptualize the silver tsunami as being driven by longevity and an expansion of elderly populations, I also divide total dependency into its components—youth dependency and old-age dependency. The former is the ratio of those under 16 years old to the working age population, while the latter is the ratio of those over 64 years old to the working age population such that total dependency is equal to the sum of youth dependency and elderly dependency.

Dependency Rate of Change

The level of dependency does not itself fully capture the silver tsunami. Rather, I argue that the trajectory of dependency over time is a key cause of demographically driven political instability. A government with a static proportion of age-dependent constituents will presumably either find a way to adapt to its equilibrium level of dependency or perish. However, when a country's age-dependent population suddenly begins to expand after decades of contraction, I expect fiscal pressure to build and economic growth to stall, contributing to political instability. Therefore, in addition to dependency, I also construct a measure of its year-to-year rate of change:

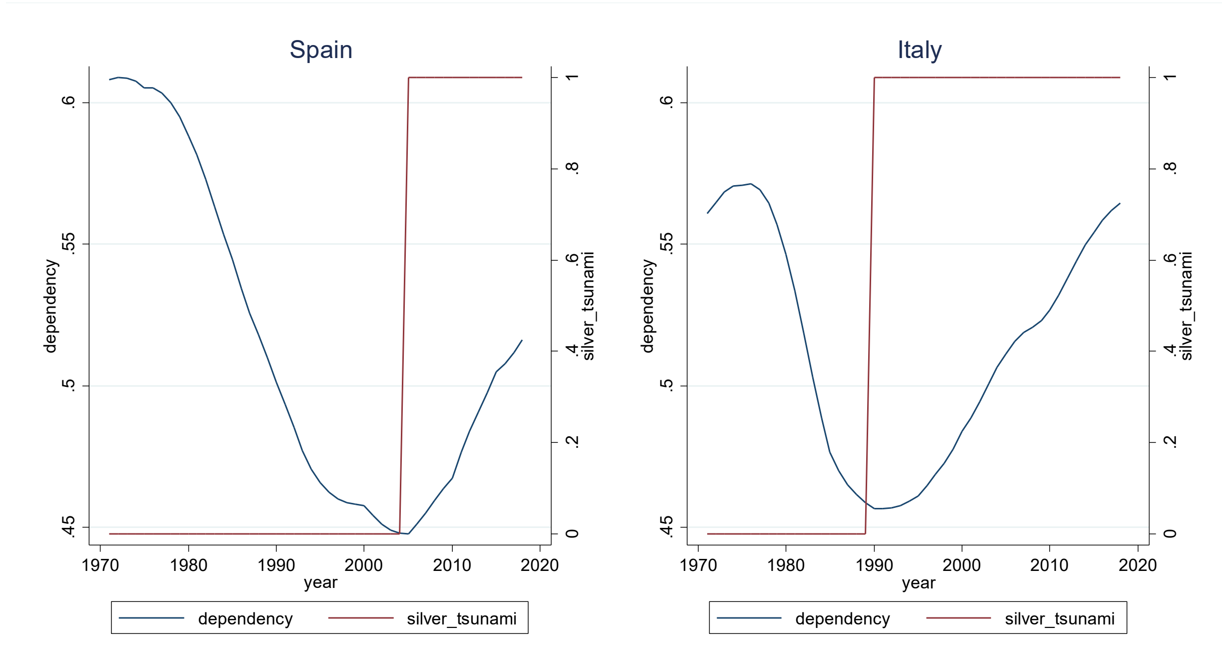
$$Dependency\ rate\ of\ change_t = \frac{dependency_t}{dependency_{t-1}}$$

Like total dependency, I also disaggregate its rate of change into its components—youth dependency rate of change and old-age dependency rate of change. I do so to ascertain any differing dynamic effects of elderly and youth populations on political instability. Again, I expect that old-age dependency rate of change is only impactful insofar as it contributes to rising total dependency—the silver tsunami.

Tsunami Dummy

As previously mentioned, I conceptualize a silver tsunami as the sudden inversion and rapid increase of total age dependency, driven for the first time by an expanding elderly cohort in the context of low, stable fertility. The onset of this novel transition is therefore marked by the inversion itself, and I argue that this inversion is politically destabilizing. As such, I generate a factor variable—silver tsunami—which takes a value of zero prior to the inversion of total age dependency, and a value of one for all post-inversion country-years (figure 6).

Figure 6. Overlay time series of total age dependency and the silver tsunami dummy variable in Spain and Italy. The onset of the silver tsunami is marked by the sudden inversion of total age dependency, driven by expanding elderly populations in the context of low, stable fertility.



Average Retirement Age

A government facing an expanding elderly cohort is likely to consider policies geared toward compelling its citizens to work longer into life. Whether such policies offer incentives for postponing retirement, disincentives for early retirement, changes to the "official" retirement age, or austerity with respect to pension benefits, such policies are often unpopular and at times met with significant public opposition. Therefore, to capture policy response, and to further incorporate political dynamics, I include Average Effective Retirement Age from the OECD (OECD, 2020).

The OECD calculates the average effective retirement age as "the weighted average of (net) withdrawals from the labor market at different ages over a 5-year period for workers initially aged 40 and over" (OECD, 2020). Estimates are based primarily on national labor force surveys. Average Retirement Age should effectively capture the interplay between government policies and popular response within each country over time as pertains to aging populations.

Control Variables

To ascertain the explanatory uplift that the silver tsunami variables provide above and beyond that of the POFED model outlined previously, I include its other four variables as controls. To model political capacity, I use the relative political extraction (RPE) measure, the data for which I draw from the Trans Research Consortium (Fisunoglu, Kang, Arbetman-Rabinowitz, & Kugler, 2020). RPE captures the ability of a government to extract resources from its population in the form of tax revenue and is measured as a ratio of predicted tax revenue, given economic and natural endowments, to a country's actual tax revenue for a given year. Predicted tax is calculated using the following regression model:

$$\frac{Tax}{GDP} = \alpha + \beta_1(time) + \beta_2\left(\frac{Mining}{GDP}\right) + \beta_3\left(\frac{Exports}{GDP}\right) + \beta_4(crude\ oil\ production) + \beta_5(GDP\ per\ capita) + \beta_6(OECD) + \varepsilon$$

All else being equal, a more capable government should be better able to implement whichever policies it selects. In the context of rapidly aging societies, a more capable government should be better situated to stave off the most dangerous political and economic consequences of shrinking revenue and increased demand for social spending. Crucially, it should also be better equipped to maintain political order and stability in the face mounting public opposition.

To control for human capital, I use gross secondary enrollment from the World Bank as my human capital measure. Gross secondary enrollment is defined as "the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown" (World Development Indicators, 2020).

I draw fertility from the World Bank's World Development Indicators, which defines it as total number of births per woman (World Development Indicators, 2020). While the demonstrable impact of fertility on political instability is theoretically and empirically convincing, I suspect that it is an incomplete means of capturing the political impact of a dynamic demographic structure. While declining fertility had for nearly a century been a boon to political stability and economic development, I argue that low fertility combined with increasing longevity has laid the foundation for a downstream inversion of this relationship. I expect that the previously demonstrated positive relationship between fertility and political instability no longer holds in much of the world.

Finally, to control for the demonstrable effects of economic development on political instability, I utilize GDP per capita (World Development Indicators, 2020).

