Population aging and economic dependency in Thailand: A multidimensional prospective analysis

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Abstract

Thailand is experiencing rapid population aging due to declining fertility rates and increasing life expectancy. Traditional dependency ratios using age thresholds suggest a dramatic increase in the ratio of dependents to workers that threatens fiscal sustainability. This paper argues for a more nuanced perspective on population aging in Thailand using a microsimulation model incorporating multidimensional measures of dependency. While the total working-age population will decline, improvements in health and life expectancy mean the elderly dependent population is increasing less steeply. Productivity gains from higher educational attainment can largely offset the impact of fewer workers. Ongoing formalization of the Thai economy also increases average productivity as informal workers transition to more productive formal employment. Sophisticated dependency ratios accounting for these changes in worker productivity show the economic burden of dependents relative to workers remaining stable or even declining by 2070 despite population aging. Rather than focusing narrowly on promoting fertility, policy should priorities human capital improvements through education and facilitating formal economic opportunities.

Keywords: Thailand, Population Aging, Dependency ratio, Labor Force, Education, Life Expectancy, Productivity, Formal Work

Introduction

Thailand is one of the most rapidly ageing countries in the world. As a result of rapid economic development, urbanization and a highly comprehensive family planning system, the total fertility rate in Thailand fell from 5.5 in 1970 to around replacement rate by 1990, and stands at around 1.3 in 2020. Over the same period of time, life expectancy at birth has risen from 57.9 to 79.3 years (United Nations, 2022). The implementation of Universal Health Care continues to make a strong contribution to improved health and wellbeing. Using the traditional measures of ageing, in 1970, the median age of the population was 16.4. By 1990 this had risen to 23.3, and in 2022 was estimated to be 39.3. By 2050, it is projected that the median age will be 50.7 years. The proportion of the population aged 65 and above was 3.0% in 1970. In 2021, however, this has risen to 14.5%, and is forecasted to rise to 31.6% by 2050 (United Nations, 2022).

These changes in the demographic characteristics of Thailand have brought concern regarding public financing and economic development. There is a strong fear that Thailand will be 'old before it is rich' and therefore unable to adequately provide social welfare systems and be fiscally sustainable in the future. This is especially important in the midst of changing patterns of familial care with children less likely to be the main source of care and support for their parents as a consequence of shrinking family size, internal migration and urbanization (Knodel et al., 2018).

In response to this rapid and pronounced demographic shift, recent Thai governments have developed a pronatalist narrative and enacted policies to encourage childbearing as a mean of slowing down population ageing. It is questionable, however, the extent to which this approach has had any significant effect, especially as the TFR remains low, perhaps partly due to the economic and social uncertainty stemming from the COVID-19 pandemic. As in other low fertility countries, the direct and indirect costs of childbearing, coupled with high costs of living, housing issues, work culture and gender inequality appear to more than offset the positive contribution of modest financial incentives and pronatalist messaging (National Economic and Social Development Council, 2023).

In this paper, we aim to provide an alternative approach to the measurement and interpretation of population aging in Thailand by considering the effects of key societal changes, such as increased life expectancy, which redefines the old-age threshold, and changes in the productivity of workers brought by improved educational attainment and a probable shift from the informal to the formal sector. To achieve this, we use a microsimulation population projection model to forecast the population of Thailand from 2020 to 2070 using four analytical dimensions: age, labor force participation, educational attainment, and sector of activity (formal/informal). From these

dimensions, we calculate and analyze the trends in sophisticated dependency ratios that account for changes in life expectancy, productivity and labor force status. This provides a more nuanced understanding of the challenges posed by population aging in Thailand.

How to measure population aging

One of the main concerns related to population aging is the capacity of the State to provide public services to a growing number of dependent people, while the relative number of workers is reduced. This impact is traditionally measured with the age dependency ratio, which divides the children and the elderly by the working-age population. While it is undeniable that population aging is a major demographic challenge for fiscal policies and the sustainability of publicly provided services, several other societal changes are simultaneously underway. These changes might, to some extent, compensate for the negative economic consequences of an aging population.

