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24-18 Migration or Stagnation: Aging and Economic Growth in Korea Today, the World Tomorrow

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ABSTRACT

South Korea faces an unprecedented economic crisis driven by rapid population aging, as it approaches a future of negative economic growth. This paper examines the full range of possible policy responses with the potential to restore dynamism to the Korean economy. Contrary to many prior analyses, I find that enhanced labor migration to Korea is necessary, sufficient, and feasible. Migration is necessary because in the best forecasts we have, no other class of policy has the quantitative potential to meaningfully offset aging. Migration is sufficient because enhanced temporary labor migration by itself would offset most of Korea's demographic drag on growth over the next 50 years. And migration is feasible because the levels of migration and timescale of the transition would resemble that already carried out by Malaysia and Australia. Many advanced economies will follow in Korea's demographic footsteps in decades to come, and have much to learn from the decisions that the Korean government makes now.

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1 Introduction

South Korea faces an economic crisis from which there may be no easy recovery. Rapid aging of the population will so hollow out the labor force that the Bank of Korea expects average GDP growth to become *negative* within 20 years, and remain negative. The once-vibrant Korean economy is now predicted to be approaching several decades of relative stagnation.

Korean policymakers must respond, but there is little agreement on how. "If Korea's complacency with its current demographic dividend and its abundant and well-trained workforce lead it to maintain superficial policies without fully appreciating the severity of the impending crisis," writes Seol (2018, 96), "it will gradually sink deeper and deeper into the bog of population aging." Given the number of other advanced economies headed in Korea's direction, the world will be watching.

In this paper, I examine the policy alternatives. I consider the quantitative potential for the full range of policy channels that could in principle offset future demographic drag on Korea's growth. These include policies that could accelerate growth in capital accumulation, productivity, employment, or education, and policies that could act to decelerate aging. For each potential channel, I compare future trends in the best available forecasts to the trends that would be necessary in order to substantially offset demographic drag.

In prior research, Korea's immigration policy plays a minor role in this policy response. Analysts commonly recommend responses to aging through all of these channels at once: structural reforms to raise productivity and investment, incentives for greater employment especially by women and the elderly, further increases in education, and incentives for higher fertility (Lee et al. 2013; Jang et al. 2022, 337; Bank of Korea 2023). Some also mention the concurrent usefulness of immigration to Korea as a direct but ancillary offset to aging. But immigration is most often discussed as an afterthought—considered largely ineffective at feasible magnitudes.[1] Some major international policy reports on the economic response to aging in Korea do not even mention immigration as a potential key to future productivity growth (OECD 2018; ADB 2024). Other

[1] Hwang et al. (2023, 91) simulate the effects of a modest (~3 percentage point) increase in immigrant prevalence in Korea, by a mix of workers and dependents—considered 'optimistically' high—finding that this would be insufficient to substantially offset demographic drag.

analysts explicitly recommend against emphasizing migration as a response to aging, preferring alternatives like pronatalism (e.g. Lee 1997; Hyun-Hoon et al. 2017).

I contend that this emphasis is misplaced. Assessed quantitatively, *no* channel of policy action other than relaxing restrictions on labor immigration carries hope of substantially offsetting demographic drag in Korea. The best forecasts and impact evaluations that we have revealed little scope to offset demographic drag by feasible acceleration of capital accumulation, productivity growth, employment growth, rising education, or pronatalism. All of these channels are expected to provide negligible counterweight to demographic drag at best, or reinforce it at worst.

But immigration policy does carry hope. I find that enhanced temporary, employment-based immigration as an offset to demographic drag in Korea is *necessary*, *sufficient*, and *feasible*. It is necessary because no policy lever shows promise. It is sufficient because temporary labor migration *can* offset most of the expected harm to Korean economic growth from aging. And it is feasible because such immigration can offset demographic drag in Korea at immigration levels and at a speed that other relevant countries have demonstrated as practical. Careful and well-designed immigration policy can prevent economic stagnation in Korea over the decades to come, and build a future of continued economic dynamism in Korea on par with the rest of the OECD.

Specifically, I estimate that unchecked demographic drag will reduce real GDP per capita growth in Korea over the next half century by 0.85 percentage points per year relative to Korea's high-growth decades of the 1970s to 1990s. I find that future trends in all of the various channels of economic growth have almost no quantitative potential to offset a drag that large, except immigration policy. A slow rise in Korea's prevalence of temporary foreign workers from today's value of less than 3 percent of employed workers to roughly 15 percent over the next 40 years is feasible: It is roughly the path already taken by Malaysia and Australia. It would be sufficient to offset the majority of the drag on economic growth due to aging for the next 30 years, and roughly half for the next half-century.

The contributions of this work are to assess all of the policy options against demographic drag in Korea within a single, comparable, quantitative framework; and to provide evidence on feasi-

ble levels of future immigration and their economic effects. Prior research often concludes with a laundry-list of policy alternatives. I argue that a closer and quantitative comparison of those options reveals that only enhanced immigration has reliable potential as a serious countermeasure. And I offer evidence that Korea should be seen as a bellwether for policy challenges coming before long to other advanced economies.

2 Korea's demographic dynamo turns to demographic drag

The explosion of Korea's productivity and prosperity in the late 20th century is one of the most compelling events in economic history. It is fittingly known in Korea as the Miracle on the Han River (한강의 기적).

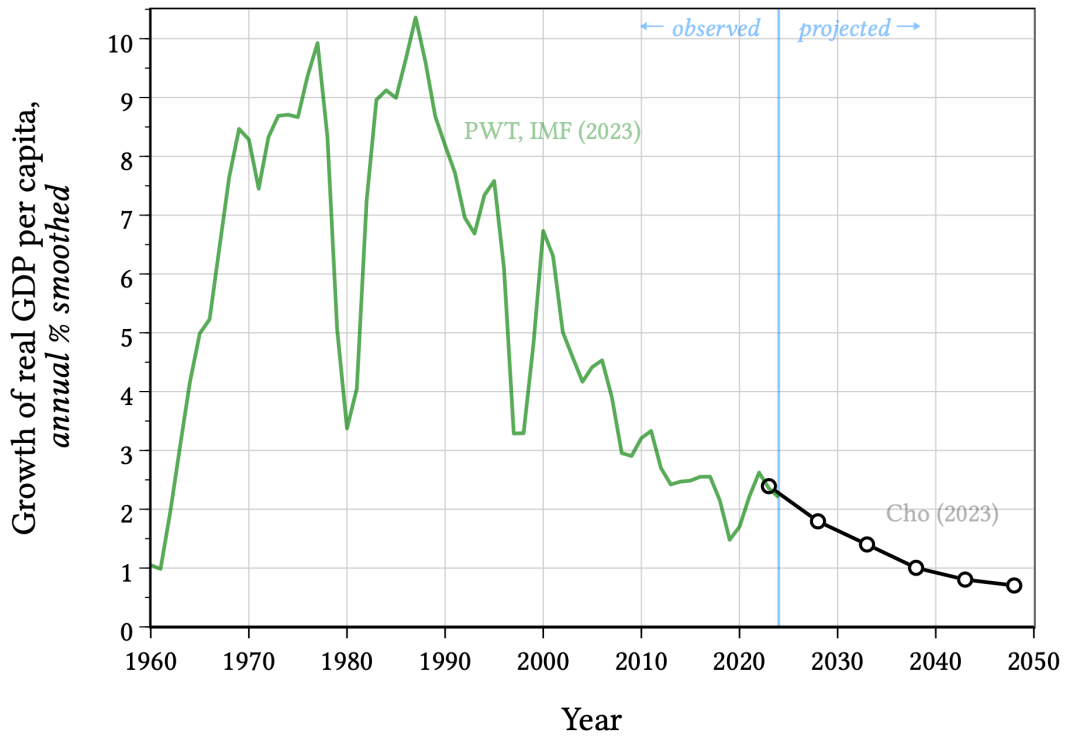
That miracle has run its course. Real GDP per capita growth is now expected to slow over the next generation, in forecasts by Taehyoung Cho (2023), the Director General of the Economic Research Institute at the Bank of Korea (Figure 1). Guillemette and Turner (2018, 15) agree the real GDP per capita growth in Korea will slow over the next four decades relative to the past two. Korea, which once grew at 3–4 times average rates in the OECD, is now expected to grow at roughly one half to one third of average rates in the OECD in coming decades (OECD 2023).

In fact, the once-dynamic Korean economy is widely expected to *shrink*—into the indefinite future—starting roughly two decades from now. Economists at the Bank of Korea estimate that real GDP growth will reach zero, and remain negative thereafter, as early as 2050 (Hwang et al. 2023, 65–66).[2] Goldman Sachs analysts similarly expect that real GDP growth in Korea will fall toward zero and remain below zero after roughly 2060 (Daly and Gedminas 2022, 39).

The rapid aging of Korea's population will be a major cause of the relative economic stagnation to come. This is a point of near consensus in the research literature on Korea (Seol 2018; Bank of Korea 2023, e.g.), which is the leading edge of a global phenomenon (Aksoy et al. 2019). Whereas the aging of Korea's population once led to a growing native workforce, further aging will reverse that trend—rapidly hollowing out the workforce.

[2]The authors expect this scenario with probability 50.4 percent—while noting that these estimates are "not official projections".

Figure 1: The Miracle on the Han River Has Run Its Course: Real growth of GDP per capita in Korea, past and future



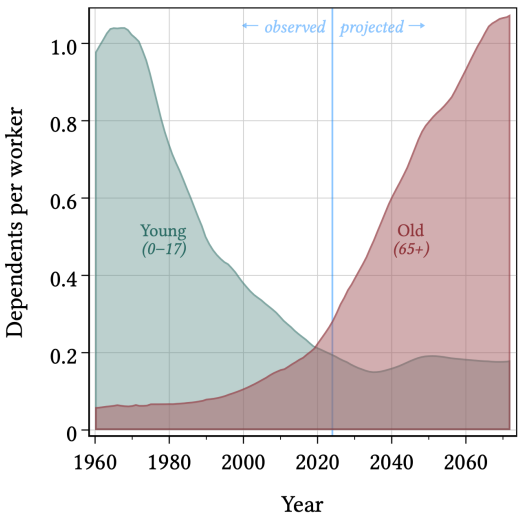
Real GDP per capita growth 1960–2019 is from Penn World Table 10.01, 2020–2024 from IMF *World Economic Outlook* April 2024 (with close agreement at their substantial overlap). Past growth is smoothed as an (Epanechnikov) kernel-weighted moving average, bandwidth one year. Forecast of real annual percentage growth in GDP per capita, in constant 2021 Korean won (₩), is by Cho (2023, 26, Table 10).

The speed and magnitude of this transition is unprecedented in Korean history, to say nothing of world history. Figure 2a shows the collapse in Korea's youth dependency ratio, the number of non-working children per working-age adult. This was quickly followed by a sharp rise in the old-age dependency ratio, the number of non-working elderly per working-age adult. A crucial turning point occurred in 2019, when old-age dependency ratio exceeded the youth dependency ratio for the first time. Dependency in Korea a half-century from now will now proceed to become similar to what it was a half-century ago—but this time the dependents will be aged.

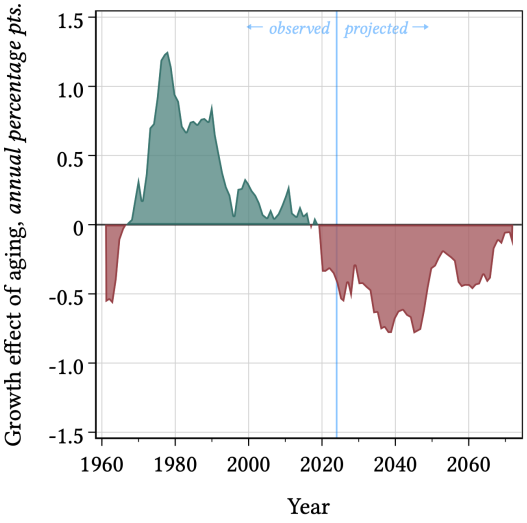
How will this tectonic shift affect economic growth? We can calculate the direct effect of aging, all else equal, with a simple and standard growth decomposition.

