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Health, an ageing labour force, and the economy: Does health moderate the relationship between population age-structure and economic growth?

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ABSTRACT

Research often suggests that population ageing will be detrimental for the economy due to increased labour market exits and lost productivity, however the role of population health and disability at older ages is not well established. We estimate the relationship between the size of the older working age population and economic growth across 180 countries from 1990 to 2017 to explore whether a healthy older working age population, as measured by age-specific Years Lived with Disability (YLDs), can moderate the relationship between an ageing labour force and real per capita GDP growth. Using country and year fixed effects models, we find that although an increase in the 55–69 year old share of the total population is associated with a reduction in real per capita GDP growth, the decline in economic growth is moderated if the population at that age is in good health. To demonstrate the magnitude of effects, we present model predicted real per capita GDP growth for a selection of countries from 2020 through 2100 comparing the 2017 country-specific baseline YLD rate to a simulated 5% improvement in YLDs. Our findings demonstrate that economic slowdowns attributable to population ageing are avoidable through policy interventions supporting healthy and active ageing.

1. Introduction

Countries around the world are ageing, as longer life expectancies coupled with decreases in fertility rates cause the share of older people in the population to increase. These changes in population age mix are contributing to an ageing labour force. Globally, the median age of the labour force – which encompasses people of working age who are either employed or who are unemployed but willing to work – has increased from 37.6 years in 2010 to 38.9 years in 2019, with the largest increases in Southern Europe (3.3 years), Eastern Asia (2.6 years), South Eastern Asia (2.0 years), and South America (2.0 years). In 2019, the regions with the oldest labour forces were Southern Europe (median age of 43.9 years), Western Europe (43.2 years) and Eastern Asia (42.1 years) (International Labor Organization, 2020).

While keeping people in paid work at older ages may be desirable from a fiscal sustainability perspective, particularly where there are concerns regarding the sustainability of public pension outlays (Naumann, 2014), there are suggestions that an older labour force may have adverse effects for the economy (Feyrer, 2007, 2008, 2008; Werding, 2008; Westelius and Liu, 2016). These effects may occur through a number of mechanisms, including potentially lower labour productivity among older workers or insufficient labour market participation at older ages due to high rates of retirement (Axelrad, 2018; Fisher et al., 2016; Van Rijn et al., 2014).

The ongoing ageing of the labour force raises questions globally about whether negative economic outcomes associated with changes in the size of the older working age population are likely to occur in practice, and whether there are factors that can mitigate any adverse economic effects. For example, the relationship between population age-structure and economic growth may vary depending on a wide range of characteristics of older people, such as their education levels (Börsch-Supan, 2003; Nagarajan et al., 2016; National Research Council, 2012; Vogel et al., 2017; Werding, 2008), their use of new productivity-enhancing technologies (Aksoy et al., 2019; Fougère and Mérette, 1999), or their health and disability status (Van Rijn et al., 2014; Axelrad, 2018).

In this paper we focus on the role of health and disability among the older working-age population. One might expect that a healthy older population will be able to remain active and productive for longer, potentially moderating some of the otherwise detrimental economic

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effects associated with an ageing labour force (Van den Berg et al., 2010). Identifying whether the health of older people affects economic outcomes however is challenging due to methodological issues, since individuals' work at older ages is endogenous with their health and other person level characteristics. Likewise, studies of individual-level data cannot identify how changes in the size of the older population affects the macroeconomy.

We use country level panel data disaggregated by age group to test whether a healthier older working age population, measured by age-specific Years Lived with Disability (YLDs), can moderate the relationship between changes in the size of the older working-age population and real per capita GDP growth. To our knowledge, this is the first study to empirically investigate the links between an ageing labour force, health and disability at older ages, and the economy.

The paper is organized as follows. We first review the existing literature linking population age structure to the economy to guide our empirical approach. We then describe the data and methods used for our analysis. Next we present model results and a simulation for selected countries to illustrate how an older working-age population with levels of disability lower than those reported in the base year, 2017, could be expected to alter GDP growth rates in the future. We conclude by discussing the results and consider policy implications.