First, the threshold of “being old” is generally defined as age 65, but this is a subject of debate (Bussolo et al., 2015; Disney, 1996; Sanderson & Scherbov, 2010). Indeed, a growing body of evidence supports the popular expression that "sixty is the new forty" (Sanderson & Scherbov, 2015). Not only are so-called older people healthier than they used to be, but they also have lifestyle habits that were previously generally observed in the younger population (Helmkamp & Carter, 2009). Thus, the public cost of health care for someone aged 65 is probably much lower today than it was for someone the same age a few decades ago, when that person’s remaining life expectancy was much lower (Sanderson & Scherbov, 2015). In light of this, when using a dynamic definition of the old-age threshold that acknowledges the improvements in health and life expectancy, the pace of population aging is significantly reduced (Sanderson & Scherbov, 2015).

Second, recent studies have showed that assessing the challenges of population aging using the age structure only is misleading, because it does not account for the changes in labor force participation by age groups or the productivity of workers. In Europe and China, an increase in the productivity of workers, potentially brought by their improved educational attainment, could in large part compensate for population aging (Marois et al., 2020, 2021). Introducing labor force participation and productivity in the analysis not only gives a more accurate outlook of the challenges of population aging, but also allows to measure the impact of more elaborated public policies related to socioeconomic dynamic. For instance, in Iran, a recent multidimensional population projection analysis showed that reducing the gender gap in labor force participation would have greater impact on the ratio of the inactive population to the active one than increasing fertility (Gietel-Basten et al., 2023). Similarly, in Europe, increasing immigration levels were found to significantly and positively

impact the economic dependency ratios only when newcomers are well educated and integrated into the labor force (Marois et al., 2020). When looking at indicators related to the capacity of workers to support the economically inactive population, labor force participation rates and the educational attainment of workers are indeed two variables that are probably as, or even more important as the age structure.

Third, the labor force participation rate of Thai women is already relatively high compared to other middle-income countries, such as India and Iran (World Bank, 2022), and there has been a strong and persistent progress in educational attainment (WIC, 2019). But despite this progress, a large proportion, of approximately 56% of the workforce still works in the informal sector (Poonsab et al., 2019), which contributes much less in tax while having lower income and being more vulnerable (Gërxhani et al., 2022). Data, however, suggest that an economic transition is ongoing, as the share of workers in the formal sectors has been increasing (Kongtip et al., 2015). Therefore, as Thailand's economic transition continues, a larger number of future workers are expected to work in the formal sector, having better income, higher productivity and making a greater contribution to finance public services.

Projection methods and assumptions

The projection is performed through a discrete-time microsimulation model based on the methodological framework provided by Marois and KC (2021). The assumptions for the demographic components (fertility, mortality and migration) as well as for the pathway of educational attainment are chosen from the SSP-2 scenario of the Wittgenstein Center multidimensional population projection (WIC, 2019). Those assumptions were made based upon past trends and statistical models, using input from experts' polls. Fertility levels are expected to vary narrowly, between 1.4 and 1.6 children per woman, while the life expectancy is assumed to continue increasing, from 72.7 in 2015 to 79.4 in 2070 for males and from 80 to 85.6 for females. Both fertility and mortality include differentials by education level. Net migration, although it has a minor role in overall demographic change in Thailand, is assumed for its part to remain slightly positive. The past progress in educational attainment is assumed to continue, with a growing share of people with postsecondary education (from 26.6% for the cohort born in 1980-84 to 68.5% for the cohort born in 2035-2039). Simultaneously, the number of individuals with no education is expected to decline significantly and become marginal.

Future labor force participation rates by age, sex, and education are calculated using the cohort-development method (Loichinger, 2015) with the data of the Thai Labor Force Survey (TLFS) from

2005 to 2021. By following cohort changes in labor force participation rates between two periods, net entry and exit rates by age group are calculated. The averages of these rates by age group, sex, and educational attainment are then applied to simulate the development of labor force participation rates. For both males and females, this yields into a slight decline in the labor force participation rates at ages 60-75 years, since older cohorts with lower education are gradually replaced by more highly educated cohorts who tend to retire earlier, and for the young adults (<20) who are more educated and postpone their entry in the labor force. Rates for other age groups remain largely stable.