Figure 2: From Dynamo to Drag: Demographic change and per-capita economic growth in Korea, 1960–2072

(a) *Shifting dependency*



(b) *Growth effect of aging (δ)*



In this figure, 'worker' refers to the working-age population, where 'working age' defined in standard fashion as the population age 18–64. 'Dependents' are all those not working age. Demographic data and projections from KOSIS, *2072, 2024.05.02, Projected Population by Age Group (Korea)*, updated Dec. 14, 2023. Figure 2b shows $\delta \equiv -\frac{\lambda\dot{\theta}}{1-\theta}$ from equation (3). Assumes the labor share $\lambda = 0.517$, the most recent value in Penn World Table 10.01, holds from 2020 through 2072.

Consider technology that produces national output Y by combining capital and labor at unit elasticity of substitution, depending on a key indicator of demographic structure: the fraction of the population that is *not* working age ($0 \leqslant \theta < 1$). National production is

$$Y = AK^{1-\lambda}\Big((1-\theta)\varepsilon h N\Big)^{\lambda}, \tag{1}$$

where N is the total population, $0 < \varepsilon < 1$ is the employment rate of working-age adults, $h \geqslant 1$ is a factor that augments employed workers according to their human capital, and K is the capital stock (Inklaar and Timmer 2013, 4). Parameter $A > 0$ captures Total Factor Productivity (TFP); λ approximates the labor share of income.[3] This implies a decomposition of the annual growth

[3]Since with $L \equiv h(1-\theta)N$, profit maximization implies the solution to the dual problem of cost minimization: $\min_{K,L}(wL + rK)$ subject to equation (1) $\underset{\text{FOC}}{\longrightarrow}$ $\ell = \frac{wL}{rK+wL}$, where r, w are the marginal products of K, L respectively. I use Inklaar and Timmer's production function so that my specifications of human capital, TFP, etc. are commensurable with those in the Penn World Table 10.01.

rate for income per capita $\left(y \equiv \frac{Y}{N}\right)$ in terms of the capital stock per capita $\left(k \equiv \frac{K}{N}\right)$,

$$\frac{\dot{y}}{y} = -\frac{\lambda\dot{\theta}}{1-\theta} + (1-\lambda)\frac{\dot{k}}{k} + \frac{\dot{A}}{A} + \lambda\left(\frac{\dot{\varepsilon}}{\varepsilon} + \frac{\dot{h}}{h}\right), \tag{2}$$

where the subscript dot indicates the time derivative. The first term on the right-hand side of equation (2) is the *ceteris paribus* effect of change in the demographic structure on the rate of per-capita economic growth,

$$\delta \equiv -\frac{\lambda\dot{\theta}}{1-\theta}. \tag{3}$$

Equation (3) allows straightforward estimates of the effect of past and future aging on economic growth, all else equal. These are presented in Figure 2b, with data observed during 1960–2023 and projected during 2024–2072. The aging of the population was a demographic dynamo during the years of the Miracle on the Han River and through 2020, adding 0.41 percentage points to annual *per-capita* economic growth from 1966 through 2019. This is a standard pattern in developing countries (Bloom et al. 2010). Continued aging in Korea has now become a demographic drag, all else equal, subtracting 0.44 percentage points from annual per-capita economic growth from 2020 through 2072.

In other words, relative to the Miracle years, the next several decades in Korea will see aging erase 0.85 percentage points of growth each year, all else equal. During the years of the Korean miracle, aging primarily meant *fewer* dependents per worker. After 2019, and for generations to come, rapid aging will primarily imply far *more* dependents per worker.

3 Policy alternatives to offset stagnation

What policy levers exist to offset future economic stagnation in Korea? The growth decomposition in equation (2) offers a framework for considering policy alternatives. Under this standard model, there are five classes of policy capable of offsetting the growth effect of aging—and no others. Such policy must either 1) accelerate the rate of capital accumulation, 2) accelerate the rate of Total Factor Productivity (TFP) growth, 3) accelerate the growth of the employment rate, or 4) accelerate the growth of education, or it must 5) directly *decelerate* population aging—by acting on fertility or immigration.

In this section, I consider each of the alternatives to immigration, as a policy offset to future economic stagnation in Korea. In principle, acceleration of growth by any of the other channels in the growth decomposition (2) could partially or even fully offset future stagnation, without substantial change in immigration policy. But current forecasts for all of the alternative channels contain no evidence that such acceleration is expected. To the contrary, expected trends in *all* of the other channels imply *further deceleration* of growth. This leaves little alternative to major changes in immigration policy—except simply allowing stagnation to occur.

3.1 Capital investment

In principle, accelerated capital investment and capital accumulation could fully offset the effects of aging in the growth decomposition (2). But in fact, capital accumulation in Korea is widely expected to decelerate.

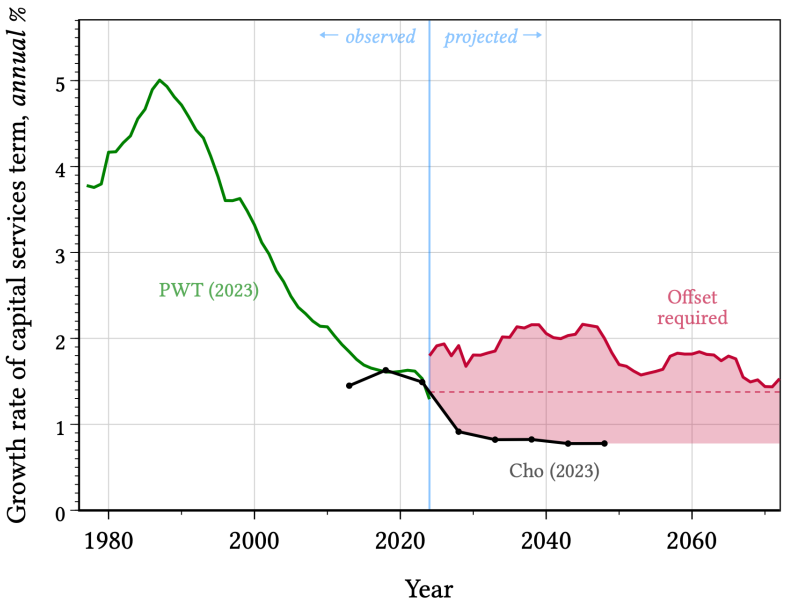
Figure 3 compares past growth in the capital term of the growth decomposition $\left((1-\lambda)\frac{\dot{k}}{k}\right)$ to future growth forecast by Cho (2023, 26).[4] The figure includes adjustments for the quality of capital by considering the flow of capital services (e.g. Schreyer et al. 2003), in both the past and future estimates.

The red line in the figure shows the growth in the capital term that would be required to fully offset the growth cost of aging δ in equation (3). The horizontal, dashed red line shows the current rate of growth; any offsetting acceleration in capital accumulation would need to rise above this level. The forecast implies that capital accumulation will come nowhere close to offsetting the impact of aging, even if is substantially underestimated.

Most analysts concur with Cho's forecast of decelerating capital accumulation in Korea, particularly from receding investment in non-residential construction and the feedback effects of lower overall growth. The OECD forecast by Guillemette and Turner (2018, 15) and by Guillemette et al. (2018) agree that the growth rates of savings, investment, and capital per worker in Korea will

[4] I follow Cho (2023, 15), Lee and Song (2023, 9), and Lim (2016) in assuming that the labor share of income (drawn from the Penn World Table 10.01), remains stable over the next few decades. While a prominent literature has found moderate recent declines in λ for the US economy after a century of prior stability, a recent literature has questioned the sensitivity of those results and found that the same trend is not evident in Korea or in most OECD economies. I review this evidence below in Section 6.

Figure 3: Capital Accumulation in Korea: Growth effect of forecast increases in capital services growth versus future additional growth needed to fully offset aging

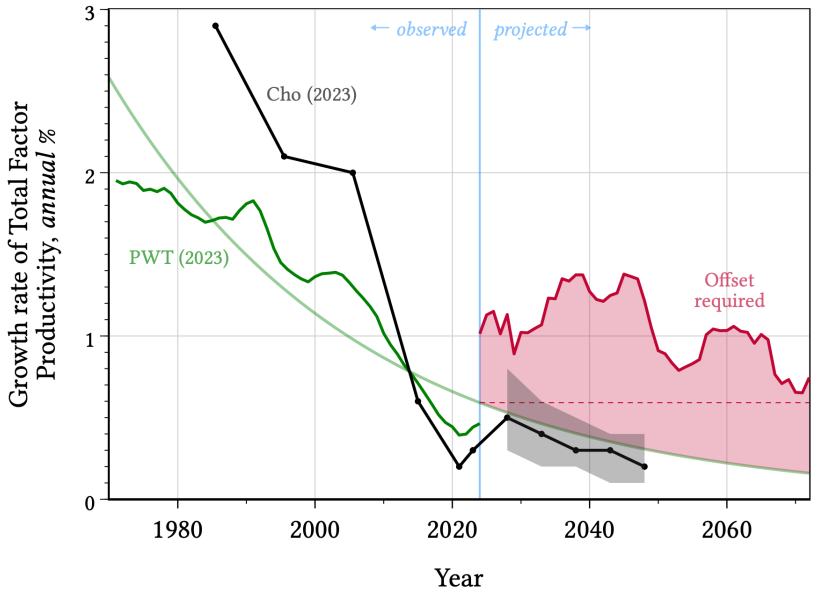


The vertical axis shows the annual percent growth in the capital term $(1-\lambda)\frac{\dot{k}}{k}$ from equation (2). The dark green line shows observed changes up to 2019, from Penn World Table 10.01, after those levels have been lightly smoothed by local linear regression (bandwidth 4 years), Epanechnikov kernel. 'Cho (2023)' is the past and future projected growth in capital services *per capita* estimated by Cho (2023, Table 10 (p26)) in black *Offset required* is the percentage points of *additional* growth in the capital term, beyond the 2024 level of growth, necessary to fully offset the economic growth effect of demographic change in Figure 2b.

gradually slow over the next four decades relative to the past two. PricewaterhouseCoopers, too, expects declining capital investment as a fraction of GDP in Korea after 2025 (Hawksworth 2017, 65). Kwon (2017, 41) projects that the growth rate of the capital stock in Korea will slow continuously and sharply through 2060. Falling rates of savings in Korea over the long term has been long predicted (e.g. Chun 2007). It is difficult to find an analyst that disagrees with Cho's stark conclusion, "For the next 30 years, through to 2050, the Korean economy will face …slumping capital input growth."

In other words, the belief that accelerated capital accumulation can serve to offset—rather than reinforce—the growth effects of aging in Korea requires another belief. It requires the belief that the most careful forecasts available are far off the mark, and have failed to consider an unknown factor capable of sharply accelerating future rates of capital accumulation. For example, the growth rate of capital accumulation forecast in Figure 3 for the 2040s would need to roughly

Figure 4: Total Factor Productivity growth in Korea: Forecasts of expected productivity growth versus future additional productivity growth needed to fully offset aging



'PWT (2023)' is a five-year moving average (weighted by Epanechnikov kernel) of *rtfpna* from Penn World Table 10.0, in dark green, and an exponential decay extrapolation through 2072 in light green. 'Cho (2023)' is the past and future projected (medium case) TFP growth estimated by Cho (2023, Table 3 (p14), Table 10 (p26)) in black, with the range between Cho's 'high' and 'low' forecasts in gray. *Offset required* is the percentage points of *additional* TFP growth, beyond the 2024 level of growth, necessary to fully offset the growth effect of demographic change in Figure 2b.

double before it could even begin to offset the growth impact of aging.