Statistical Models

To test the hypotheses presented earlier, I employ the following statistical models:

Model 1:

$$Instability_{it} = \beta_0 + \beta_1 Instability_{it-1} + \beta_2 dependency_{it-1} + \beta_3 dependency_{it-1} + \beta_4 dependency\_roc_{it-1} + \beta_5(dependency_{it-1} * dependency\_roc_{it-1}) + \beta_6 GDPPC_{it-1} + \beta_7 RPE_{it-1} + \beta_8 fertility_{it-1} + \beta_9 gross\_secondary_{it-1} + \beta_{10} year_{it} + \varepsilon_{it}$$

Model 2:

$$Instability_{it} = \beta_0 + \beta_1 Instability_{it-1} + \beta_2 old\_dependency_{it-1} + \beta_3 youth\_dependency_{it-1} + \beta_4 old\_roc_{it-1} + \beta_5 youth\_roc_{it-1} + \beta_6(old\_roc_{it-1} * youth\_roc_{it-1}) + \beta_7 retire_{it-1} + \beta_8 GDPPC_{it-1} + \beta_9 RPE_{it-1} + \beta_{10} gross\_secondary_{it-1} + \beta_{11} year_{it} + \varepsilon_{it}$$

Model 3:

$$Instability_{it} = \beta_0 + \beta_1 Instability_{it-1} + \beta_2 old\_dependency_{it-1} + \beta_3 youth\_dependency_{it-1} + \beta_4 old\_roc_{it-1} + \beta_5 youth\_roc_{it-1} + \beta_6 tsunami_{it-1} + \beta_7 (old\_roc_{it-1} * tsunami_{it-1}) + \beta_8 (youth\_roc_{it-1} * tsunami_{it-1}) + \beta_9 retire_{it-1} + \beta_{10} GDPPC_{it-1} + \beta_{11} RPE_{it-1} + \beta_{12} gross\_secondary_{it-1} + \beta_{13} year_{it} + \varepsilon_{it}$$

where instability is WCI; dependency is total dependency ratio; dependency_roc is the rate of change of dependency; old_dependency is the old-age dependency ratio; youth_dependency is the youth dependency ratio; old_roc is the rate of change of old_dependency; youth_roc is the rate of change of youth_dependency; retire is average effective retirement age; GDPPC is logged per capita GDP; RPE is relative political extraction; fertility is births per woman; gross_secondary is the ratio of those attending secondary school to those of the official attendance age; and year is a control variable for the year[1]. Tsunami is a dummy variable for years after the inversion of a country's age-dependency trajectory. The subscripts i and t represent country and time, respectively, whereas ε represents the combined time-invariant and idiosyncratic error terms. A lagged dependent variable is included in each equation to account for the autoregressive nature of the dependent variable; instability yesterday predicts instability today.

Model 1 is meant to assess the effect of total age dependency on political instability in this sample. Model 2 deconstructs total age dependency to its constituent parts to examine the specific effects of youth and elderly dynamics respectively. Their rates of change are interacted to model the nonlinear dynamics observed in figure 3. Model 3 includes a dummy variable for the silver tsunami and interacts it with youth and old-age dependency rates of change to explicitly test the arguments (1) that the inversion of a country's dependency trajectory is itself destabilizing, and (2) that the expansion of old-age dependency brings instability only insofar as it drives the inversion and expansion of total age dependency. Notably, fertility is omitted from models 2 and 3 because of the extremely high correlation between fertility and youth dependency.

Results

The data for this research consist of 12 variables drawn from 39 OECD members and partner countries covering the period from 1970-2018 at the annual level (table 1).[2] The choice of countries is justified in that every country in this sample has experienced the inversion of its age-dependency trajectory—its silver tsunami.[3]

---

[1] I include a variable to control for time fixed effects because of the cross-national trend of increasing political instability over time for my sample

[2] Please see appendix for a table of relevant summary statistics.

[3] Japan, noticeably missing from this sample, is omitted because the World Bank lacks data on gross secondary enrollment in Japan.

Table 1. List of the 39 countries used in this research.

Australia	Denmark	Italy	Russian Federation
Austria	Estonia	Latvia	Slovak Republic
Belgium	Finland	Lithuania	Slovenia
Bulgaria	France	Malta	South Africa
Chile	Germany	Netherlands	Spain
China	Greece	New Zealand	Sweden
Costa Rica	Hungary	Norway	Switzerland
Croatia	Iceland	Poland	United Kingdom
Cyprus	Ireland	Portugal	United States
Czechia	Israel	Romania	

The models are estimated using a zero-inflated negative binomial (ZINB) estimator with country fixed effects.[4] I use ZINB due to the nature of the dependent variable. WCI is analogous to a count variable with a range of [0, 14625]. Further, it is over-dispersed with roughly half of the country-years including zero incidents of political instability.[5] An over-dispersed, count-based dependent variable with an excess of zeroes suggests the superiority of ZINB over other common regression techniques (UCLA: Statistical Consulting Group, 2021).[6]

Table 2 contains the empirical results of a nested set of regressions. All coefficients are centered and standardized with a mean of zero and standard deviation of one.

---

[4] A Hausman test confirms systematic difference in coefficients between random and fixed effects estimation techniques. The results can be found in the appendix (table a2).

[5] Alpha, the over-dispersion parameter, has a value of 0.58. An alpha equal to 1 occurs when there is no over-dispersion (UCLA: Statistical Consulting Group, 2021)

[6] A Vuong test comparing a standard negative binomial regression to a zero-inflated negative binomial regression provides a test statistic of $z = 13.23$ ($p < 0.0000$)

Table 2. Results of Zero-Inflated Negative Binomial Regressions with Robust Standard Error