The model we developed for Thailand also included for the first time a dimension allowing formal workers to be distinguished from informal workers among the economically active population. Informal employment is operationally defined as workers who are not subscribed to contributory social security schemes in Thailand (National Statistical Office, 2021). The modeling of this dimension is based on a sex-specific age-cohort logit model including education (see equation 1) using data from the TLFS.

Eq1. $logit\ (SCT) = \beta_{s,0} + \beta_{s,1}COHORT + \beta_{s,2}AGE + \beta_{s,3}AGE^2 + \beta_{s,4}EDU + \beta_{s,5}EDU * AGE + \beta_{s,6}EDU * AGE^2$

The parameters of this model are provided in Table S1 in the Supplementary Information (SI) section. The predicted proportions by sex, age, education, and cohort of birth of workers in the formal sector (SCT) are also shown in Figure S1. The positive coefficients of β_1 for both sexes (s) capture the increasing probability of being a formal worker for younger cohorts at each educational level. β_2 and β_3 account for the inverted U-shaped relationship with age, with lower probabilities to work in the formal sector for older and younger workers compared to middle-aged adults. With β_4, β_5 and β_6, the model also accounts for the increased probability of being a formal worker with higher education, with heterogeneity of this impact of across age groups. For the projection, we assume that the cohort trend (β_1) continues in the future, while other differentials remain constant. Summing up, our modeling suggests a gradual increase in the proportion of workers in the formal sector due to both increasing educational attainment and a persistent secular effect capturing an economic transition of the country.

Dependency ratios

In the research brief, we analyze five different dependency ratios that capture different dimensions of dependency. The first one is the traditional age-dependency ratio (ADR), which is the ratio of the children (0-14) and the elderly (65+) to the working age population (15-64). This ratio only measures

the dependency in terms of age structure, assuming that all the elderly are “dependent” and all the working age population can provide support.

Eq. 2 $\mathrm{ADR} = \frac{Pop_{0-14}+Pop_{65+}}{Pop_{15-64}}$

This ADR is a very common standardized indicator that measure population aging, but set arbitrarily the old age-threshold at 65 years old. Using an alternative approach, Sanderson and Scherbov (2008, 2010) have suggested to use as old-age threshold the age at which the remaining life expectancy (RELA) is 15 years or less. This alternative concept of “old age” is associated with the calculation of what Sanderson and Scherbov call a “prospective age dependency ratio” (PADR), with an old-age threshold that changes with remaining life expectancy, as noted in equation 3.

Eq. 3 $PADR = \frac{Pop_{0-14}+Pop_{RLE<15}}{Pop_{15-RLE<15}}$

Following this definition, the old-age threshold from our mortality assumption (age at which RELA = 15 years) increases from 67.9 in 2020 to 71.4 in 2070 for men and from 71.2 to 75.5 for women.

The two dependency ratios mentioned above implicitly assume that the entire “working age” population can provide support while the entire elderly population is retired and dependent. The “labor force dependency ratio” (LFDR, see equation 4) provides a more accurate insight into the economic dependency, as it divides the inactive population (I) by the active one (A), regardless of age. The LFDR thus takes into account changes in labor force participation that can be brought for instance by changes in educational attainment.

Eq. 4 $LFDR = \frac{I}{A}$

Because not all workers are equally productive, Marois et al. (2020, 2021) suggested to weight the workers by a productivity factor based on their human capital. In addition to considering changes in the labor force participation, this “productivity-weighted labor force dependency ratio” (PWLFDR) also accounts for changes in the human capital of the workers. Using the data from the TLFS, productivity factors are calculated with parameters from a log linear regression model on the income variable of the active population, controlling for age, sex, and year.

In this study, we calculated two types of PWLFDR. The first one uses education-specific weights only (PWLFDR(EDU)). The model for calculating the productivity-weights is shown in equation 5.