3.2 Technological change

The next, natural place to look for potential offsets to aging is Total Factor Productivity (TFP). In the growth decomposition of equation (2), accelerated TFP growth could, in principle, fully offset the effects of aging. But here, too, the most careful analyses of productivity trends that we have suggest no evidence of such expected acceleration. To the contrary, it implies continued deceleration.

Figure 4 juxtaposes past rates of TFP growth with forecast future growth. The black line shows the estimates of Cho (2023, 14–16) for past rates of TFP growth and expected future growth. The gray band around Cho's forecasts represent the full range between his "high productivity" and

"low productivity" scenarios. The solid green line shows decades of decay in the TFP growth rate reported by the Penn World Table (PWT version 10.01; Feenstra et al. 2015, updated 2023). The shaded green curve extends that trend into the future by modeling the long-term deceleration as a simple exponential decay. Note that simple extrapolation of the long-term decay reported by PWT yields optimistically high projections of future TFP growth relative to Cho's much more detailed analysis.

As in the preceding figure, the red line in Figure 4 shows the rate of growth in TFP that would be required to fully offset the growth cost of aging δ in equation (3).[5] The horizontal, dashed red line shows the rate of growth that would need to be exceeded in order to accelerate above current (trend-smoothed) growth, and thereby offset the growth effect of aging. The forecast implies that TFP growth will come nowhere close to offsetting the impact of aging, even if is substantially underestimated in these forecasts. The expected, continued deceleration of TFP growth will instead reinforce the effect of aging.

Cho, one of the leading experts on Korean productivity, reaches the conclusions in Figure 4 from analysis of industry-level productivity trends in Korea over the last several decades. He concludes that TFP growth is likely to slow further in the coming decades due to 1) the Korean economy's shift from manufacturing toward services, where TFP growth has historically been much lower, 2) declining investment in new capital, entailing longer persistence of outmoded technology, 3) reduced entry and exit of firms with consequent misallocation of resources, 4) global conditions, with a persistent slowdown in global economic integration and demand for Korean exports, and 5) an aging workforce, with elderly workers less prone to create and adapt to digital technologies.

This analysis does not, of course, rule out the possibility of a sharp, unexpected acceleration of TFP growth in Korea. Instead, it points out a lesser claim: The belief that accelerated TFP growth in Korea can offset the growth effect of aging—even to any nonzero degree—would require large errors in the analysis of Cho (2023). For example, TFP growth in the late 2040s would have to rise to more than triple the rate forecast by Cho before they could even begin to offset the growth impact of aging. It remains unclear what specific policy lever is available that could reliably triple

[5] Denton and Spencer (2018, 121) project that Korean TFP would need to grow at 16% per decade during 2015–2045 in order to offset population aging enough to keep GDP per capita growing at 1% per year.

TFP growth in Korea.

3.3 Education

The next place we could seek potential offsets to aging is education, the next term in the growth decomposition equation (2). In principle, accelerated growth in education could fully offset the growth effects of aging. But in fact, again, the best analysis of education trends in Korea not only cast doubt on the likelihood of such an acceleration. To the contrary, it implies a deceleration.

The human capital term $\left(\lambda \frac{\dot{h}}{h}\right)$ in equation (2) is a function of the years of schooling for average workers. It is estimated as in the Penn World Table, to capture the effect on workers' wages and productivity from rising levels of education. Its method originates with Hall and Jones (1999) and Caselli (2005). The variable $h \equiv e^{\phi(s)}$, is defined such that s is average years of schooling and ϕ is a step function of globally-estimated Mincer coefficients at different levels of s.[6]

Is it reasonable to expect substantial future acceleration in Korea's schooling (s)? The first step in considering likely future scenarios is to note that s and thus h are bounded from above in a way that k and A are not. It appears implausible, for example, that the *average* worker in Korea or any other country will spend 25–30 years in school, in the foreseeable future. This inherently circumscribes the feasibility of accelerated growth in s. A variable that is growing, but bounded from above, must exhibit slowed growth at some point.

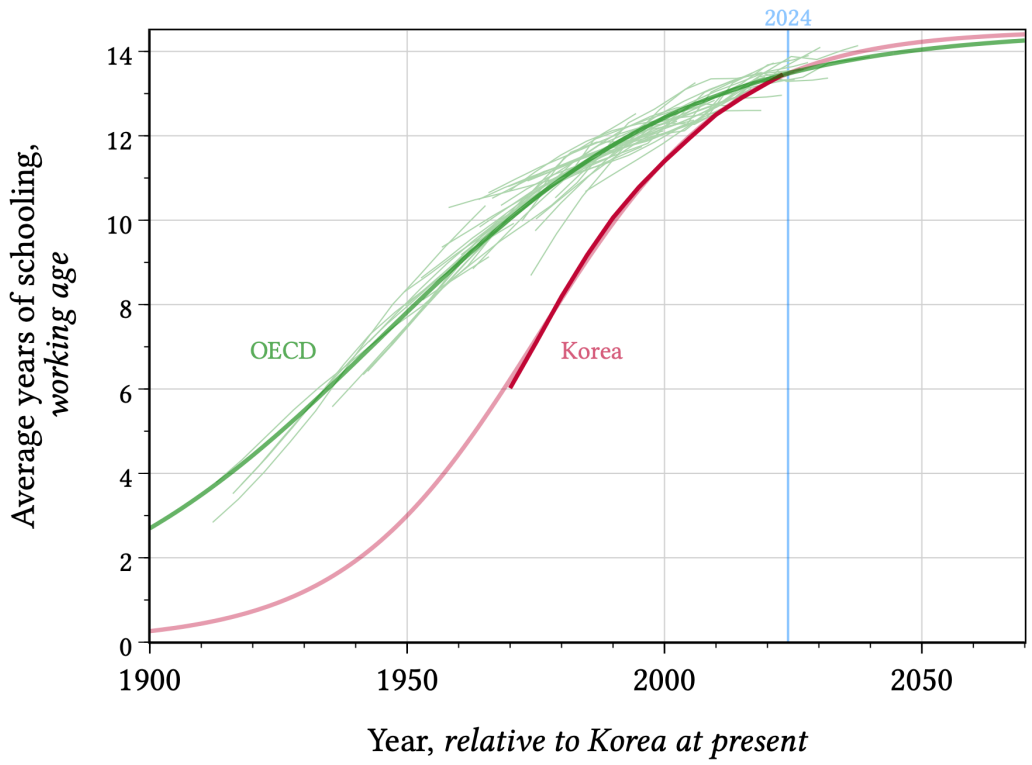
What, then, is a reasonable expectation for future growth in Korean workers' years of schooling? I address this with Trajectory Analysis, following Clemens (2004). Figure 5 plots the rate of increase in years of schooling in Korea (dark red) along with a logistic curve fit for Korea (light red).[7] Compare this to the trend in the rest of the OECD, the dark green logistic curve. The OECD trend is estimated with the regression

$$\ln\left(\frac{s_{i,t} - s_0}{s^* - s_{i,t}}\right) = \beta t + \phi_i + u_{i,t}, \tag{4}$$

[6] $\phi(s) = 0.134s$ if $s \leqslant 4$; $\phi(s) = 0.134 \times 4 + 0.101(s-4)$ if $4 < s \leqslant 8$; and $\phi(s) = 0.134 \times 4 + 0.101 \times 4 + 0.068(s-8)$ if $s > 8$. See Fang (2016, 543) for a straightforward explanation. Caselli (2016) shows that the relationship of this schooling-based measure to economic growth is robust to adjusting for measures of cognitive skill.

[7] The upper bound in the distant future is assumed to be 14.5 years, following KC et al. (2024). The lower bound in the distant past is assumed to be 0, following Godo (2011).

Figure 5: The education transition: Korea has already been raising its average years of schooling faster than the OECD average

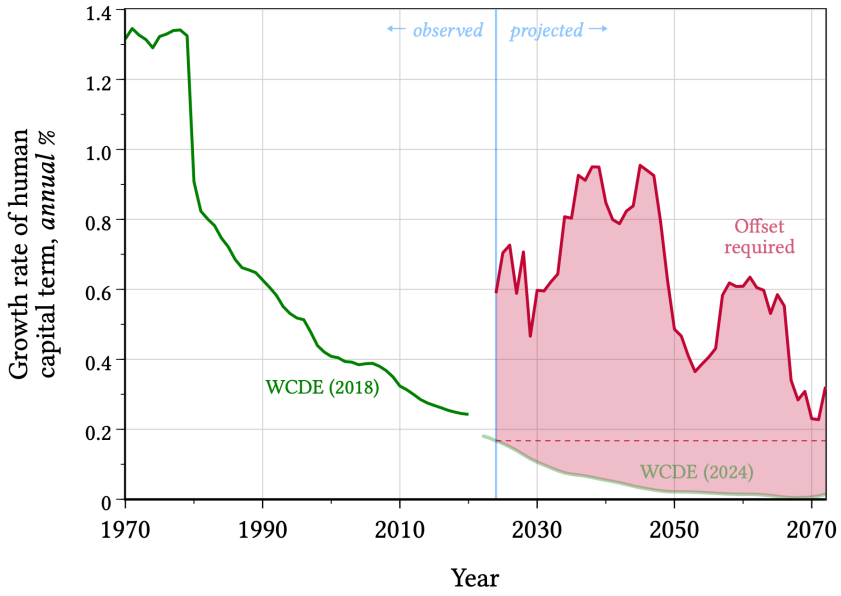


The vertical axis shows the average years of schooling in the population age 20–64, from 1950–2023 estimated by Lutz et al. (2018) and KC et al. (2024), and closely agreeing with the estimates in the Penn World Table 10.01 based on the method of Cohen and Soto (2007). The green (OECD) curve shows logistic growth where each country is assumed to exhibit the same slope with a country-specific horizontal shift, and has been aligned so that it meets Korea's logistic curve in the year 2024. Omits Luxembourg.

where in the long run schooling $s_{i,t}$ in each country i and year t transitions from lower bound s_0 to upper bound s^*; ϕ_i is a country fixed effect; and u is the error term. The OECD curve estimated with the shape parameter $\hat{\beta}$ is then shifted so that the two curves meet at Korea's actual value of s in 2024. The figure addresses questions such as: how long did it take typical OECD countries to transition to Korea's current level of schooling, relative to how long it took Korea?

Figure 5 points out several features of schooling growth in Korea. The Korean workforce is already one of the most educated in the world. Years of schooling have been rising in Korea much faster than in the average OECD country, for two generations. That rate of growth has been slowing continuously since Korea reached roughly 11 years of education, the same level after

Figure 6: Growth of education in Korea: Growth effect of past and forecast increases in schooling versus additional growth needed to fully offset the economic growth effect of future aging



The vertical axis shows the annual percent growth in the human capital term $\lambda \frac{\dot{h}}{h}$ from equation (2). The dark green 'WCDE (2018)' line shows observed changes in the human capital term up to 2020 implied by Korea's average years-of-schooling estimates in the Wittengenstein Centre Human Capital Data Explorer (WCDE) version 2 due to Lutz et al. (2018), from Figure 5, after those levels have been lightly smoothed by local linear regression (bandwidth 2 years), Epanechnikov kernel. The light green 'WCDE (2024)' line shows the future annual change in the human capital term implied by the forecasts of Korea's average years of schooling in WCDE version 3 by KC et al. (2024) via the Mincerian transformation due to Hall and Jones (1999). *Offset required* is the percentage points of *additional* growth in the human capital term, beyond the 2024 level of growth, necessary to fully offset the economic growth effect of demographic change in Figure 2b.

which the rate of schooling growth in typical OECD countries likewise slowed. For Korea to exhibit *accelerated* growth of schooling in the future would require a second long-run inflection point in the red curve of Figure 5, an event essentially without precedent in Korean history or broader OECD history.