2. Literature review

The relationship between population age structure and the economy has often been quantified empirically in the literature by regressing economic indicators on population shares by age group and reporting the estimated coefficients. Following this approach, researchers typically find an 'inverse-U' or 'hump'-shaped relationship, where younger and older age groups are associated with comparatively worse economic outcomes and those in the middle ages associated with comparatively better economic outcomes.

In their seminal paper, Fair and Dominguez (1991) were among the first to take this empirical approach to estimate the effects of changes in US population age distributions from 1954 through 1988 on macroeconomic aggregates including consumption, saving rates, money demand and labour force participation using population shares by age as the main regressors (Fair and Dominguez, 1991). Lindh and Malmberg (1999, 2009) later investigate the effects of changes in age distributions on economic growth by analysing data for OECD countries from 1950 to 1990, finding a positive relationship between increases in the share of middle-aged people (50–64 years) and economic growth, but strong negative effects of increases in the share 65+ (Lindh and Malmberg, 1999, 2009). Persson (2004) incorporates age distributions into economic growth models and similarly finds negative associations between per capita income growth and increases in population shares aged 0 to 14 and over 65 in the US between 1930 and 2000 (Persson, 2004). This is likewise consistent with Aksoy et al. (2019) who find that the young and older age shares of the population correlate with reduced output growth and positive inflationary pressures in the long-run across OECD economies (Aksoy et al., 2019).

These associations appear to be robust across a range of different country settings. In addition to the aforementioned studies, Bloom et al. (2008) and Dao (2012), respectively, show that the decrease in the working-age population share and the rise in the old-age dependency ratio have a statistically significant negative association with economic growth, both in Asia and in developing countries (Bloom et al., 2008; Dao, 2012). Maestas et al. (2016) find that in the US, a 10% increase in the share of the population aged 60+ is associated with a decline in GDP per capita growth by 5.5% (Maestas et al., 2016).

Researchers also investigate the economic effects associated specifically with an ageing labour force. Using panel data from developed and developing countries between 1960 and 1990, Feyrer (2007, 2008) simulates the impact of labour force ageing on total factor productivity and per capita GDP growth (Feyrer, 2007, 2008). The author finds that the inverse U-shaped relationship between labour force age structure and productivity growth peaks between ages 40 and 49 (Feyrer, 2007). An inverted U-shaped peak between ages 40 and 49 for total factor productivity is also found by Werding (2008) for OECD countries and Liu and Westlius (2016) for Japan (Werding, 2008; Westelius and Liu, 2016). Aiyar and Ebeke (2016) build on Feyrer's model and estimate that workforce ageing in Europe will decrease total factor productivity by 0.2 percentage points annually from 2014 to 2035 (Aiyar and Ebeke, 2016).

Other research challenges the association between an older labour force and decreases in labour productivity and economic growth (Acemoglu and Restrepo, 2017; Börsch-Supan and Weiss, 2016; National Research Council, 2012; Siliverstovs et al., 2011). For example, difficulties performing manual and intensive physical work among older workers may be countered by traits that improve with age including experience, maturity, a wider network and ability to work collaboratively and prevent low frequency problems (Bloom et al., 2015; Börsch-Supan, 2003; Börsch-Supan et al., 2021; Börsch-Supan and Weiss, 2016; Prskawetz et al., 2006). Burtless (2013) shows that by taking average earnings as a measure of labour productivity, older people appear to be more productive since their labour force participation and earnings increase faster than their younger counterparts (Burtless, 2013).

Researchers have identified technology adoption by older people and education levels as two factors that can potentially moderate the relationship between population age-structure and the economy. The use of new technologies by older workers has been shown to compensate for some of the declines in growth and productivity associated with ageing (Aksoy et al., 2019; Fougère and Mérette, 1999). Börsch-Supan (2003) estimates that greater use of technology boosts labour productivity by 6% (Börsch-Supan, 2003). Similarly, the Asian Economic Integration Report (2019) estimates that technology adoption adds up to 5 additional years of productive labour. Acemoglu and Restrepo (2017) and Kaniovski and Url (2019) argue that population ageing encourages digitalisation and use of robot technologies, increasing labour productivity and capital efficiency, which in turn induces economic growth (Acemoglu and Restrepo, 2017; Kaniovski and Url, 2019).