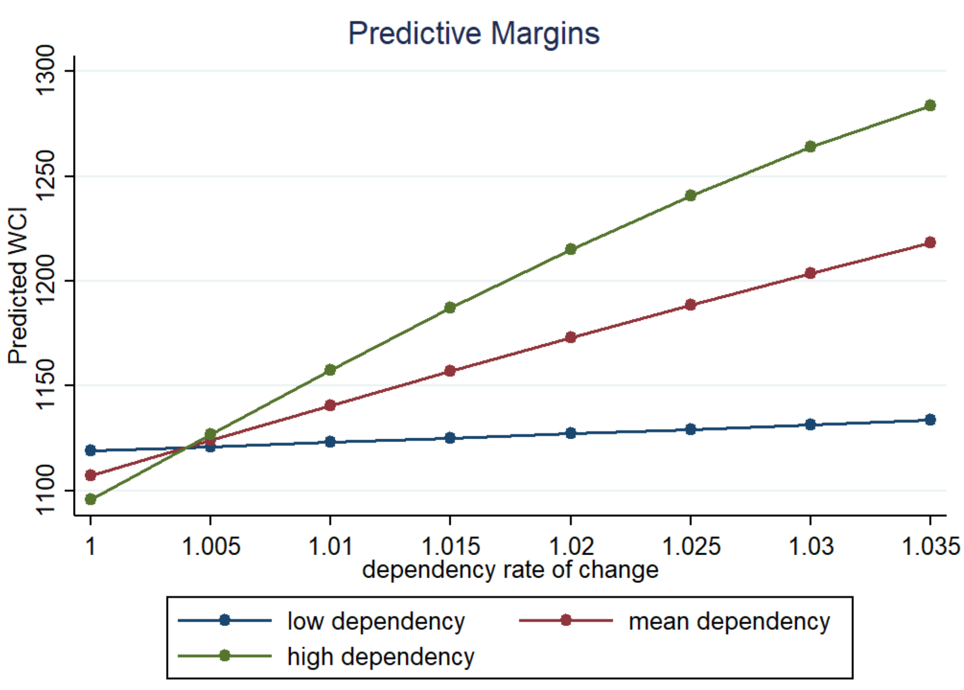
VARIABLES	(0) baseline	(1) total	(1a) pre-inversion	(1b) post-inversion	(2) components	(3) tsunami
Weighted Conflict Index (t-1)	0.000256***	0.000202***	0.000226***	5.01e-05**	0.000200***	0.000198***
	(2.29e-05)	(2.33e-05)	(3.88e-05)	(2.47e-05)	(2.34e-05)	(2.35e-05)
dependency		0.0887	-0.239*	-0.177		
		(0.0710)	(0.132)	(0.201)		
dependency rate of change		0.177***	0.0126	0.596***		
		(0.0514)	(0.0806)	(0.110)		
dependency * dependency ROC		0.0263	-0.0194	0.294***		
		(0.0352)	(0.0621)	(0.0939)		
fertility		-0.0143	0.235**	-0.583**		
		(0.0912)	(0.117)	(0.258)		
average retirement age		0.220***	-0.0547	0.319	0.219***	0.204***
		(0.0742)	(0.112)	(0.246)	(0.0695)	(0.0685)
old-age dependency					0.0669	0.0633
					(0.115)	(0.116)
youth dependency					0.0780	0.0834
					(0.108)	(0.106)
old-age dependency ROC					0.141***	0.0583
					(0.0371)	(0.0468)
youth dependency ROC					0.0725*	0.0410
					(0.0425)	(0.0546)
old-age ROC * youth ROC					0.0638**	
					(0.0273)	
silver tsunami (dummy)						0.199
						(0.149)
silver tsunami * old-age ROC						0.185**
						(0.0752)
silver tsunami * youth ROC						0.0219
						(0.103)
GDP per capita (logged)		-0.147	0.305	-0.637	-0.192	-0.208
		(0.218)	(0.283)	(0.628)	(0.216)	(0.211)
RPE		-0.0892	-0.293***	0.336	-0.0580	-0.0874
		(0.0820)	(0.112)	(0.267)	(0.0889)	(0.0874)
gross secondary enrollment		-0.0474	0.217*	-0.164	-0.0355	-0.0221
		(0.0764)	(0.122)	(0.119)	(0.0731)	(0.0733)
year		0.0153*	-0.0449***	0.0627***	0.0160	0.00987
		(0.00794)	(0.0147)	(0.0173)	(0.0106)	(0.0112)
Constant	6.276***	-24.29	94.16***	-118.3***	-25.74	-13.58
	(0.230)	(15.67)	(28.91)	(34.62)	(20.99)	(22.28)
Observations	1,424	1,424	910	514	1,424	1,424
MAE	686	626	430	650	646	636
AIC	12924	12850	7257	5464	12823	12805
BIC	13150	13171	7537	5719	13155	13158

*** p<0.01, ** p<0.05, * p<0.1

Model (0) is a simple baseline using only a lagged dependent variable as a regressor. Model (1) corresponds with the first equation. It includes aggregate dependency, its rate of change, and average effective retirement age as well as those variables from the POFED model—the structural controls found in the existing literature to affect political instability (Feng, Kugler, & Zak, 2000; Abdollahian, Kugler, Nicholson, & Oh, 2010; Yang, 2016). Models (1a) and (1b) replicate model (1), dividing the data set into pre- and post-inversion country-years—those years before and after the inversion of a country's total dependency trajectory. Model (2) disaggregates total dependency and its rate of change into their constituent parts. Finally, model (3) incorporates a dummy variable for post-inversion country years and interacts that dummy with the disaggregated rates of change. I do this to explore how the inversion itself conditions the effects of the explanatory variables.

Model (1) and its sub-models (1a) and (1b) examine the effect of total dependency and its rate of change on WCI. They suggest no overall relationship between the level of dependency and political instability. However, the coefficient for dependency rate of change is positive and statistically significant in model (1) ($p = 0.001$). An examination of the pre- and post-inversion models (1a) and (1b) demonstrates that the effect of dependency rate of change is driven entirely by the post-inversion period. Further, the coefficient for the interactive term becomes positive and statistically significant in the post-inversion model ($p = 0.02$). This suggests that, while total level of dependency does not itself affect WCI, once the demographic transition occurs a higher level of dependency tends to exacerbate the destabilizing effects of its rate of change. Figure 7 demonstrates this conditional effect in the post-inversion period.

Figure 7. Conditional marginal effects of total dependency and its rate of change on WCI. "low dependency" and "high dependency" represent 1.5 standard deviations above and below the mean, respectively.



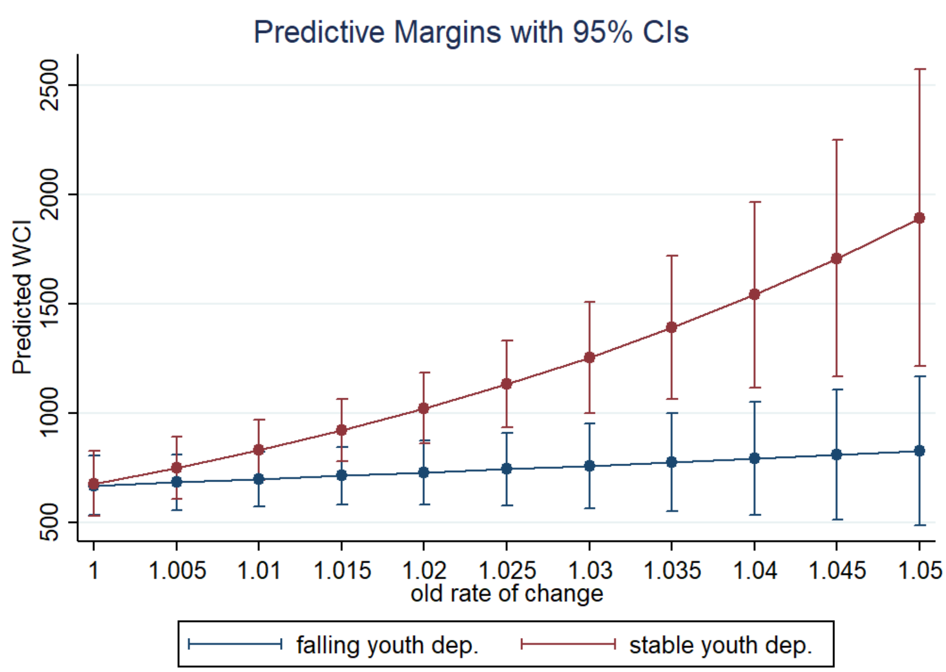
The first hypothesis states that expanding old-age dependency causes an increase in political instability, but only insofar as it drives the inversion and rapid increase of a country's total dependency ratio. Models (2) and (3) test this hypothesis directly by disaggregating total dependency into its constituent parts—

youth dependency and old-age dependency. Together, they offer strong empirical support for the first hypothesis.

Like total dependency, coefficients for the levels of old-age dependency and youth dependency are not significantly different from zero in either model. However, the coefficients for their respective rates of change are each positive and statistically significant in model (2) ($p=0.000$; $p=0.08$). It is noteworthy that the magnitude and statistical significance of old-age rate of change are both greater than those of youth rate of change. A comparison of their standardized coefficients in table 2 suggests that, all else being equal, the expected impact of a one unit increase in old-age dependency rate of change is nearly twice that of the same increase in youth dependency rate of change.