More rigorously, the most careful quantitative forecasts of education trends indicate that schooling growth in Korea will *decelerate* for decades to come (Han and Lee 2020, 10; KC et al. 2024). For example, KC et al. (2024) use a cohort-component projection model to forecast average years of schooling in Korea and around the world, released via the Wittgenstein Centre Data Explorer (WCDE). This model integrates age-specific educational attainment rates, assuming a continuation of historical trends in educational transitions between different attainment levels, based on

patterns in nearly all countries over the past 60 years. They incorporate these transitions within age cohorts, apply them across different countries, and account for variations in enrollment rates and demographic changes over time.

Figure 6 shows estimates for actual growth in the human capital term of equation (2), $\lambda \frac{\dot{h}}{h}$, through 2020 implied by the years-of-schooling estimates from WCDE (Lutz et al. 2018), in dark green. It shows the forecasts for growth in the human capital term implied by the years-of-schooling projections by the WCDE though 2072, in light green (KC et al. 2024). The rate of growth of average schooling in the Korean workforce is forecast to continue its sharp deceleration, for several decades to come.

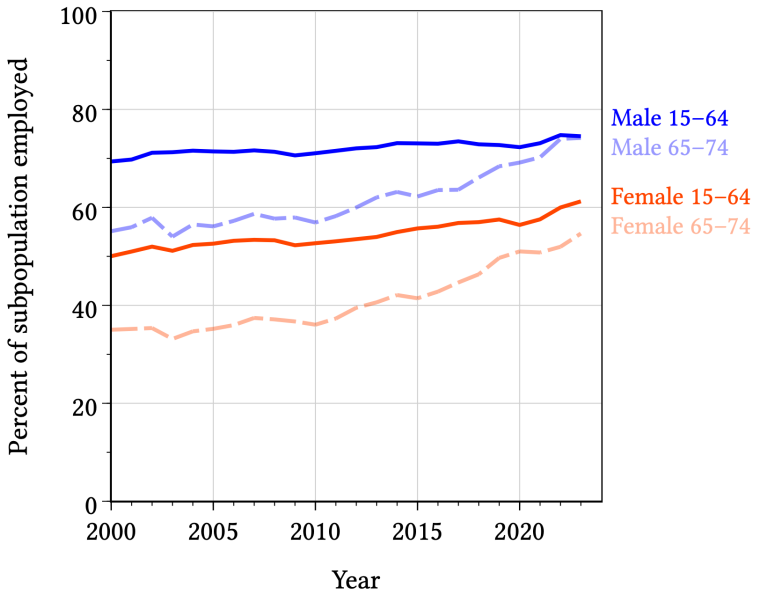
Far from offsetting the economic growth impact of aging, slow future growth in schooling is expected to aggravate it. As in the analogous preceding figures, the red line in Figure 6 shows the rate of growth in the human capital term that would be required to fully offset the growth cost of aging δ in equation (3). The horizontal, dashed red line shows the current rate of growth in the human capital term—the level that would need to be *exceeded* in order to offset future aging. The shaded red area shows the gap between forecast growth in the human capital term and the growth that would be needed to offset aging.

As above, this does not rule out any possibility of a future acceleration in human capital accumulation in Korea. Instead, this analysis suggests that any such acceleration would require events with little precedent in Korean or world history, and would ultimately be short-lived. An argument that accelerated investment in schooling could offset the growth effects of aging in Korea in (say) 2050 would require an explanation of why the forecasts of schooling growth by KC et al. (2024) are an order of magnitude too low.

3.4 Employment

There is one term left in the growth decomposition (2): employment. In principle, the future effects of aging on economic growth in Korea could be offset by sufficient acceleration in the fraction of working-age people who are employed. In practice, growth in the employment term is very likely to slow.

Figure 7: Elderly Employment Convergence Has Largely Run Its Course: Korean fraction of people employed, by age and gender, 2000–2023



The vertical axis shows the number of people in each subpopulation considered 'employed' by Statistics Korea, in each year, as a percentage of the total number of people in each subpopulation. The subpopulations are defined by age and gender.

As a fraction, the employment rate is inherently bonded from above by 1. This implies that any positive growth rate in a given year must be followed at some point by systematically slower growth. The only question is when.

Figure 7 shows the employed fraction of Korea's working-age population, by gender. Considering first the traditional definition of "working age" (15–64), the employed fractions of both men and women have risen in recent decades, with a modest catch-up by female workers toward male employment rates. Employment among elderly workers (65–74) has risen markedly over the past 15 years—by eight percentage points, for both genders. But notwithstanding frequent discussion of rising elderwork as an antidote to demographic drag (e.g. Lee 2023), this surge in elderwork has largely run its course. The employment rate of elderly Korean males has fully converged with the employment rate of younger workers; elderly Korean females have nearly closed the same gap.

Figure 7 suggests that any future acceleration of growth in the employment fraction in Korea is

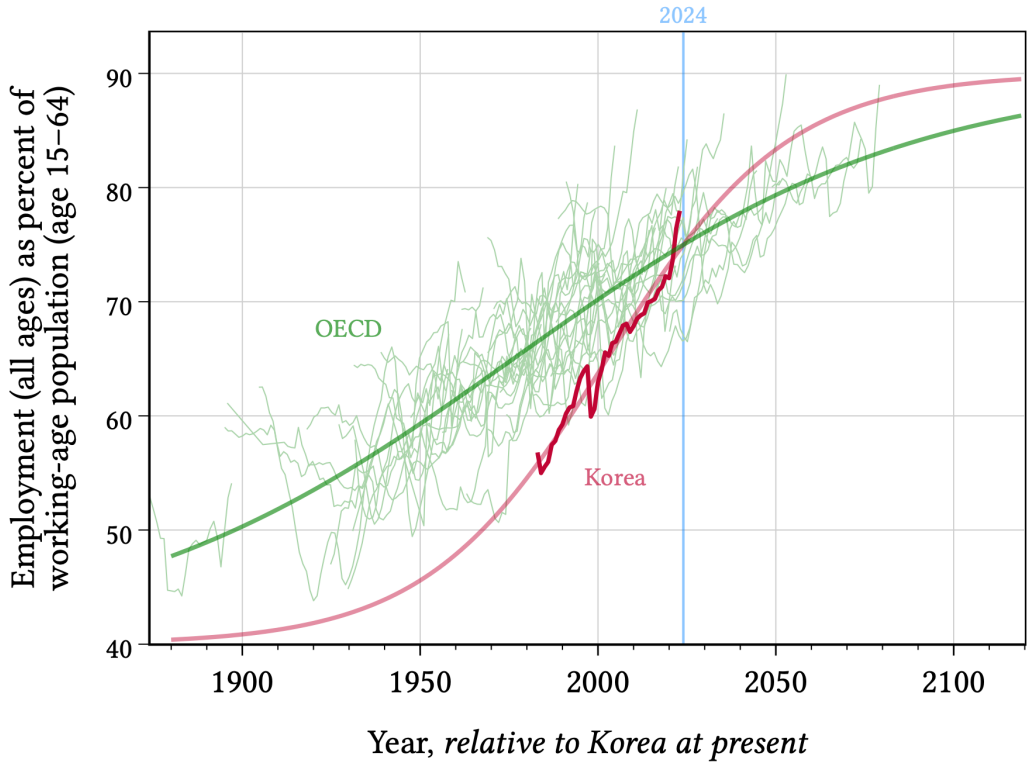
unlikely to come from further expansion of elderwork. Korea already has the highest effective retirement age in the OECD (Kirkegaard 2021). Korean workers spend *half* the number of years in retirement, on average, as their counterparts in France. At the Bank of Korea, Hwang et al. (2023, 89) agree that there is limited potential for acceleration in the growth of the employment rate through further expansion to elderwork.

But there is potential in principle for acceleration from rising female employment in particular, as well as male employment. To be sure, women's labor force participation in Korea is limited by uncommonly high societal expectations of childcare and eldercare responsibilities relative to women's historically high levels of education, deterring marriage and childbearing, and by substantial gender wage gaps even within education levels, industries, and occupations (Kirkegaard 2021, Stansbury et al. 2023). In principle the rate of overall employment growth could rise if these barriers could somehow be overcome.

But what degree of acceleration would be reasonable to expect? Figure 8 displays a Trajectory Analysis for employment growth in Korea versus the OECD, otherwise identical to the analysis for education in the preceding subsection. The dark red line shows the gross employment rate in Korea, the number of people employed *of any age* as a percentage of the population of traditional working age, 15–64. (This number captures elderwork, and could in principle rise above 100, though it has never done so in an OECD country). The light red curve shows a logistic fit for Korea's long-term transition to higher employment rates. The dark green line shows a logistic fit to rising employment in the rest of the OECD, analogous to the regression (4), and the light green lines show the raw data. As before, the OECD curve is shifted in time to line up with Korea's curve in 2024.

Figure 8 reveals that Korea's employment rate has already been rising much faster than employment rates in the rest of the OECD. It also reveals that over the last three years, Korea's employment rate has been growing unusually quickly relative to its long-term trend—a phenomenon of labor-market tightness amid recovery from the COVID-19 pandemic that is visible for several OECD economies in the same graph. Going forward, should we expect Korea to continue along its long-term transition curve, already accelerated relative to other OECD members? Or should we interpret the last few years' accelerated growth in employment as Korea's potential shift to

Figure 8: The employment-rate transition: Korea has already been raising its employment ratio much faster than the OECD average

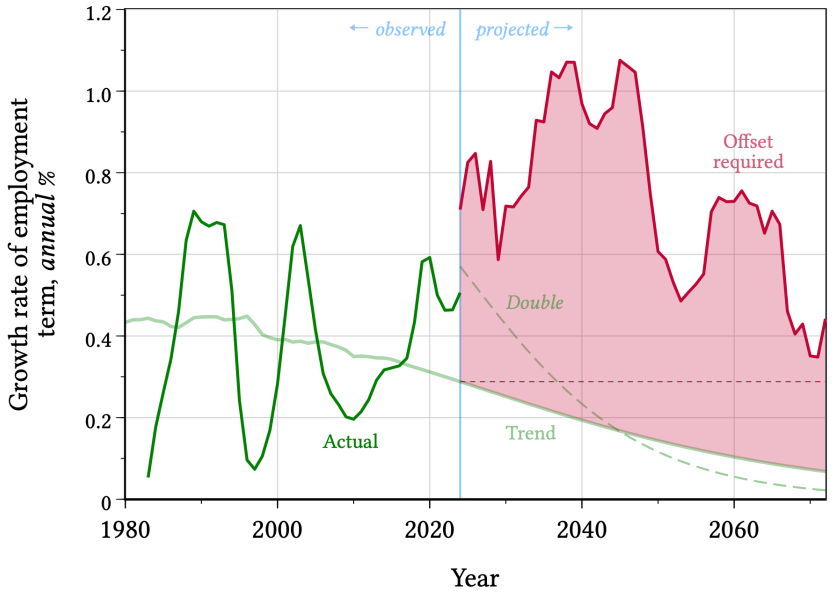


The vertical axis shows 100 × the ratio of employed persons (any age) to working-age population (age 15–64), which can in principle exceed 100 percent. Employed persons is from OECD and working-age population is from the United Nations *World Population Prospects* 2022 revision. The green (OECD) curve shows logistic growth where each country is assumed to exhibit the same slope with a country-specific horizontal shift, and has been aligned so that it meets Korea's logistic curve in the year 2024.

a new, more rapid long-term logistic curve?