Eq. 5 $\ln(INCOME) = \beta_0 + \beta_1 EDU + \beta_2 AGE + \beta_3 SEX + \beta_4 SEX * AGE + \beta_5 YEAR$

Education(e)-specific productivity weights (W_e) are calculated using the natural exponential of β_1 ,setting the reference value (a weight of 1) to the average income of workers in 2020. The corresponding productivity weights (W_e) are 2.1 for workers with postsecondary education, 1.1 for workers with upper secondary education, 0.9 for workers with lower secondary education and 0.6 for workers with less the lower secondary education. This PWLFDR (EDU) thus takes into account the productivity gain resulting from changes in the educational composition of the workforce.

The calculation of the productivity-weighted labor force dependency ratio with education-specific weights (PWLFDR(EDU)) is then done by multiplying workers (A) by the weight (W) associated with their educational attainment (e), as shown in equation 6.

Eq.6 $\text{PWLFDR (EDU)} = \frac{I}{\sum_{e=1}^{k} W_e * A_e}$

Since a weight of 1 is set for the average income of workers in 2020, the PWLFDR(EDU) in 2020 is exactly equal to the LFDR in 2020. The PWLFDR(EDU) can therefore be interpreted as the labor force dependency ratio equivalent to the average productivity of workers in 2020.

The second PWLFDR takes into account productivity gains from changes both in education (e) and in the sector of activity (s). The log-linear regression model for estimating the productivity-weights thus adds the sector of activity and its interaction with the educational attainment (see equation 7).

Eq. 7 $\ln(INCOME) = \beta_0 + \beta_1 EDU + \beta_2 SECTOR + \beta_3 EDU * SECTOR + \beta_4 AGE + \beta_5 SEX + \beta_6 SEX * AGE + \beta_7 YEAR$

Sector(s)- and -education(e) specific productivity-weights($W_{e,s}$) are then calculated using β_1, β_2 and β_3. For workers in the formal sector, the weights ($W_{e,formal}$) are 2.6, 1.4, 1.2 and 0.9 for workers with postsecondary education, upper secondary education, lower secondary education and less than lower secondary education, respectively. For workers in the informal sector, corresponding productivity weights ($W_{e,informal}$) are 1.1, 0.8, 0.7 and 0.5. In concrete terms, this means that a worker with postsecondary education in the formal sector is considered to be more than twice as productive as a worker with the same level of education in the informal sector. Using these weights, the productivity-weighted labor force dependency ratio with sector-and education- specific weights (PWLFDR(EDU-SCT)) can be calculated using equation 8.

Eq.8 $\text{PWLFDR (EDU} - \text{SCT)} = \frac{I}{\sum_{e=1}^{k} W_{e,s,} * A_{e,s}}$

Note that both productivity-weighted labor force dependency ratios only account for gains in productivity resulting from changes in the composition of workers and do not account for other factors likely to impact the productivity, such as technological or organizational developments.

Results

Figure 1 shows the age-pyramids of Thailand in 2020 and 2070, decomposed by educational attainment and labor force participation. They first depict the steep population aging that Thailand will experience in the upcoming decades, as the upper part of the pyramid will be larger and the bottom part will be smaller. This is due to both rising life expectancy and persistently low fertility, for which trends are unlikely to change in the future to give a very different outcome.