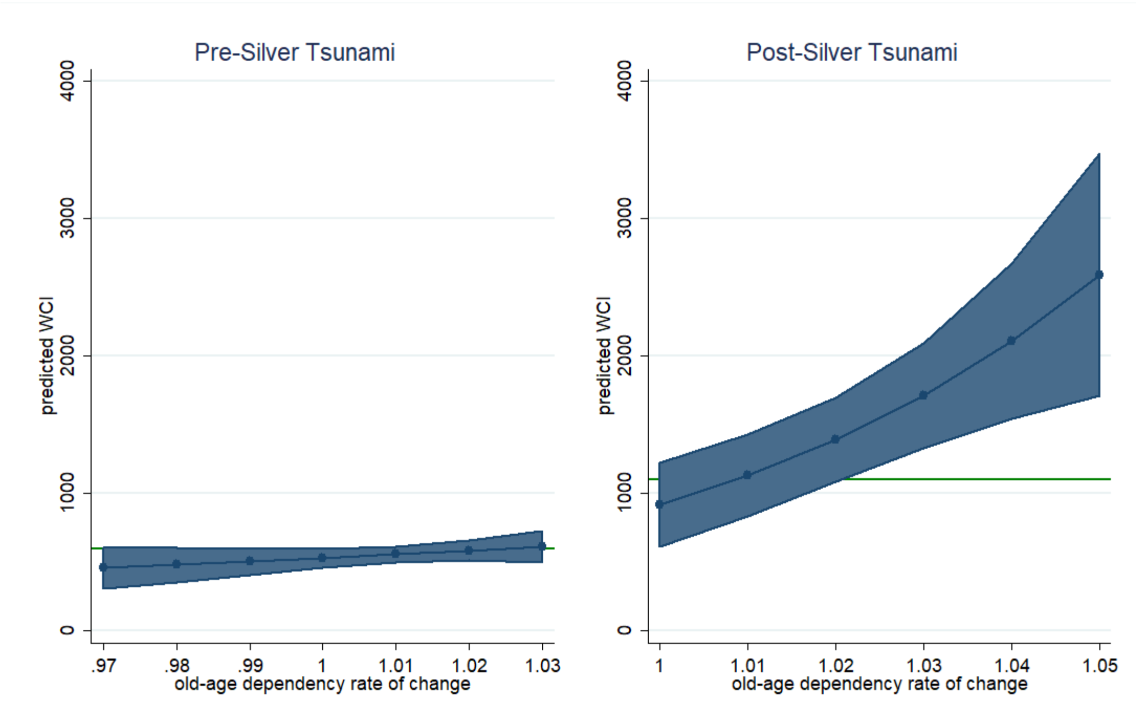
An interactive term between old-age rate of change and youth rate of change was included in model (2) to examine the dynamic interplay between both cohorts. The coefficient is positive and statistically significant ($p=0.02$). A conditional marginal effects plot allows for a succinct interpretation of this coefficient (figure 8). It shows a stark difference in the expected impact of old-age rate of change conditional on whether youth rate of change is falling or stable. This is further evidence for the argument that expanding elderly cohorts are destabilizing exclusively in the context of relatively stable youth cohorts.

Figure 8. Plot of the conditional marginal effects of old-age dependency rate of change and youth dependency rate of change on predicted WCI scores. "Falling youth dep." corresponds with a youth ROC value of 0.97, which is 1.5 standard deviations below the mean.



Model (3) takes an alternative approach to assessing the impact of the silver tsunami through the application of a dummy variable. In model (3) the individual coefficients for old-age dependency, youth dependency, and their rates of change are each statistically insignificant. However, when each rate of change is interacted with the silver tsunami dummy variable, the coefficient for old-age rate of change becomes positive and statistically significant ($p = 0.01$), while the coefficient for youth rate of change remains insignificant. In other words, this suggests that an expanding old-age dependent cohort is politically destabilizing, but only insofar as it drives the inversion of total age dependency (figure 9). This finding supports the first hypothesis. Further, it fails to demonstrate any impact of youth dependency or its rate of change beyond their impact on the inversion itself.

Figure 9. Marginal effects plots for old-age dependency rate of change, conditional upon the silver tsunami dummy variable. The green lines represent mean WCI pre- and post-inversion.



The second hypothesis to be tested is that an increase of a country's average effective retirement age in response to the crisis of demographic aging is itself politically destabilizing. The empirical results in table 2 offer strong support for this hypothesis as well. The coefficients for average effective retirement age are positive and statistically significant in models 1-3 ($p = 0.003$; $p = 0.002$; $p = 0.003$ respectively). Further, the standardized coefficients are consistent across models (0.22, 0.22, 0.20, respectively) and of greater magnitudes than any other statistically significant coefficients. This suggests that, while expanding elderly cohorts tend to be politically destabilizing, this key policy response tends to be even more destabilizing.

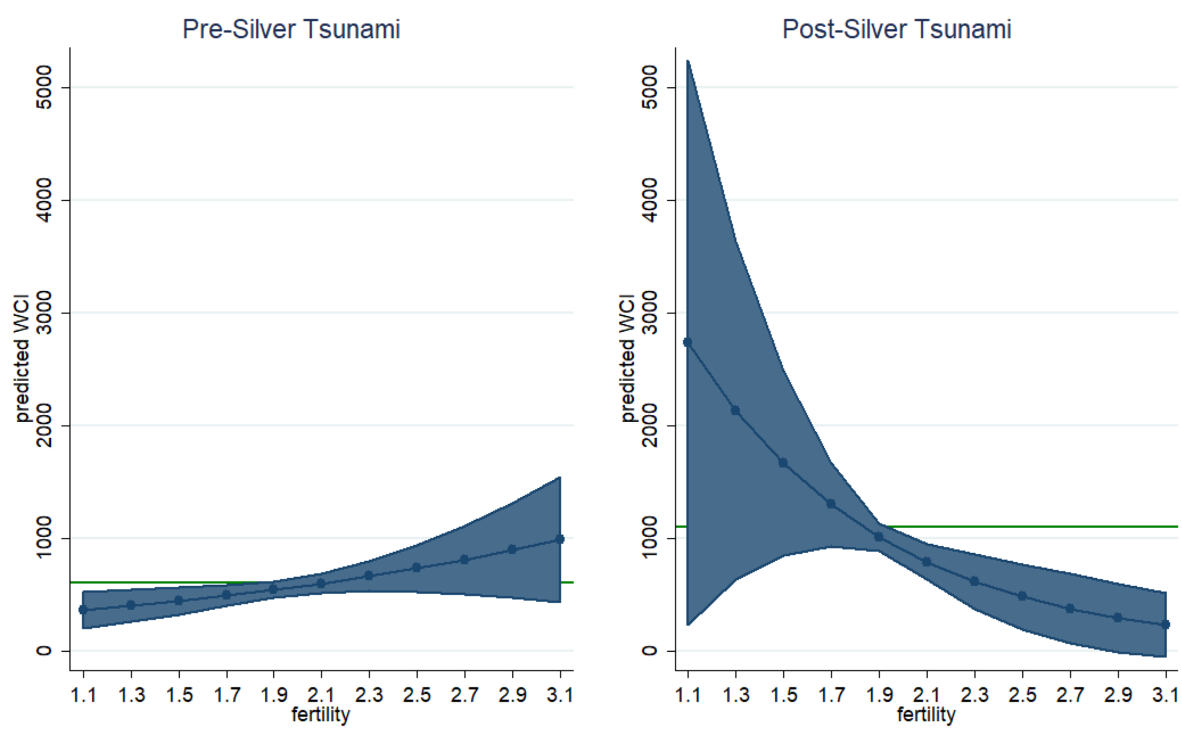
The results displayed in table 2 offer little support for the assertions of POFED with respect to political instability. The coefficients for GDPPC lack statistical significance in any model. Further, while the coefficient for RPE is negative and statistically significant, as predicted by POFED, in the pre-inversion model (1a), it loses statistical significance in the post-inversion period, demonstrated by model (1b). It appears that the mitigating effects of political capacity are strong prior to the silver tsunami but diminish after the inversion of a country's age-dependency trajectory. Once countries experience the inversion of their dependency trajectories, political capacity no longer helps governments to mitigate instability.