Education and training have also been shown to be important determinants of both technological adoption as well as increased productivity at older ages (Börsch-Supan, 2003; Nagarajan et al., 2016; National Research Council, 2012; Vogel et al., 2017; Werding, 2008). Burtless (2013) and Maestas et al. (2016) show that higher educational attainment among older people extends their participation in the labour force (Burtless, 2013; Maestas et al., 2016). Since on average, the current older generation has higher educational attainment compared with older cohorts in prior years, one would expect them to participate in the workforce for longer (National Research Council, 2012; Prskawetz et al., 2006).

While no studies have investigated the role of health as a moderating factor in the association between population age structure and the economy, health plays an important role in individual labour market decisions (Axelrad, 2018; Berg et al., 2010, Van Rijn et al., 2014). Data from the Health and Retirement Study shows that around one-fourth of workers aged between 60 and 61 will most likely have a disability that hinders their work capacity (National Research Council, 2012). Rehkopf, Adler, and Rowe (2011) find that increases in disability decrease older people's likelihood of remaining in the workforce (Rehkopf et al., 2011). Similarly, Berg et al. (2010) show poor self-perceived health and to a lesser extent, chronic diseases, mobility problems and daily activity limitations are associated with older Europeans exiting the workforce (Berg et al., 2010). Poor health is a well-established risk factor for leaving paid employment, with those in poor health typically transitioning into unemployment, disability pensions, as well as early retirement (Van Rijn et al., 2014).

Overall, the literature suggests that increases in the share of older people in the population is negatively associated with GDP per capita growth and labour productivity across a range of country settings. The inverted U-shaped relationship between age and economic growth seems to peak for those in their 40s and decline thereafter. Nevertheless, variations in human capital may play a key role, as evidence suggests more educated and well-trained older people are more likely to be productive and remain attached to the labour market as they age, which in turn can mitigate the adverse economic effects associated with changing age-structures.

3. Data

We use country level panel data from multiple publicly available sources. Real (i.e. price inflation-adjusted) per capita GDP in local currency units (LCU) is extracted from the World Bank World Development Indicators (WDI) and used to calculate GDP growth rates; we use real as opposed to nominal (i.e. non-price-inflation adjusted) per capita GDP because it better captures the value of economic output per person over time. Historical and forecasted population by age data is obtained from the United Nations World Population Prospects; we use the medium variant projection as our population by age forecast.

Age-specific Years Lived with Disability (YLDs) are our measure of health and disability (Institute for Health Metrics and Evaluation (IHME), 2018). YLDs are a measure of disease burden estimated by multiplying the prevalence of a condition by a weight reflecting its severity. YLDs are preferable to Disability-Adjusted Life Years (DALYs) for our purposes because DALYs include both YLDs and premature deaths.

All together, historical data are available for 180 countries from 1990 to 2017; population by age forecasts are available through 2100.

4. Methods

Following the methods that have been traditionally used in the literature to estimate the relationship between population age structure and the economy as our starting point, we regress GDP growth on population age shares to estimate the association between population age-mix and economic growth and ultimately explore the potential moderating role of health and disability among the older working-age population. Our hypothesis is that while population ageing may be detrimental for the economy if older people are in poor health, causing them to be unproductive or unable to participate in the labour market, a comparatively healthier and disability-free older population can retain sufficient human capital to continue to be productive at older ages, contributing positively to economic growth.

We use both annual growth in real per capita GDP and the five-year average of annual growth in real per capita GDP as dependent variables. There are advantages and disadvantages to both approaches; while annual data can be noisy, 5-year averages may distort business cycles and smooth relevant variations over time (Attanasio et al., 2000).