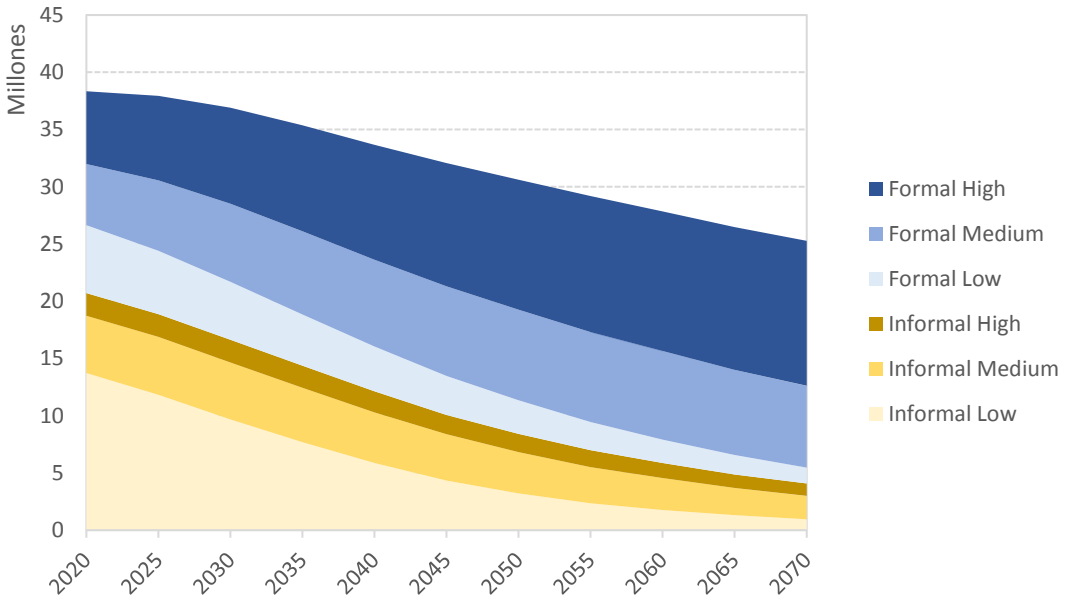
They also reveal that the working-age group will be smaller, but also more educated. Since education is a persistent characteristic, this increasing educational attainment among the working age population is a forecast outcome that is very likely to happen as a result of the demographic metabolism according to which older cohorts are replaced by younger ones with different characteristics and behaviors (Lutz, 2013). Already in 2020, among the population age 70-74, only 6% has a postsecondary education, while the proportion exceed 33% for those aged 25-29. Because this increasing trend in educational attainment is consistent in past cohorts, we can expect it to continue in the future.

Figure 1. Age pyramid by educational attainment and labor force status, Thailand, 2020 and 2070

Finally, the pyramids show few changes in terms of labor force participation rates. In contrast to many other Asian countries, Thailand's female labor force participation rates is already relatively high for every education level and all cohorts. Therefore, neither educational progress nor the demographic metabolism are expected to provide any major changes on this matter.

Consequently, in Thailand, the decline foreseen in the working-age population thus translates directly into a decline in the workforce. However, this workforce will have a very different composition. First, as we already showed, under our scenario assuming continuation of past trends, the educational attainment of workers will continue to rise. Second, more and more workers will probably work in the formal economy, as a result of both higher educational attainment and a cohort effect. Therefore, as shown in Figure 2, while the total number of workers is expected to decline, the number of workers in the formal economy may increase slightly, from 18M in 2020 to 21M in 2070. Moreover, the number of workers in the formal economy with high education will double, from 6M to 13M. Consequently, the decline will be only of those in the informal economy and of those of low educational level, through the end of the projection period.

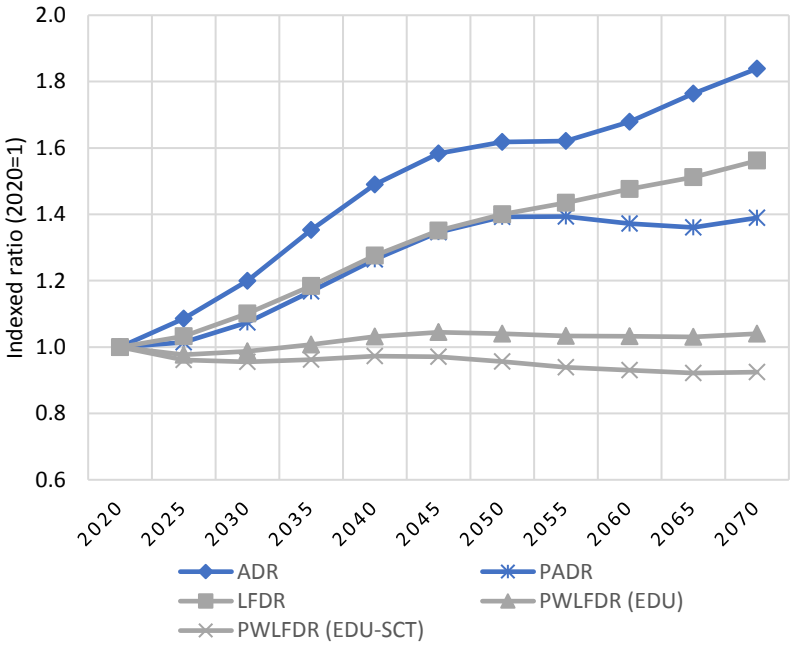
Figure 2. Projected labor force size by type of job (formal/informal) and educational attainment, Thailand, 2020-2070