POFED demonstrates that high fertility rates are a root cause of political instability. One would therefore expect the standardized coefficient for fertility to be positive and significant. The results of model (1) do not support this argument; while the standardized coefficient is negative, it is not statistically significant ($p = 0.88$). Once again, the results from sub-models (1a) and (1b) are telling. Prior to the inversion of a country's total dependency trajectory, the coefficient for fertility is positive and statistically significant (p =

0.045) with a relatively large magnitude. Thus, prior to the silver tsunami, fertility behaves as POFED expects, contributing to an increase in political instability. Yet once a country reaches the inversion of its age-dependency trajectory, the coefficient for fertility becomes negative and nearly doubles in magnitude, retaining its statistical significance (p = 0.024). Thus, upon the inversion of age dependency trajectories, the effect of fertility reverses and begins to contribute quite significantly to reducing political instability.

Figure 10 contains marginal effects plots for fertility, comparing the pre- and post-inversion effects. It shows that the relationship between fertility and political instability which held for at least a century appears to have been starkly reversed by the silver tsunami.

Figure 10. Marginal effects plot for fertility before and after the silver tsunami. The green lines represent mean WCI pre- and post-silver tsunami, respectively. The inversion of age-dependency trajectory appears to reverse the beneficial effects of low fertility demonstrated by POFED.



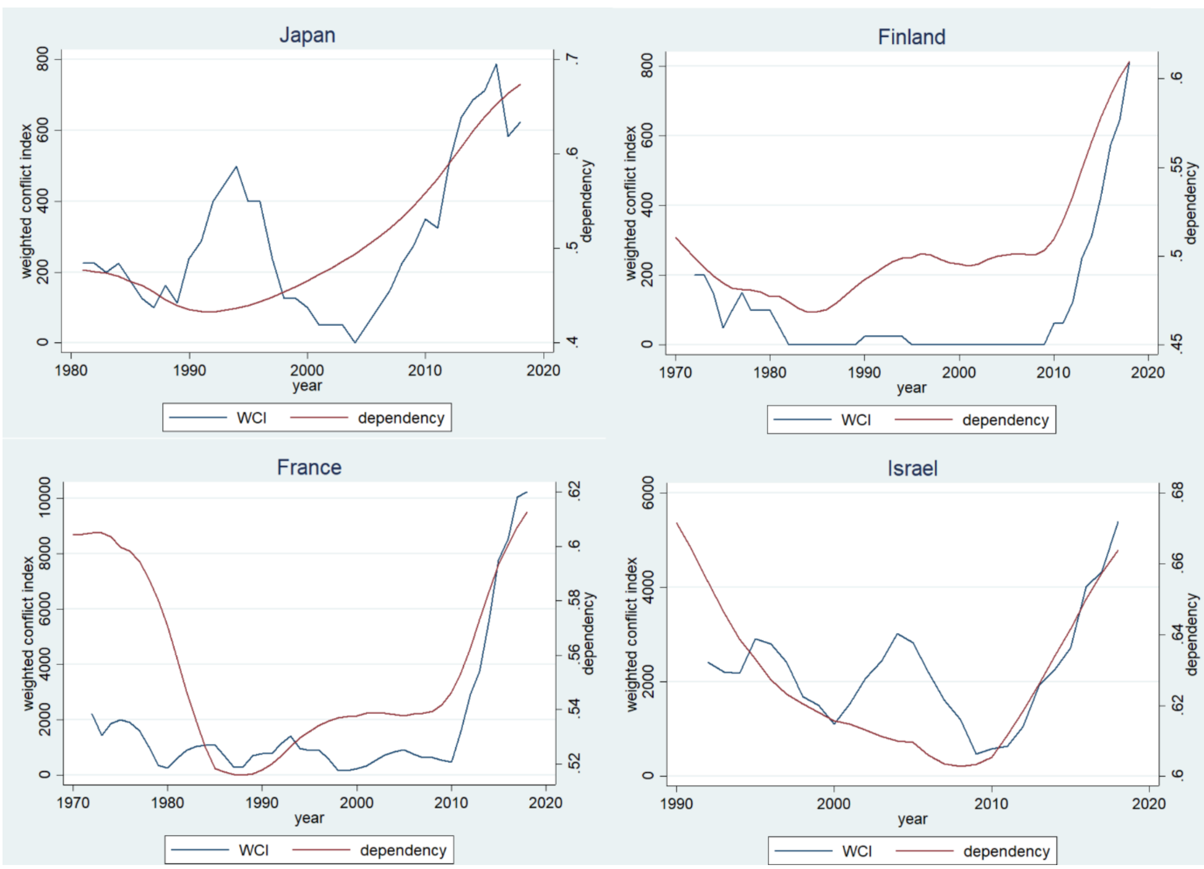
Discussion

The empirical analysis in the preceding section offers empirical support for the claim that rapid demographic aging is a harbinger of political instability. It also shows that efforts to compel elderly cohorts to postpone retirement—a key policy prescription in the face of expanding elderly populations—tends to further contribute to instability.

The level of dependency at any given point in time offers an incomplete, static picture of a complex, dynamic process. Were the size of a country's dependent population to remain in a static equilibrium, I would expect a government to cope with that level of dependency. Indeed, the level of dependency itself is not a significant predictor of political instability. Yet dependency ratios are not static. They show a consistent pattern of decline for generations as fertility declines, before abruptly reversing course and beginning to rise with increasing longevity. The preceding statistical analysis demonstrates that this reversal in the trajectory of dependency is a significant driver of ensuing political instability. Falling overall dependency rates contribute to larger economically active populations, more potential economic activity, and more potential government revenue with each passing year. The sudden reversal of this favorable condition inevitably leads to declining per capita government revenue. As this reversal is driven by an expansion of elderly cohorts, the decline in revenue is accompanied by an increase in demand for costly government services. A double impact of decreased supply of government revenue and increased demand for government programs is understandably a destabilizing situation for any government.

That the trajectory of old-age dependency contributes to political instability is exacerbated by those unfortunate circumstances in which a country is faced with a particularly high level of total dependency at the point where increasing longevity spurs a reversal of the trajectory of total age dependency. This does not bode well for the prospects of historically stable countries such as Japan, Finland, or France, nor for historically unstable polities such as Israel, each of which is currently experiencing extremely high and rapidly rising levels of old-age and total dependency. Indeed, we see that the recent history of each of these countries is one of rising dependency closely accompanied by rising levels of political instability (figure 11).

Figure 11. Time series plots tracing political instability for four countries currently experiencing a combination of high and rapidly rising dependency.[7]



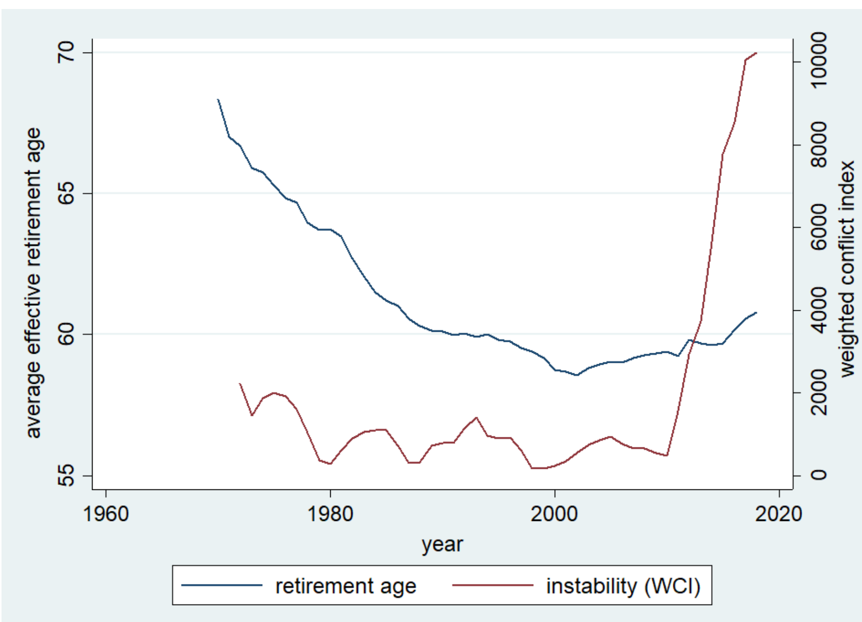
[7] Note the different scales for each country. While inappropriate for cross-national comparisons, this should not be problematic given that the aim of this research is to examine within-country variation over time.