The perhaps surprising answer is that it matters little, for the present purpose, which of these is true. This is because any current *acceleration* in growth for a variable that is bounded from above must be followed by a future *deceleration* of growth. Figure 9 illustrates this. Analogously to Figures 3, 4, and 6 before it, Figure 9 shows in dark green the actual rate of growth in the employment term of equation (2) implied by Korea's rising employment rate in Figure 8, from the 1980s through the present. Note the fast growth in the mid-1980s, as the Korean economy recovered from the Second Oil Shock of 1982, and just after 2000, during recovery from the Asian Financial Crisis of 1997. Recent high growth rates likewise coincide with the global recovery from

Figure 9: EMPLOYMENT-RATE GROWTH IN KOREA: The growth effect of forecast employment growth versus future additional productivity growth needed to fully offset aging



The vertical axis shows the annual percent growth in the employment term $\lambda \frac{\dot{e}}{e}$ from equation (2). The dark green line shows observed changes in the employment term up to 2024, from Figure 8, after those levels have been lightly smoothed with an (Epanechnikov) kernel-weighted moving average, bandwidth 2 years. The light green 'Trend' line shows the annual change in Korea's logistic trend line from Figure 8. The dashed green 'Double' line shows the annual growth rate if the actual trend logistic curve is altered so as to double the growth rate in 2024. *Offset required* is the percentage points of *additional* growth in the employment term, beyond the 2024 trend level of growth, necessary to fully offset the economic growth effect of demographic change in Figure 2b.

the COVID-19 pandemic.

The descending light-green line in Figure 9 shows the rate of growth in the employment term implied by the long-term logistic fit for Korea in Figure 8. If Korea continued to follow that long term trend—decelerating as typical OECD countries do—then the rate of growth in the employment term will fall for the indefinite future. Employment growth would thus fall below its current rate (the horizontal dashed red line). This would reinforce, not offset, the growth effect of aging. The acceleration in growth of the employment term necessary to offset aging is again shown by the solid red line.

And what if, indeed, Korea has shifted to a new and steeper long-term logistic curve in the last few years? Suppose that this shift implies that growth in the employment term is now *double* the

rate that would be implied by the long-term logistic fit in Figure 8. This is shown by the dashed green "double" line in Figure 9. As noted above, any such current acceleration in the growth of an inherently bounded variable requires future deceleration. As the figure shows, even such a drastic acceleration of employment growth would only offset a small fraction of the economic stagnation due to aging, and would only do so for just over a decade (before the dashed green line falls below the dashed red line). Thereafter, decelerating employment growth would reinforce the effects of aging. And two decades into the future the dashed green "double" falls below the solid light green "trend" line: reduced growth in the employment term would erase more economic growth each year in the scenario of a current acceleration in employment growth—necessarily followed by that future slowdown—then if the current acceleration had not occurred.

In sum, there is little room left to counteract the economic stagnation of aging via expanded elderwork. It would be possible in principle to offset the effects of aging with other forms of employment growth, particularly by women. But in fact this would require rates of acceleration in employment growth that are highly unlikely. If Korea follows its own long-term transition to higher employment rates—already much faster than the transition in typical OECD countries—employment growth will decelerate and reinforce rather than offset the effects of aging. Even if Korea shifts to a long-term transition that is much faster than its historical, already highly-accelerated transition, this would only offset the effects of aging for a few more years, and even that accelerated trajectory would begin to reinforce the effects of aging by the late 2030s.

Considering the next several decades as a whole, in Figure 9, in no reasonable scenario can accelerated employment growth offset the effects of aging on economic growth. Considering the next few decades as a whole, the future slowdown in Korea's employment growth entailed by past rapid employment growth is instead very likely to reinforce economic stagnation due to aging. Research at the International Monetary Fund by Swiston (2021, 16) agrees that the contribution to Korea's economic growth from rising employment and human capital will fall over the next three decades, as does the research of Cho (2023).

3.5 Pronatalism

What remains is policy action to shape demographic change itself. The preceding analysis offers little reason to expect a sharp acceleration in *any* of the other, non-demographic terms in the growth decomposition equation (2). On the contrary, it offers many reasons to believe that growth will *decelerate* for each other term. What possibility is there, then, for policy to act directly on aging?

Korea has invested heavily in a popular program of pronatalist policies over the past few decades, explicitly attempting to slow aging of the population by raising fertility. Korea's Total Fertility Rate (TFR) has nevertheless been the lowest of any country on earth for over a decade, and has now fallen below 0.72.[8] This is the lowest fertility rate on record anywhere Hwang (2023), with long-lasting consequences for the age structure of the population (Kirkegaard 2021). The causes of extremely low fertility in Korea include "high 'competitive pressure' and 'insecurity' (employment, housing, child rearing) experienced by young people, which cause them to delay or altogether opt out of marriage and childbearing" (Hwang et al. 2023, 69).

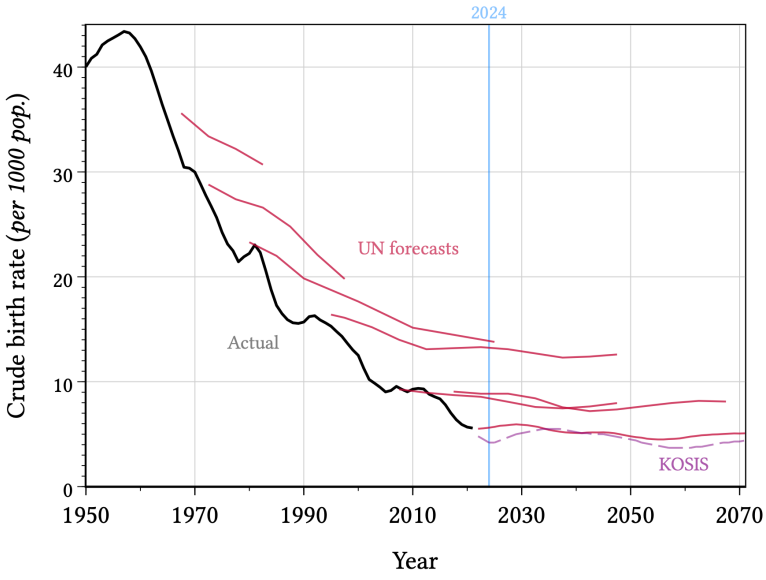
In theory, pronatalist incentives could substantially raise fertility in Korea (Kim et al. 2024; Lee and Park 2020). And there is evidence, from Korea and beyond, that government policy to raise fertility can have nonzero impact (Hart et al. 2024).

But in practice, the magnitude of this effect in Korea has been extremely small. Kim (2023b) examines the effect of Korea's pronatalist *Baby Bonus* cash transfer program, a large cash incentive to reward procreation (US$4,500–16,000 per child). Using district-level heterogeneity in the rollout of the *Baby Bonus* from 2001–2012, he finds that the program as a whole only caused a 4.7% increase in fertility. Given the TFR of 0.72 in 2023, Kim's estimate implies that even decades of large incentive payments have raised Korea's fertility rate by only 0.03. Choo and Jales (2021) estimate that pronatalist incentives in Korea would have to be massively and unrealistically larger in order to have a quantitatively substantial effect on Korea's age structure. Ouedraogo et al. (2018) fail to find evidence, in cross-country data, of an association between pro-fertility policy

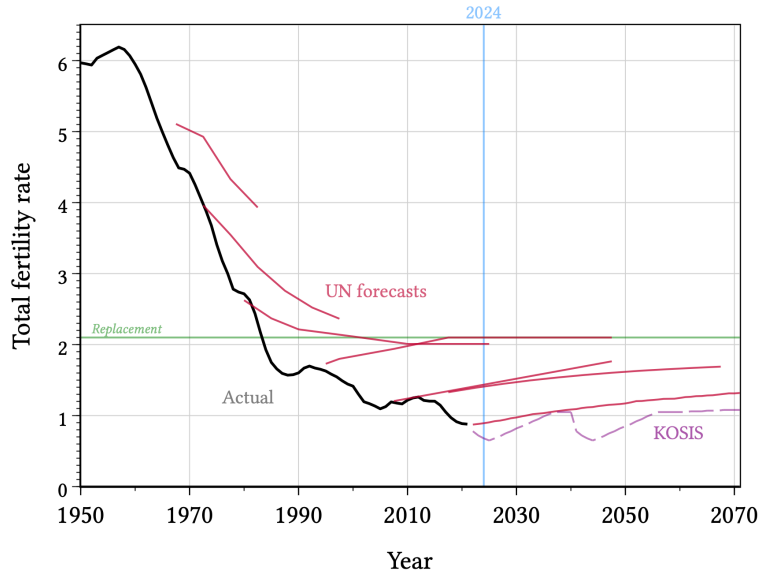
[8] The Total Fertility Rate is the average number of children that would be born to a woman over her lifetime if, at each current and future age, she were to exhibit the fertility of today's women of that age. The population tends to fall if the TFR lies below 2.1.

Figure 10: Fertility in Korea, Forecasts vs. Reality: Korean childbearing in UN predictions (1968–2072) and in fact (1950–2022)

(a) *Crude birth rate*



(b) *Total fertility rate*



"Actual" outcomes for Korea, in solid black, are taken from the UN *World Population Prospects* (WPP) 2022 revision. UN forecasts for Korea in solid red, are taken from the WPP 1968, 1973, 1984, 1994, 2004, 2014, and 2022 revisions. The 1968 and 1973 revisions forecast the Gross Replacement Rate (GRR) rather than the Total Fertility Rate, which I estimate by dividing the GRR by the fraction female at birth. The 2023 "KOSIS" forecast is from Statistics Korea.

and rising fertility. For East Asia in particular, Lee (2016, 108) flatly concludes that pronatalist policy is not "likely to have a major impact on fertility." Chen et al. (2020) find that fertility incentives in Korea have been "ineffective". Reviewing pronatalist policy in Korea, Lee and Choi (2015, 121) conclude that "reversing the trend toward low marriage rates and very low fertility is extremely difficult. . . . [T]he current low level of fertility is not a transitory phenomenon, but rather is a long-term feature of South Korean society that must be addressed with a broad response."

But for generations, demographers and policymakers have had evident difficulty in accepting the reality of persistent, very low fertility in Korea. Figure 10a plots the sharp and persistent decline in Korea's Crude Birth Rate across six decades, compared to UN demographers' forecasts over the entire period. Childbearing in Korea has consistently collapsed at rates much faster than UN forecasts. A similar pattern is evident for the Total Fertility Rate in Figure 10b. While UN demographic forecasts since the 1960s have consistently expected Korean women to imminently converge toward replacement fertility, they have defied such expectations generation after generation.

The latest forecasts from the Korean government, in contrast, represent a welcome and long-awaited acceptance of reality. These are the dashed purple lines in Figure 10. The Korean Statistical Information Service (KOSIS) now expects and plans for very low fertility into the indefinite future. The concept of pronatalist policy has been a political winner, but there appears to be appropriately limited belief in its potential to meaningfully shape Korea's demographic structure in our lifetimes.[9]

There is a fundamentally different genre of policy to shape the age structure of Korea's resident population, directly shaping the number of workers in Korea relative to the number of dependents: the systematic and long-term relaxation of restrictions on employment-based migration to Korea. This, too, could counteract future economic stagnation from aging in the growth decomposition (2). But unlike all of the other policies that could do so in principle, there is clear evidence that migration could do so in practice.

[9]UN projections for fertility have exhibited generally limited accuracy (e.g. Keilman 2019). The persistently large and unidirectional errors with respect to Korea, however, are nevertheless extraordinary.