Although the working-age population will not have higher rates of economic activity overall, workers will be better educated and will be more likely to work in the formal sector. This will lead to greater levels of productivity and ability to provide economic support to the increasing dependent population. At the same time, the probable continuation of the increase in the life expectancy will postpone the age at which people require more intensive healthcare. In sum, while the number of people aged 65 and over will increase by about 9M between 2020 and 2070, the number of people with a remaining life expectancy of less than 15 years will only increase by 5M. How will those societal changes in regard with the composition of the working age population and the increasing life expectancy impact the dependency ratios?

As shown in Figure 3, the age dependency ratio (ADR) - the traditional measure of the population aging - will increase drastically during the coming decades, by nearly 90% from 2020 to 2070. However, the increase in the prospective age dependency ratio (PADR) is significantly less steep, only about 30%. This is because raising the old-age threshold not only reduces the number of dependents, but also expands the working-age population by including those that were traditionally to be considered "old."

Figure 3. Projected dependency ratios (indexed to 2020=1), Thailand, 2020-2070. *ADR: Age Dependency Ratio. PADR: Prospective Age Dependency. LFDR: Labor Force Dependency Ratio. PWLFDR: Productivity-weighted Labor Force Dependency ratio.*



However, as previously stated, not all of the working-age population is working and can provide economic support. Based on current trends, we do not assume any substantial increase in the labor force participation rates of women. Consequently, the labor force dependency ratio will follow a similar but slower trend as the ADR, showing an increase of about 60% between 2020 and 2070.

That being said, we already observed that the population in the denominator of dependency ratios will be more educated and more likely to work in the formal sector. As shown in Figure 3, when factoring for these changes, the trends in dependency ratios look quite different. When considering only the gain in productivity from higher educational attainment among workers, the dependency ratio (PWLFDR (EDU)) in 2070 is just 4% higher than in 2020. Adding in the productivity gain from a shift towards formal employment results in an 8% decline in the dependency ratio (PWLFDR (EDU-SCT)). In other words, under these last 2 scenarios, smaller future workforce has the potential to provide a stronger economic support than the current one.

Discussion

Like many other countries with low fertility rates, Thailand's population is aging, and this trend is unavoidable. The reasons for this demographic shift are rooted in past fertility behavior and increases in life expectancy. Even a sudden and substantial increase in the fertility rate would not have a significant demographic impact in the short-term, as it would take at least two decades for new births to enter the working-ages (Holzmann, 2005).

Population aging however looks also much less daunting when using the prospective old-age definition, which is based on the remaining life expectancy rather than the biological age. While the trends in increasing life expectancy is likely to continue, the future elderly population is also likely to be healthier and to adopt some behaviors seen previously among younger adults. At the same time, there is so far no discernable trend toward increased labor force participation among the elderly in Thailand (Paweenawat & Vechbanyongratana, 2015). Indeed, although a better education is in general associated with higher labor force participation rates for adult women in the central working ages, it is also associated with earlier retirement for both men and women. Therefore, the shift in the old-age threshold associated to the definition of the PADR (based on remaining life expectancy), would not impact much the corresponding economic dependency ratio if it is not accompanied by incentives for the most productive workers to remain in the labor force for longer.