As for the second hypothesis—that efforts to increase the average age of retirement in response to the economic impacts of an expanding elderly population further contribute to political instability—the analysis herein offers empirical support. Indeed, efforts to compel people to work later into life are often met directly with fierce popular opposition. France offers an illustrative example.

In 2007, the French General Review of Public Policies led to a proposed postponement of the national retirement age by raising the normal retirement age for public pensions from 65 to 67 and raising the age for early reduced pensions from 60 to 62. As the proposal made its way through government, popular opposition grew, culminating in the 2010 pension reform strikes. French union leaders organized nationwide strikes and public demonstrations. Beginning in March with between 395,000 and 800,000 participants, by October there were up to 3.5 million people of all ages participating in the strikes (BBC News, 2010). While one may expect that those approaching retirement would be the most strongly opposed to such reforms, there was a significant contingent of youth and young adults that participated in the strikes. In fact, fear of reduced job opportunities for youth entering the workforce was cited as a key reason for the protests (France 24, 2010). This illustrates the complex, dynamic route through which the crisis of rapid demographic aging spreads instability throughout the system. Though not deadly, the protests and strikes did turn violent and inflicted significant economic damage and disruption (France 24, 2010). French President Nicolas Sarkozy eventually signed the pension reform bill into law on November 10, 2010. France's average effective retirement age has steadily increased since the law went into effect, rising from a low of 58.6 up to 60.8 as of 2018, while political instability endured and intensified through the subsequent decade (figure 12).

Similar protests, strikes, and demonstrations have occurred in many countries in the face of government efforts to curb the disruptive effects of aging populations. One million Italians took to the streets in 1994 in protest of the Berlusconi regime's attempts at pension reform. Again, in October of 2003, millions of Italian workers walked off the job to protest government plans to raise the official retirement age from 57 to 65 and to cut pension benefits. Post offices, schools, and banks were closed. Flights were cancelled, and public transit ground to a halt (The Guardian, 2003).

Figure 12. Retirement age and political instability in France. The pension reform bill was enacted in 2010, corresponding with a sharp and enduring rise in political instability.



In 2018, thousands of Russians took to the streets around the Kremlin and elsewhere around the country in protest of a proposal to raise the pension age for men from 60 to 65. Polling showed that 90 percent of Russians opposed the legislation. Opposition leader Alexei Navalny organized a series of protests on this issue, leading to his imprisonment (Ivanova, 2018). He would eventually be poisoned—allegedly by members of Russia's FSB domestic security agency (Litvinova, 2020). If true, this was an attempted political assassination—a hallmark of political instability—related in part to retirement and pension reform. As more countries face the silver tsunami and its associated fiscal pressures, there will necessarily be more attempts at retirement and pension reform. Popular backlash and political instability are likely to accompany such attempts.

Conclusions

The silver tsunami is particularly troublesome because it is an opaque and slow-moving phenomenon. Like climate change, it is often difficult to muster the political will required to confront the greying of society and its associated costs and fiscal pressures. And as with climate change, there is a significant penalty for acting late. Unlike terrorism or a global pandemic, the silver tsunami is a problem that builds momentum incrementally over decades without an acute, observable moment or event to point to. As such, politicians concerned with capturing headlines through grand gestures and sensational phenomena are particularly ill-suited to make the greying of society one of their primary concerns. The pressure builds and instability follows. This does not bode well for the historically great powers.

Nor are emerging powers immune to this phenomenon and its destabilizing effects. As Jackson and Howe (2008) argue, "many nations in North Africa, the Middle East, South and East Asia, and the former Soviet bloc—including China, Russia, Iran, and Pakistan—are now experiencing rapid or extreme demographic change that could push them either toward civil collapse or (in reaction) neo-authoritarianism" (Howe & Jackson, 2008). Indeed, China, Russia, and Iran have all reached the beginning of their silver tsunami in recent years. The prospects for these countries are grim.

There is considerable debate over the appropriateness of various policy responses to the silver tsunami. While policy efforts to compel the postponement of retirement may make sound economic sense, this research has made clear that such efforts are tremendously destabilizing in the political realm. This implies that the form such policies take is crucial. Incentives to work later into life are likely to face less popular backlash and may be less politically toxic than sweeping mandates, the removal of retirement benefits, or new penalties for early retirement. Furthermore, such policies are likely to be less costly and better received by the public if they are introduced early and incrementally rather than in large sweeping reforms amid growing crises. As the empirical analysis above demonstrates, the capacity of governments to mitigate political instability diminishes with the silver tsunami. Therefore, governments that are able ought to act well before the inversion to maximize the impact of whatever capacity they have.

Expanding immigration may be an additional policy option to maintain the labor force and slow the process of demographic aging (Hewitt, 2002; Haas, 2007). Indeed, its historical openness to immigration has arguably helped to slow the acceleration of old-age dependency in the U.S. relative to the other great powers (Libicki, Shatz, & Taylor, 2011). Yet immigration reform itself can be a destabilizing force, as seen in the violent protests against the UN migration pact in Brussels in 2018 (BBC, 2018), and riots throughout Europe over immigration policy in the just the past five years (Associated Press, 2020; BBC, 2015). Similar, and perhaps more fervent anti-immigrant sentiment was seen recently in the United States with the election of Donald Trump and his campaign promise to build a wall at the southern border with Mexico. Immigration is an exceedingly polarizing topic in American politics; Pew Research Center (2020) reported that more than half of American voters said that immigration was "very important" to their vote in the 2020 election. The question thus becomes how to encourage inward migration while avoiding the political toxicity surrounding the issue. As the links between immigration, age structure, and political instability are apparent, future empirical research on the political effects of rapid demographic aging would therefore benefit from incorporating immigration policy and migrant flows.

In sum, this research reveals a significant, causal link from rapid demographic aging through mounting fiscal pressure to political instability. It refines and augments the dynamic interaction between politics, demography, and economics, extending it beyond the POFED paradigm by incorporating the downstream, unintended consequences of reduced fertility. In doing so, it contributes explicitly to our understanding of what may become one of the greatest global political and economic issues of the 21st century.

Appendix

Table A1. Summary Statistics

variable	N	mean	sd	min	max	skewness	kurtosis
WCI	1462	790	1763	0	14625	3.85	21.13
total dependency	1462	0.52	0.06	0.36	0.80	0.84	4.65
old-age dependency	1462	0.21	0.06	0.07	0.36	-0.31	3.14
youth dependency	1462	0.31	0.09	0.19	0.72	1.37	5.12
dependency ROC	1462	1.00	0.01	0.95	1.04	0.11	3.14
old ROC	1462	1.01	0.01	0.97	1.05	-0.02	3.61
young ROC	1462	0.99	0.01	0.94	1.04	0.00	2.89
average retirement age	1462	63.28	3.16	55.73	73.75	0.37	2.85
fertility	1462	1.79	0.47	1.09	4.14	1.54	5.91
GDPPC	1462	28104	17625	634	92078	0.87	3.81
RPE	1462	1.07	0.32	0.32	2.10	0.31	2.17
gross secondary enrollment	1462	98.63	20.08	34.72	163.93	0.33	4.72
silver tsunami (dummy)	1462	0.38	0.48	0	1	0.51	1.26

Figure A1. Histogram of Weighted Conflict Index (WCI). This variable is over-dispersed with an excess of zeros.