4 Temporary migration

Restrictions on immigration directly alter the age structure of a population relative to the counterfactual of less restriction. The impact of restrictions on *permanent* immigration is ambiguous and can differ at different time horizons. Whether permanent immigration can substantially slow population aging depends on how it is structured; Lee (2016, 108) calls it "doubtful because immigrants themselves become old and in the long run tend to make receiving countries older."

But another form of policy change can act directly on the age structure: easing restrictions on temporary, employment-based migration to Korea. The vast majority of such migrants augment the working-age, employed population without enlarging the dependent population. Time-bound migrants do not enter the ranks of elderly Korean residents unless further policy change adjusts their status to permanent migrants.

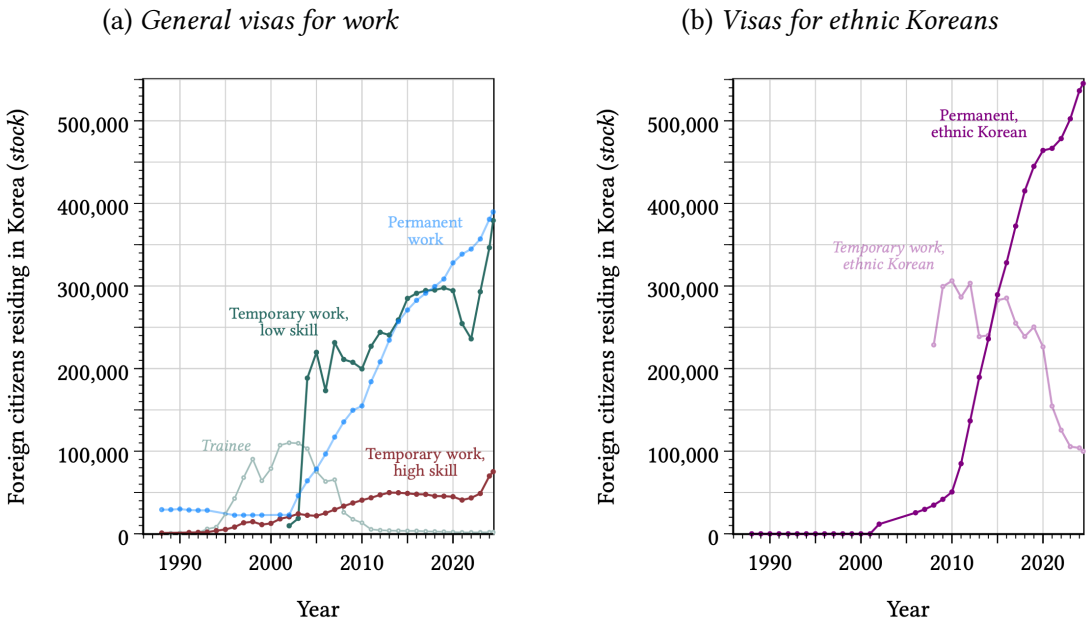
Here I consider the potential effects of relaxed restrictions on temporary, employment-based immigration on Korea's future age structure, employment, human capital, and economic growth. I discuss whether *feasible* levels of temporary labor immigration would be *sufficient* to substantially offset economic stagnation due to aging in Korea's future.

4.1 Korea cracks open the door

A generation ago, Korea tightly restricted immigration of all kinds. This fundamentally changed in the early 2000s. Korea now hosts almost a million employed noncitizen residents—temporary and permanent—under visas focused on employment (Figure 11).

In broad terms, this opening can be traced to the liberalization of Korea's labor market arising from political liberalization after 1987. The consequent empowerment of workers and labor unions contributed to rising wages but also to rising labor costs of native employment for (especially) small businesses, who began bending a *de jure* 'trainee' visa program into a *de facto* low-skill guest worker program in the early 1990s (Pak 2008; Lee 2015; OECD 2019). This was gradually but completely replaced with a *de jure* low-skill temporary work visa program, the Employment Permit System, after 2003. Korea's relaxation of restrictions on temporary migration

Figure 11: Korea's Opening Door: Stock of foreign citizens in Korea for work, 1987–2024

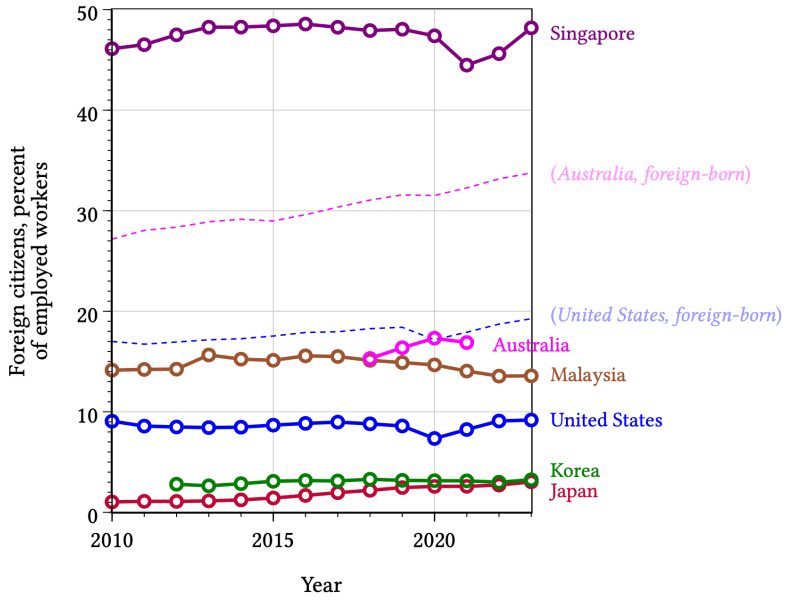


Stock of noncitizens present in Korea at the end of the year (or for 2024, the end of April). 'Trainee' visa is D-3; 'Temporary work, low skill' is E-8, E-9, and E-10; 'Temporary work, high skill' is E-1 through E-7; 'Permanent work' is F-2, F-5, or F-6 (following Lee 2024); 'Temporary work, ethnic Korean' is the H-2 'Working Visit System'; and 'Permanent work, ethnic Korean' is F-4—or their historical equivalents. Sources are KOSIS (2009–2022), Ministry of Justice (1987–1992, 2023–2024), and Hahn and Choi (2006, 43) (1993–2002).

for low-skill work has come accompanied by a proportional but much smaller rise in temporary visas for higher-skill work, such as by researchers and language teachers. There has been a roughly commensurate rise in the number of noncitizen residents on *permanent* visas that can be used for employment-based migration (Figure 11a). Permanent visas for work are limited in their vast majority to skilled, high-income workers earning more than double Korea's GNI.

All of the above visas are targeted at foreign citizens who are not ethnically Korean. But in parallel, Korea has established ample temporary and permanent work visa opportunities for ethnic Koreans overseas (Figure 11b). Most of these are people, known as *Joseonjok* (조선족), with Korean roots but originateing from provinces of China close to the border with North Korea. Because the global supply of such workers is limited to below two million, the possibility for future expansion of such migration flows is limited. New arrivals on these visas have dwindled over the last five years.

Figure 12: Foreign workers in selected countries: How Korea's noncitizen fraction of employed workers compares to others



'Noncitizens' are employed workers who are not citizens of the indicated country. Sources are as follows. United States: US Census Bureau, Current Population Survey. Malaysia: Department of Statistics Malaysia, *Labour Market Review*. Singapore: Ministry of Manpower, Manpower Research and Statistics Department. Australia: Australian Bureau of Statistics. Japan: Ministry of Health, Labor, and Welfare. Korea: KOSIS. Note that noncitizens in Singapore include permanent residents, who are often considered 'locals' in common statistics on 'foreign' workers in Singapore.

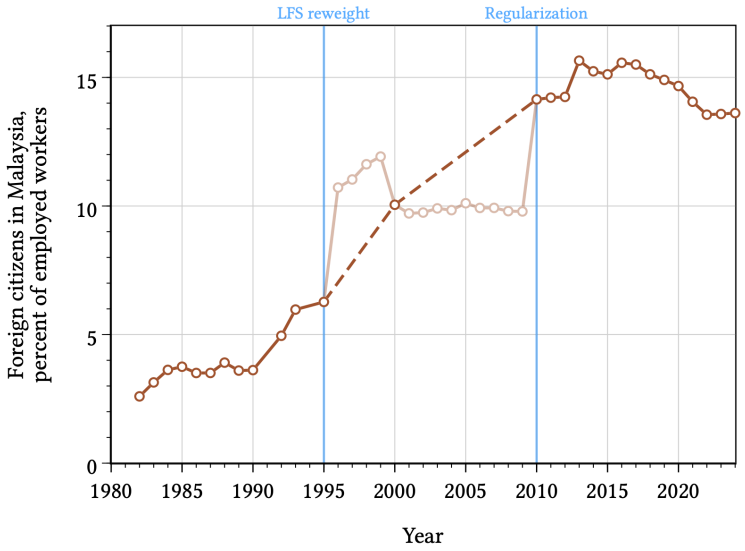
4.2 The feasible scale and speed of temporary migration

Korea, then, has taken decisive steps to open a door that was previously closed to temporary migrant workers. How far and how fast can that process proceed? What prevalence of noncitizen workers in an advanced economy is feasible, and how quickly can it rise?

Other countries offer an informative experience. Figure 12 shows foreign citizens as a fraction of all employed workers, in Korea and selected comparison countries, since 2010. (For the United States and Australia, dashed reference-lines are added to show the foreign-*born* fraction of employed workers—many of whom have become citizens.)

Korea, Figure 12 suggests, has only begun to tap the economic potential of foreign workers. In Korea, as in Japan, just three percent of employed workers are foreign citizens. This fraction

Figure 13: Malaysia: Reaching today's prevalence of noncitizen workers took four decades



From Department of Statistics Malaysia, *Labour Market Review*, various years. Interpretation of mismeasurement due to changing survey weights, migrant regularization, and migrant tracking systems is from Yi et al. (2020) and Siti et al. (2017), see text.

is three times higher in the United States, 4–5 times higher in Malaysia, 5–6 times higher in Australia, and 16 times higher in Singapore. Some of these have emphasized temporary work by less skilled noncitizens (such as Malaysia), while others have embraced a broad range of skills (such as Australia). All of these countries meet any reasonable, global standard of high economic opportunity for their citizens in general.

The countries in Figure 12 with high prevalence of noncitizen workers took several decades to arrive there. Figure 13 plots four decades of rising noncitizen employed-worker stocks in Malaysia. Simply measuring this stock is complicated by changes in regulations and in measurement methods at different moments (Yi et al. 2020). The official statistics that are known to be substantially incorrect are plotted in light brown: the apparent uptick from 1996–1999 likely represents inappropriate weights applied to the Labor Force Survey; the apparent downtick from 2001–2009 likely represents uncounted workers prior to policy reforms including the regularization and biometric tracking of migrants (Siti et al. 2017, 54 *passim*).

Thus only the dark solid and dashed lines in Figure 13 should be interpreted as approximating the speed of Malaysia's true long-term increase in the prevalence of noncitizens among employed workers. Malaysia rose from three percent in 1982 (Korea's current prevalence), to its current prevalence of 13–14 percent, across four decades. This relaxation of restrictions was less of a hairpin turn than an intergenerational transition.

4.3 Effects of temporary foreign workers on Korea's future economic growth

Even if a higher prevalence of temporary foreign workers in Korea is feasible, would it be *sufficient* to substantially offset the effect of aging on economic growth? I consider this question within the straightforward model of Section 2. I account for the effects of less-skilled temporary foreign workers on the working-age population, employment, and average schooling.