While population aging poses real challenges for public policies, this paper argues that other social changes will possibly offset the increasing age dependency ratio. Firstly, future workers will be more educated than their counterparts today. This assertion can be made with a high degree of certainty, as younger generations entering the workforce are already more highly educated than the older generations leaving it. Secondly, the younger generation is also more likely to be employed in the formal sector. Our analysis has shown a persistent positive cohort effect on this issue, with each successive generation being more likely to work in formal employment than older generations at any given age. The progressive transition from informal to formal employment is a well-documented phenomenon in the economic development of various developing countries (La Porta & Shleifer, 2014), and we believe that this trend will persist in Thailand, although the degree, extent and speed of this transition in the future is unknown.

Over the past few decades, informality has been a policy focus in Thailand, prompting the government to take several actions aimed at reducing it and improving social protection for informal workers. Notable measures include revising of the scope, eligibility, contribution rates, and benefits of the Social Security Act (Section 40) to increase incentives for informal workers to enroll in the social security program, as well as establishing the contributory National Saving Fund to encourage

savings for old age. The extension of health and social protection was also adopted in parallel to cover those not included in any existing schemes. Nonetheless, given that future generations of workers will likely have higher levels of education, productivity and better health status, their employment in the formal sector will be facilitated. In this context, the government's attention should be directed to create quality and productive jobs in this sector, which requires an integrated set of policies and coordinated actions across various fields, including developing labor market infrastructure and governance, and addressing drivers that retain workers in the informal sector. By taking these steps, the tax base and fiscal space will be ultimately expanded allowing the country to effectively address population aging issues.

Conclusion

Numerous studies have already underscored the critical role of policies increasing human capital in mitigating the consequences of population aging. In regions where women's economic activity remains low, such as Taiwan, India or Iran, reducing gender inequalities in the labor force would have a major impact on economic dependency ratio (Cheng & Loichinger, 2017; Gietel-Basten et al., 2023; Marois, Zhelenkova, et al., 2022). Similarly, Marois et al. (2022) demonstrated that improving the educational persistence of Finnish boys would enhance the future workforce's productivity and provide support for the growing retiree population. Here, our simulation suggests that the probable economic transition from the informal to the formal economy in developing countries, such as Thailand, could offer additional avenues for mitigating the consequences of population aging. Therefore, policymakers should prioritize facilitating this transition.

As with any long-term projection, there are inherent uncertainties associated with the continuation of past trends several decades into the future. The assumptions around fertility, mortality, migration, educational attainment, and formalization of the workforce are based on the best available data and expert analysis, but future deviations from these assumptions would alter the projected outcomes. The analysis also makes simplifying assumptions, such as using income as a proxy for productivity. More complex economic modeling would be needed to fully capture the nuances of productivity changes over time. While the projections aim to provide realistic scenarios, the future dependency ratios presented contain inevitable uncertainty intervals around them. The value of this analysis is illustrating plausible alternative perspectives on population aging, highlighting the importance of driving positive changes in human capital development and economic formalization, rather than providing definitive forecasts.

Declaration of interest

No potential conflict of interest was reported by the author(s).

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Supplementary Information

Table S1. Regression parameters on probability to work in the formal sector

	Male		Female	
Intercept	-3.395	***	-2.445	***
Cohort (0=1925-1929, 1=1930-1934…)	0.139	***	0.164	***
Age (15, 20,…70)	0.098	***	0.041	***
Age^2	-0.001	***	-0.001	***
Edu (ref=Upper sec.)				
<Lower sec	0.793	***	0.192	**
Lower sec.	-0.300	***	-1.229	***
Postsec	0.831	***	0.746	***
Age*Edu				
<Lower sec	-5.1E-02	***	-3.1E-02	***
Lower sec.	7.3E-03	*	5.6E-02	***
Postsec	-3.3E-03		1.5E-02	**
Age^2*Edu				
<Lower sec	2.6E-04	***	1.2E-04	*
Lower sec.	-1.5E-04	**	-7.4E-04	***
Postsec	1.1E-04		3.1E-05	
N	954,719		878,354	

*** p<0.0001; **p<0.01; *p<0.05

Figure S1. Predicted proportions of workers in the formal sector by sex, age, education and cohort of birth