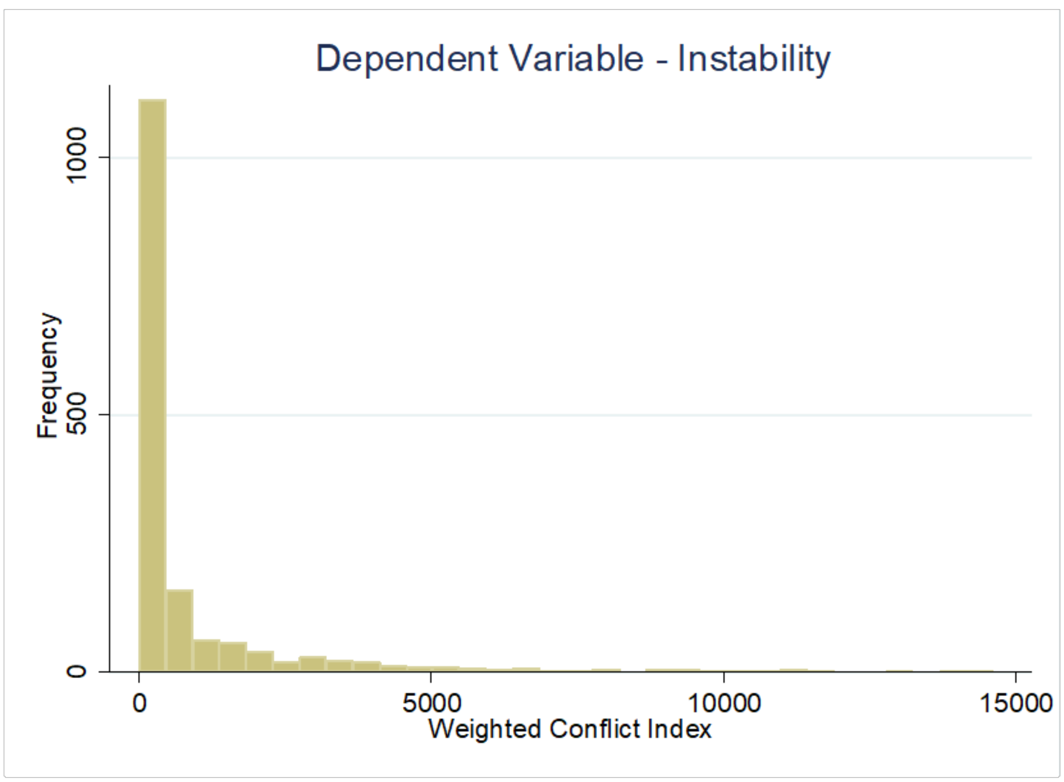
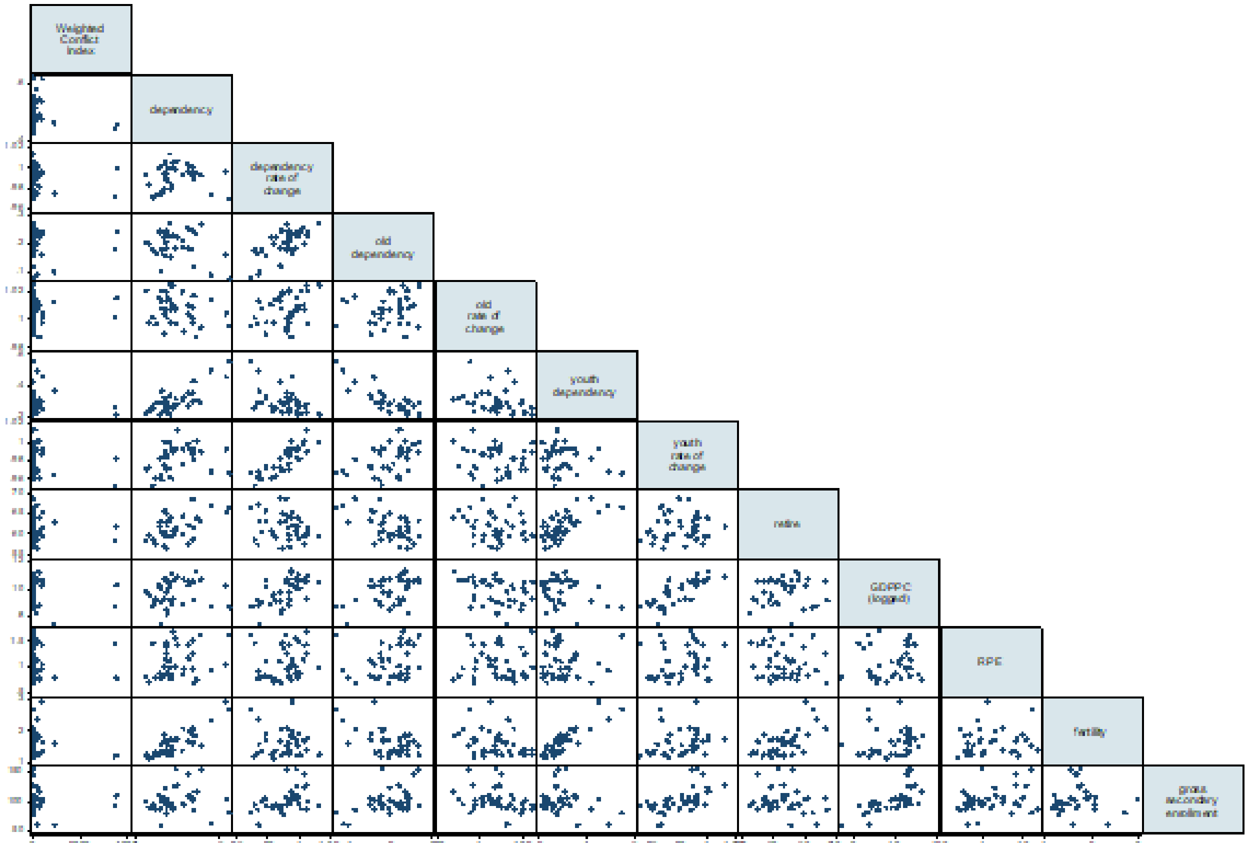


Table A2. Scatterplot matrix for the year 2000



References

Abdollahian, M., Kugler, J., Nicholson, B., & Oh, H. (2010). Politics and Power. In A. Kott, & G. Citrenbaum, *Estimating Impact: A HAndbook of Computational Methods and Models for Anticipating Economic, Social, Political and Security Effects.* New York: Springer Science & Business Media.

Abdollahian, M., Nicholson, B., Nickens, M., & Baranick, M. (2009). A Formal Model of Stabilization and Reconstruction Operations. *Military Operations Research Society*, 5-30.

Associated Press. (2020, 2 27). *Greek islanders assail riot police in protests over migrant camps.* Retrieved from France 24: https://www.france24.com/en/20200227-greek-islanders-assail-riot-police-in-protests-over-migrant-camps

Barusch, A. S. (2013). The Aging Tsunami: Time for a New Metaphor? *Journal of Gerontological Social Work*, 181-184.