We seek to estimate overall material welfare of average Korean citizens with and without varying future prevalence of temporary foreign workers. We can estimate actual income per capita in year t (y_t) as a fraction of potential income per capita without aging (y_0), all else equal, as the reduction factor

$$\mathcal{R} \equiv \frac{y(\theta_t)}{y(\theta_0)} = \left(\frac{1-\theta_t}{1-\theta_0}\right)^{\lambda}, \tag{5}$$

implied by equation (1), using demographic projections of the working-age share of the population *without* immigration.

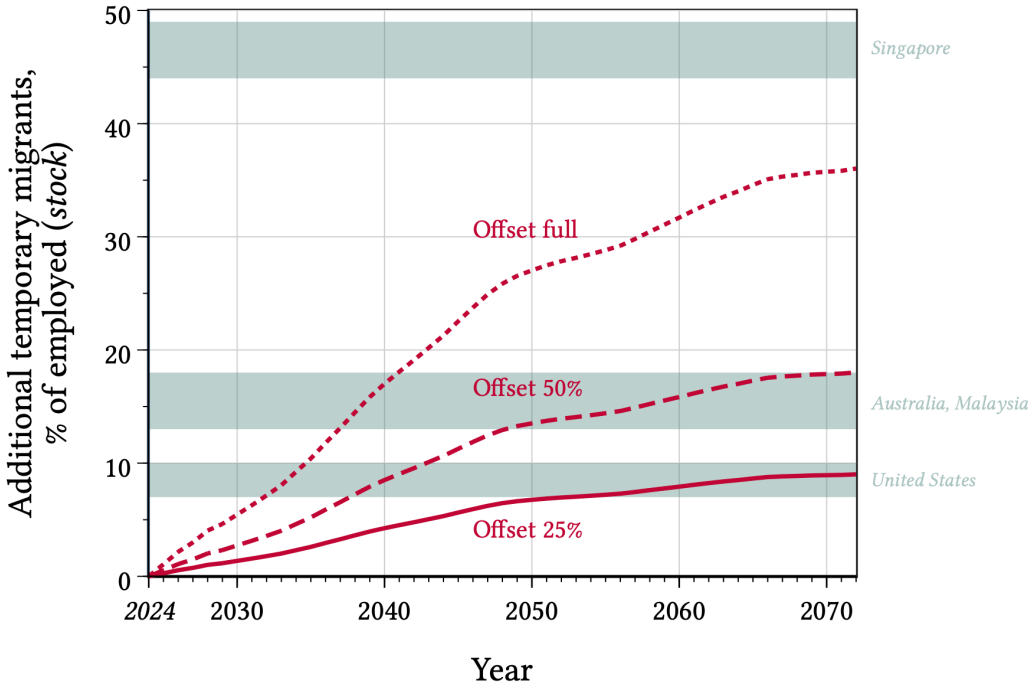
Temporary migrant workers augment the employed, working-age labor force one-for-one. They might also reduce human capital by the factor $\bar{h} \equiv h_m/h \leqslant 1$, if migrants have fewer years of schooling than natives. The fraction of all employed workers who are migrants (m) is just sufficient to offset the reduction $\mathcal{R}$ in income per citizen due to aging when $\left(1+\bar{h}\cdot\frac{m}{1-m}\right)^{\lambda} = \mathcal{R}^{-1}$, that is, when

$$m = \frac{\Delta\theta_t}{\Delta\theta_t + \bar{h}\left(1-\theta_t\right)}, \tag{6}$$

where $\Delta\theta = \theta_t - \theta_0$ is the cumulative change in the aging parameter θ between the base year and year t (derived in the Appendix).

The migration expression (6) has several intuitive features. When the growth impact of aging

Figure 14: Temporary Migrant Workers in Korea as an Offset to Aging: Stock of temporary foreign workers in Korea projected to offset the effect of aging on GDP per citizen, compared to current stocks in selected countries



The dashed red "Offset full" line plots the noncitizen percentage of employed workers m from equation (6) that would entirely offset future direct effects of aging on economic growth, given KOSIS projections of θ_t relative to base year 2024. The "Offset 50%" and "Offset 25%" lines show fractions of the full-offset m in each year. Shaded green bands show the rough ranges of *today's* prevalence of noncitizen employed workers in reference countries in recent years, from Figure 12.

is positive ($\mathcal{R} > 1$, and $\Delta\theta_t < 0$), during the years of demographic dynamo, the immigration necessary to maintain GDP per citizen is negative (for plausible parameters). That is, *emigration* prevents a fall in GDP per citizen, and indeed Korea exhibited large-scale emigration during the years of the Miracle on the Han River (Noland 2003). When the growth impact of aging is negative ($\mathcal{R} < 1$, and $\Delta\theta_t > 0$), as it is now and into the indefinite future, positive immigration can offset that impact and reverse the decline in GDP per citizen, all else equal. This requires a greater stock of migrants m to the extent that migrants have lower human capital than citizens $(\bar{h} < 1)$.

Figure 14 plots the noncitizen fraction of employed workers m in Korea, in each year 2024–2072,

that would just offset expected aging in equation (6). That is, it shows the stock of noncitizen workers in each year, as a fraction of all employed workers, that would be sufficient to offset the direct reduction in GDP per citizen by an aging population—all else equal. This is the "Offset full" line in the figure.[10] The "Offset 50%" line shows half of the full-offset level of m, that is, the prevalence of noncitizens among employed workers that would be sufficient to offset the future direct effects of population aging on cumulative economic growth relative to base year 2024. The "Offset 25%" line shows the migrant-worker prevalence that would offset a quarter of the direct reduction in cumulative economic growth due to aging.

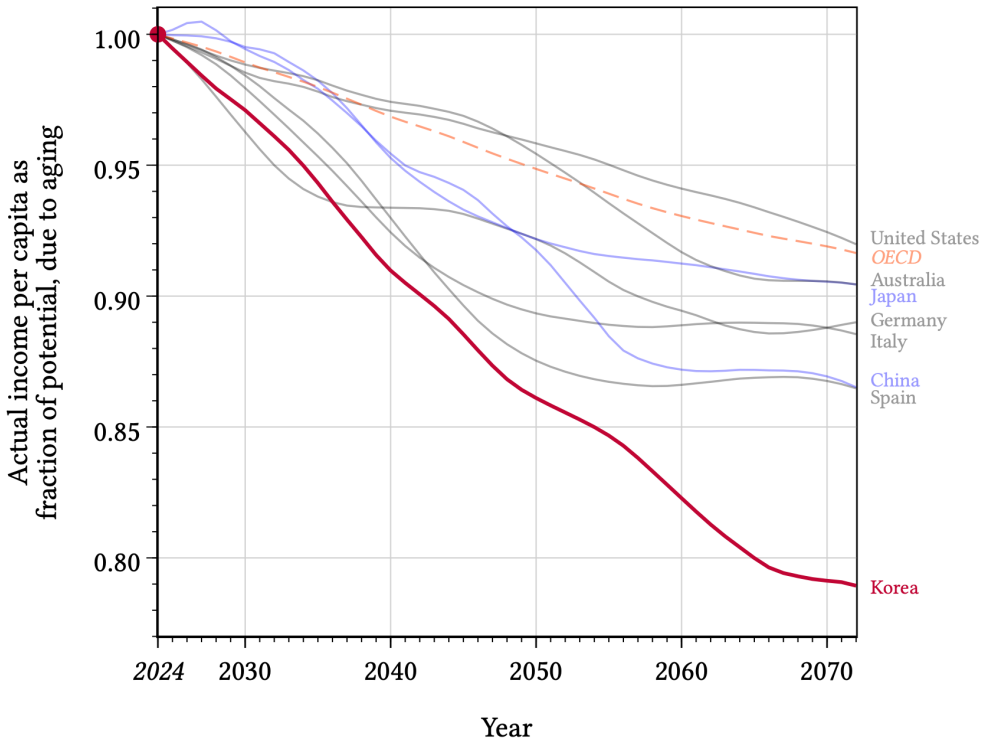
Figure 14 suggests that enhanced temporary labor migration to Korea would be sufficient to substantially offset demographic drag in Korea for several decades to come. It furthermore implies that that the approximate levels of temporary migration required have been shown to be broadly feasible by other relevant countries. If Korea were to follow in the footsteps of Malaysia or Australia, raising noncitizen worker prevalence to roughly 15 percent over the next four decades (Figure 13), this would be sufficient to reverse the majority of the reduction in economic growth due to aging over the next 30 years. Thereafter, Korea could continue to offset the majority of the aging impact by slowly rising to a slightly higher prevalence (18 percent) over the subsequent 20 years. If Korea were to pursue a path more similar to the United States, even this would be sufficient to offset roughly one quarter of the economic effects of aging. In a more aggressive scenario, where Korea pursues a degree of openness to noncitizen workers similar to Singapore's, it could entirely reverse the direct effects of aging. Whatever course Korea chooses would unfold across a half-century and surely be subject to numerous reforms and course-corrections, as it has been in all of the references countries of Figure 12.

5 The Korean bellwether

Whatever path Korea chooses will become a model for many other countries that will follow closely in its footsteps. Demographic drag has arrived earlier and more quickly in Korea than in many other advanced economies. But a range of countries will follow—from a historical

[10] For the migrant-worker human capital term h_m, I use the average years of schooling for low-skill temporary workers in recent years of Korea's Employment Permit System. KDI and World Bank (2019, 30) survey EPS workers across a range of industries and find that they have $(0.640 \times 12) + (0.237 \times 16) + (0.100 \times 9) + (0.020 \times 6) = 12.5$ years of education on average.

Figure 15: Loss of Income per Citizen due to Aging, without Immigration: Korea compared to selected peer countries, 2024–2072, all else equal



Plots $\mathcal{R}$ from equation (5). Uses the *Zero Migration* scenario of the United Nations *World Population Prospects* 2022 revision, which assumes no international migration after the year 2022, and the most recent reported labor share of income from the *Penn World Table* 10.01. The line for Korea uses current demographic projections from Statistics Korea.

perspective—soon after Korea.

Figure 15 suggests that Korea is a bellwether for demographic drag around the world in decades to come. The figure plots projected values of the direct fractional reduction in GDP per capita due to aging—$\mathcal{R}$ from equation (5)—for Korea and several other countries. The line for Korea uses current demographic projections from Statistics Korea. The lines for other countries use United Nations demographic projections that assume zero additional immigration (or emigration) after the year 2022. In this way, the figure portrays the magnitude of the opportunity to offset demographic drag with enhanced temporary labor migration, largely separate from countries' decisions regarding migration policy, in a way that is approximately comparable.

It is well known that Korea is likely to experience major welfare losses without greatly enhanced labor migration, as Figure 15 shows. It may be less well known how parallel other countries' *native* demographic dynamics are to Korea's. Consider $\mathcal{R} = 0.9$, the point at which demographic drag has erased ten percent of potential material welfare for citizens relative to base year 2024. Korea is expected to reach this point in 18 years. It may be less well-known that Spain and Italy, in the absence of their much higher prevalence of immigrant workers, would be projected to arrive at the same point just 3–6 years later. Roughly a decade after that come China and Germany. A decade after that, without further increases in immigrant prevalence, Australia and Japan would be projected to approach the same $\mathcal{R} = 0.9$ mark.

Korea's current experience, in other words, is less an aberration than a harbinger. Other governments can and should closely observe how Korea decides to navigate these difficult waters. Whatever choice Korea makes, in the spectrum between migration and stagnation, will offer important lessons to policymakers around the world.

6 Caveats

This analysis, like any exercise in scenario-building that extends half a century into the future does not provide precise predictions. The accuracy of forecasts relies on countless explicit and implicit assumptions. Here I touch on some of the key assumptions that shape this exercise.