BBC. (2015, 12 17). *Migrant crisis: Dutch town riots over asylum centre plan.* Retrieved from BBC News: https://www.bbc.com/news/world-europe-35118496

BBC. (2018, 12 16). *Brussels protest over UN migration pact turns violent.* Retrieved from BBC News: https://www.bbc.com/news/world-europe-46585237

BBC News. (2010, October 20). *French police frustrated by new strike blocades.* Retrieved from BBC: https://www.bbc.com/news/world-europe-11580492

Bello-Schunemann, J. (2017). *Africa's population boom: burden or opportunity.* Retrieved from Institute for Security Studies: https://issafrica.org/amp/iss-today/africas-population-boom-burden-or-opportunity#:~:text=Africa's%20population%20is%20the%20fastest,decades%20(see%20Figure%201).

Bloom, D. E., Canning, D., & Sevilla, J. (2003). *The Demographic Dividend: A New Perspective on the Economic Consequences of Population Change.* Santa Monica: RAND.

Cross-National Time-Series Data Archive: CNTS Data Archive. (2020). Retrieved from CNTS: www.cntsdata.com/

Desilver, D. (2014, July 9). *The politics of American generations: How age affects attitudes and voting behavior*. Retrieved from Pew Research: https://www.pewresearch.org/fact-tank/2014/07/09/the-politics-of-american-generations-how-age-affects-attitudes-and-voting-behavior/

Feng, Y. (2003). *Democracy, Governance, and Economic Performance: Theory and Evidence.* Cambridge: The MIT Press.

Feng, Y., Kugler, J., & Zak, P. (2000). The Politics of Fertility and Economic Development. *International Studies Quarterly*, 667-693.

Fisunoglu, A., Kang, K., Arbetman-Rabinowitz, M., & Kugler, J. (2020). Relative Political Capacity Dataset (Version 2.4). Harvard Dataverse. doi:https://doi.org/10.7910/DVN/NRR7MB

France 24. (2010, 10 17). *More disruptions expected after weekend protests*. Retrieved from https://www.france24.com/en/20101017-france-faces-further-disruption-after-weekend-protests-strikes-pension-reform

France 24. (2010, 10 21). *Students rally as unions threaten further pension strikes*. Retrieved from France 24: https://www.france24.com/en/20101021-france-student-unions-strike-pension-reform

Goldstone, J., Marshall, M. G., & Root, H. (2015). The Impact of Global Demographic Changes on teh International Security Environment. In C. Crocker, F. Hampson, & P. Aall, *Managing Conflict in a World Adrift* (pp. 241-254). Washington, DC: U.S. Institute of Peace.

Haas, M. L. (2007). A Geriatric Peace? The Future of U.S. Power in a World of Aging Populations. *International Security, 32*(1), 112-147.

Hewitt, P. (2002). Managing the Global Aging Transition. *THe Brown Journal of World Affairs, 8*(2), 241-249.

Howe, N., & Jackson, R. (2008). *The Graying of the Great Powers: Demography and Geopolitics in the 21st Century.* Center for Strategic and International Studies.

Ivanova, P. (2018, 9 7). *Despite Putin's concessions, Russians protest pension reform law*. Retrieved from Reuters: https://www.reuters.com/article/us-russia-protests-pensions/despite-putins-concessions-russians-protest-pension-reform-law-idUSKCN1LI0DU

Kugler, T. (2016). Political Demography: Annotated Bibliography. In *Oxford Encyclopedia.*

Landry, A. (1987). Adolphe Landry on the Demographic Revolution. *Population and Development Review*, 731-740.

Lee, R. (2003). The Demographic Transition: Three Centuries of Fundamental Change. *Journal of Economic Perspectives, 17*(4), 167-190.

Lee, R. (2014). Macroeconomic Consequences of Population Aging in the United States: Overview of a National Academy Report. *The American Economic Review*, 234-239.

Lee, R., & Mason, A. (2011). *Population Aging and the Generational Economy: A Global Perspective.* Edward Elgar, IDRC.

Leon, G. (2014). Loyalty For Sale? Military Spending and Coups d'etat. *Public Choice*, 363-383.

Leuprecht, C. (2015). Geriatric Interventions: The Demographic Horizon of Collective Security. In F. Hampton, & S. Saideman, *Elusive Pursuits: Lessons from Canada's Onterventions Abroad* (pp. 225-242). McGill-Queen's University Press.

Libicki, M., & Taylor, H. (2011). Global Demographic Change and its Implications for Military Power. *Rand Corporation & Project Air Force (U.S.).*

Libicki, M., Shatz, H., & Taylor, J. (2011). *Global Demographic Change and Its Implications for Military Power.* RAND Corporation.

Litvinova, D. (2020, 12 21). *Navalny releases recording of call to his alleged poisoner*. Retrieved from AP News: https://apnews.com/article/alexei-navalny-poisoning-underpants-202f470c2d1c19151b9deb564d94e8f9

Mukunda, G. (2018, September 5). *The SOcial and Political Costs of the Financial Crisis, 10 Years Later*. Retrieved from Harvard Business REview: https://hbr.org/2018/09/the-social-and-political-costs-of-the-financial-crisis-10-years-later

Neuman, S. (2018, August 28). *Anti-Immigrant Protest Turns Violent in Eastern German City of Chemnitz*. Retrieved from NPR.

OECD. (2020). Retrieved from OECD: https://www.oecd.org/els/emp/average-effective-age-of-retirement.htm

Organski, A., & Kugler, J. (1980). *The War Ledger*. Chicago: University of Chicago Press.

Pew Research Center. (2018, June 28). *Shifting Pubklic Fiews on Legal Immigration into the U.S.* Retrieved from Pew Research Center: https://www.pewresearch.org/politics/2018/06/28/shifting-public-views-on-legal-immigration-into-the-u-s/

Pew Research Center. (2020, August 13). *Important Issues in the 2020 Election*. Retrieved from Pew Research: https://www.pewresearch.org/politics/2020/08/13/important-issues-in-the-2020-election/

Sheen, S. (2013). Northeast Asia's Aging Population and Regional Security. *Asian Survey, 53*(2), 292-318.

Sheiner, L. (2014). The determinants of the macroeconomic implications of aging. *American Economic Review, 104*(5), 218-223.

Social Security Administration. (n.d.). *Social Security History: Life Expectancy for Social Security*. Retrieved from Social Security Administration: https://www.ssa.gov/history/lifeexpect.html

The Guardian. (2003, 10 24). *Milliona strike in Italy over pensions*. Retrieved from The Guardian: https://www.theguardian.com/world/2003/oct/24/italy

Torgler, B., & Frey, B. S. (2013). Politicians: Be Killed or Survive. *Public Choice*, 357-386.

UCLA: Statistical Consulting Group. (2021). *Regression Models with Count Data*. Retrieved from UCLA Institute for Digital Research and Education: https://stats.idre.ucla.edu/stata/seminars/regression-models-with-count-data/

UN ECOSOC. (2019). *World Population Ageing 2019.* Retrieved from United Nations: https://www.un.org/en/development/desa/population/publications/pdf/ageing/WorldPopulationAgeing2019-Highlights.pdf

United Nations Department of Economics and Social Affairs Population Division. (2011). *Seven Billion and Growing: The Role of Population Policy in Achieving Sustainability.* United Nations.

United Nations Economic Commission for Europe. (2016). *Guide on Measuring Human Capital.* Geneva: United Nations.

Urdal, H. (2006). A Clash of Generations? Youth Bulgers and Political Violence. *International Studies Quarterly*, 607-629.

World Development Indicators. (2020). Retrieved from The World Bank: https://databank.worldbank.org/source/world-development-indicators

Yang, Z. (2016). An Agent-based Dynamic Model of Politics, Fertility and Developoment. *Journal of Systemics, Cybernetics and Informatics*, 68-72.