First, as noted above, like Cho (2023, 15), Lee and Song (2023, 9), and Lim (2016), I assume that the labor share of income in Korea will remain at roughly its current value for several decades. To readers accustomed to current discussion of recent declines in the United States labor share (e.g. Kehrig and Vincent 2021; Karabarbounis 2024), this assumption may appear strong. But a robust recent literature has questioned whether any clear long-term trend in the labor share is evident in advanced economies other than the United States, including Korea. Researchers at the Bank of Korea and the OECD find no evidence of a substantial, structural decline in the labor share of income in Korea, nor across the OECD more generally, after accounting for rising rates of capital depreciation (Cho et al. 2017), a finding backed up by Bridgman (2018). Cette et al. (2020) provide evidence that the finding of a declining labor share even in the United States and France

is sensitive to the treatment of real estate services. Gutiérrez and Piton (2020) show that a similar adjustment reverses the common finding of a declining labor share in most countries (though not the United States). Acemoğlu and Restrepo (2018) point out that even widespread mechanization is compatible with long-term stability of the labor share, provided that the creation of new tasks for human specialization continues.

Second, in its use of the Cobb-Douglas production function (1), the analysis furthermore assumes a constant elasticity of substitution in production between capital and labor. Given the uncertainty of future technological change, especially on a timescale of several decades, this assumption may appear strong. Future artificial intelligence and robotics technologies, or currently unknown types of technology, may make capital more substitutable for labor in a range of tasks than has been possible in the past.

But the use of a Cobb-Douglas production function is conservative in one sense: It implicitly assumes unit elasticity of substitution between capital and labor—substantially higher than most estimates for advanced economies *current* technology, which tend to cluster around 0.7–0.8 or lower (Robert S. Chirinko and Meyer 2011; Mućk 2017; de Albuquerque 2017; Chirinko and Mallick 2017; Ialenti and Pialli 2024). If this elasticity were to rise under future technologies, it would converge *toward* the value of unity implicitly assumed here.[11]

Moreover, mechanization *per se* does not necessarily entail a rise in the economywide marginal elasticity of substitution between capital and labor. Workers can and likely will adjust to growing mechanization by further specializing in tasks and occupations that use human capacities more intensively. That is, even if current tasks are further allocated to machines by technical advances, the national production function is also likely to include tasks that are new and more intensively allocated to human beings than the current national production function (e.g. Acemoğlu and Restrepo 2018). In a world where human and robots/artificial intelligence are more fully specialized in the tasks that each does best, the marginal elasticity of substitution between them could fall.

[11] While one study does find a capital-labor elasticity of substitution in Korea above unity—unlike in almost all other advanced economies—the same study notes that this is likely an artifact of past but now-defunct price distortions created by the Korean government to cheapen capital goods rather than an aberrant structural feature of Korean production technology (Mallick 2012, 685).

Third, the analysis above considers only direct, *ceteris paribus* effects of each component of the decomposition (2) on economic growth. The literature offers reasons to believe that this trait of the analysis might render the conclusions here conservative. For example, the literature offers reasons to believe that demographic decline could reduce innovation and productivity, both in theory (Jones 2022) and in cross-country data (Poplawski-Ribeiro 2020). Such effects would render even more remote the possibility that an acceleration in the growth of other terms in equation (2) could compensate for demographic drag. In a different dimension, increases in higher education for Korean women have contributed to low fertility and thus the aging of the population (Jung and Jung 2022). An attempt to compensate for demographic drag with increased educational attainment, then, could also tend to indirectly increase demographic drag itself. Another example is that researchers have raised the possibility that aging societies might produce less innovation (Kaltenberg et al. 2023)—an indirect ripple effect of aging on growth via TFP. Such an effect would make it even more difficult for policy actions other than those shaping migration to remediate demographic drag.

Finally, this analysis considers only the impact of aging on average material welfare via national production. It does not consider the fiscal impact of aging, which is also projected to be large and negative (Kim and Lee 2021), and is likely to be disproportionately incident upon the elderly. The positive fiscal impact of temporary labor migration would be part of a more complete analysis. This analysis furthermore does not consider sector-specific labor market dynamics where the contribution of immigrant workers could be exceptionally valuable, such as in care work (Chae et al. 2024).

7 Discussion

Korea is "a country that places a high value on its ethnic and cultural homogeneity," writes Park (2017). Immigration is often dismissed as a policy response to Korea's rapid aging. Analysts often dismiss out of hand that feasible levels of immigration would be sufficient, or even necessary, to stave off economic stagnation in Korea's near future. Suspicions of permanent immigration run particularly high (Lim 2012).

The present analysis offers a basis to reconsider that broad, common stance. Levels of temporary labor migration to Korea are set by policy and act directly on the demographic structure and employment status of the resident population, without contributing to societal aging. Temporary labor migration thus constitutes a tangible and effective policy lever. This analysis has offered evidence that temporary labor migration, as a class of policy to offset demographic drag in Korea, is necessary, sufficient, and feasible.

Temporary labor migration is *necessary* because the most careful and quantitative analysis of *all* alternative channels for offsetting demographic drag concludes that they will offset at best a sliver of Korea's demographic drag—or in most cases, actually aggravate it. Mainstream projections of capital accumulation, TFP growth, employment growth, and education investment all imply future trends that will tend to reinforce demographic drag. None offers a clear and straightforward policy lever to alter that trajectory.

Temporary labor migration is *sufficient* because, to first order, such migrants add to the stock of working-age employed but do not add to the stock of dependents. I estimate that if Korea over the next 40 years followed roughly the path of Malaysia over the past 40 years—raising noncitizen employment prevalence from three percent to roughly 15 percent over several decades—this by itself would suffice to reverse most of the expected economic stagnation directly caused by aging in Korea. Despite the focus of policymakers on high-skill immigration, ongoing polarization of the Korean labor market will ensure continued robust demand for workers performing routine manual tasks (e.g. Hong 2023), causing native workers to specialize in more complex cognitive and communication tasks (Kim and Lee 2023).

Finally, temporary labor migration is *feasible*. It is commonplace to suggest that Korea is uniquely incapable of relaxing restrictions on the entry of noncitizen workers to the degree and at the pace that Malaysia and Australia already have. It is true that giving full citizenship to foreign residents remains somewhat unpopular in Korea: only 38% of Koreans agree. But Koreans have sharply more positive attitudes toward Korean residence by noncitizens: 89% of Koreans report that they would accept a foreign neighbor, colleague, close friend, or even spouse (Lee et al. 2024, 143). Surveys have long revealed rising support for Korean openness to immigration, particularly in the up-and-coming generation (Dongsung Kong and Yu 2010).

Obviously, unforeseen and unforeseeable events could produce sharp divergence between the forecasts summarized here and the real progression of the Korean economy. Artificial Intelligence, or as-yet unimagined advances, could hypothetically raise Total Factor Productivity growth in Korea. This is not at all a foregone conclusion, and the course of future technological advance may alter the distribution of income while reducing productivity (e.g. Acemoğlu and Restrepo 2020). I do not claim that no such unforeseen productivity boost can happen. Rather, it is highly unclear whether or not it will happen, much less which policy lever could be pulled to make it happen. Temporary labor migration, in contrast, bears clear and foreseeable effects and is unquestionably a direct function of policy. The EPS program for temporary low-skill migration today faces the binding constraint of a tight and explicit cap set by policy.

All of this suggests that further relaxation of restrictions on temporary, low-skill labor migration to Korea represents a generational opportunity to build a dynamic economic future in Korea. The upcoming and widely forecast permanent contraction of the Korean economy, and stagnation of living standards, are not fate. Policy exists that could avert it. Korea already has a temporary foreign worker program that is widely admired and considered a global model for its careful design features—including worker mobility between employers and extensive language training to protect labor rights while raising productivity (Cho et al. 2018), sophisticated worker-employer matching system (Cho and Lee 2021), and governance through bilateral agreements with origin countries (Chung et al. 2023). There is no sign that EPS migrants have reduced the employment or earnings opportunities of native workers, even those working alongside them at the same firms (Kwon and Chun 2011; Dong et al. 2023) or that foreign workers in Korea in general have adversely impacted native wages (Kim 2023a).[12] Temporary work in Korea via EPS causes migrants' wages to rise by a factor of five relative to their best opportunity at home, allowing among other things expanded investment in human capital by their families (Clemens and Tiongson 2017).

Korea is already, in other words, a global leader in the design of relatively well-functioning migrant worker programs. This challenges the conventional wisdom that Korea is somehow uniquely impeded from seizing economic opportunities related to labor mobility; through its leadership in temporary migration policy design and execution, Korea is in fact well placed to

[12] Jeong (2022) corroborates this result by finding that an exogenous negative shock to EPS worker supply in the COVID-19 pandemic caused higher vacancy rates at Korean firms, compatible with very low substitutability between EPS workers and comparable natives.

seize this opportunity.

But Korea's demographic predicament, and the large opportunity it can find in temporary low-skill labor migration, are not at all unique. Many other advanced economies will face similar challenges that can be similarly addressed. Clemens and Chand (2023) find that sustaining economic growth in Australia, too, through 2050 will require millions of additional workers with vocational—not university—qualifications. Orrenius et al. (2020) make a related case for a future migration-stagnation tradeoff in the United States, as do Walmsley et al. (2017) for East Asia. Research at the International Monetary Fund and elsewhere suggests that this phenomenon is generalized across the advanced economies (e.g. Jaumotte et al. 2016; Poutvaara 2021; Dao et al. 2021). In a world where the richest countries are rapidly aging, creating a massive geographic mismatch between capital and workers, restrictions on migration will remain one of the tightest constraints on global prosperity (Clemens 2011; Dustmann and Preston 2019; Pritchett and Hani 2020).

But the institutions regulating and shaping migration remain in their infancy relative to what may be needed in the wealthiest and oldest countries, both in Korea (Callinan 2020) and elsewhere. The world will look to Korea for models and lessons. When the advanced economies one-by-one face their own choice between migration and stagnation, and look back to Korea's choices, what will they learn?

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Online Appendix

Migration or Stagnation: Aging and Economic Growth in Korea Today, the World Tomorrow

Michael A. Clemens — July 2024

This Appendix presents material to supplement the main text.

A1 Derivation

Prior to any additional immigration, with the aging parameter at its initial value θ_0, GDP per capita (that is, per citizen) is

$$y_0 = \frac{AK^{1-\lambda}}{N}\Big((1-\theta_0)\varepsilon hN\Big)^{\lambda}. \tag{A.1}$$

After migration, denoting by $\tilde{m}$ the ratio (stock) of employed migrant workers to employed citizen workers, GDP per citizen is

$$y = \frac{AK^{1-\lambda}}{N}\Big((1+\bar{h}\tilde{m})(1-\theta_t)\varepsilon hN\Big)^{\lambda}, \tag{A.2}$$

where $\bar{h} \equiv h_m/h$ is the ratio of human capital for the average migrant worker to human capital for the average citizen. In the absence of immigration, all else equal, GDP per citizen declines by the factor

$$\mathcal{R} \equiv \frac{y(\theta_t)}{y(\theta_0)} = \left(\frac{1-\theta_t}{1-\theta_0}\right)^{\lambda}. \tag{A.3}$$

The migrant ratio $\tilde{m}$ that will just offset the income reduction (A.3) is recovered by holding GDP per citizen constant, setting (A.1) equal to (A.2), and solving for $\tilde{m}$ in terms of θ_t, θ_0, and $\bar{h}$. In terms of the migrant *fraction* m, the fraction of all employed workers who are noncitizens, the offset condition is

$$\frac{1-\theta_0}{1-\theta_t} = 1 + \bar{h}\cdot\frac{m}{1-m}, \tag{A.4}$$

which yields

$$m = \frac{\theta_t - \theta_0}{\theta_t - \theta_0 + \bar{h}(1-\theta_t)}, \tag{A.5}$$

in the main text.

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