As discussed, the literature makes use of models that include a range of population age groupings, from each individual year of age to much more aggregated age groups as explanatory variables. This approach, despite its pervasiveness, could however be problematic due to correlations between population age shares within countries; we use an adapted but more pragmatic methodology. We begin by modelling real per capita GDP growth as a function of three aggregated age groupings covering working-ages between 20 and 69: the young working age (20–39), the mid-working age (40–54) and the older working-age (55–69).

This initial model is shown in (1) below:

$$(1)\ \ln GDPcap_{i,t} - \ln GDPcap_{i,t-1} = \beta_1 PopShare(20\text{-}39)_{i,t} + \beta_2 PopShare(40\text{-}54)_{i,t} + \beta_3 PopShare(55\text{-}69)_{i,t} + C_i + T_t + u_{i,t}$$

Log differenced real per capita GDP (or alternatively, the 5-year centred average of log differenced real per capita GDP, not shown in the equations) in country i and year t is modelled as a function of population age shares in country i and t. We include country fixed effects to control for all time invariant country characteristics and year fixed effects to capture developments over time that affect the entire sample. The aim of this model is to confirm the established inverted U-shaped relationship between population age-structure and GDP growth.

For the remainder of the paper we resort to a more parsimonious modelling approach that first includes only the 55–69 year old population share along with country and year fixed effects (model 2).

$$(2)\ \ln GDPcap_{i,t} - \ln GDPcap_{i,t-1} = \beta_1 PopShare(55\text{-}69)_{i,t} + C_i + T_t + u_{i,t}$$

Taking a stepwise approach, we then incorporate health and disability among the older-working age group in the form of the inverse of YLDs per person among the 55–69 year old population (model 3). We use the inverse of YLDs per person to facilitate interpretation of the coefficient results (i.e. so that larger values imply better health).

$$(3)\ \ln GDPcap_{i,t} - \ln GDPcap_{i,t-1} = \beta_1 PopShare(55\text{-}69)_{i,t} + \beta_2 (1/(YLD5569_{i,t})) + C_i + T_t + u_{i,t}$$

Model 4 incorporates both the main effect of the inverse of YLDs and the interaction between YLDs and the older working-age population share. Incorporating the interaction term tests whether any adverse effects of a larger older working-age population are moderated by the health and disability of the population in that specific age group.

$$(4)\ \ln GDPcap_{i,t} - \ln GDPcap_{i,t-1} = \beta_1 PopShare(55\text{-}69)_{i,t} + \beta_2 (1/(YLD5569_{i,t})) + \beta_3 (1/YLD5569_{i,t} * PopShare(55\text{-}69)_{i,t}) + C_i + T_t + u_{i,t}$$

Lastly, we also incorporate the log of real per capita GDP (at t-2 for the annual growth models, as shown in (5) below, and at t-3 for the 5-year centred average) to account for a range of country-specific time varying characteristics that correlate with the level of GDP per capita; such characteristics could include technological innovation, education, or unemployment rates among others.

$$(5)\ \ln GDPcap_{i,t} - \ln GDPcap_{i,t-1} = \beta_1 PopShare(55\text{-}69)_{i,t} + \beta_2 (1/(YLD5569_{i,t})) + \beta_3 (1/YLD5569_{i,t} * PopShare(55\text{-}69)_{i,t}) + \ln GDPcap_{i,t-2}\ C_i + T_t + u_{i,t}$$

All models used robust standard errors (Abadie et al., 2017). To account for potential serial correlation and heteroskedasticity, as a robustness check we ran all models with Newey-West standard errors. Allowing for lags up to at least 10 years there were no relevant differences in standard errors.

To better understand the magnitude of potential effects we use our preferred model to forecast GDP growth from 2020 through the 2100 for a selection of countries. We present the predicted real per capita GDP growth under a 'healthy ageing' scenario where YLDs for 55–69 year olds are 5% lower in the forecast period than they were in 2017, compared to a baseline scenario that holds 2017 health and disability rates constant.

5. Results

Descriptive statistics for the full sample of 180 countries can be found in Table 1. There are a few extreme outliers and relatively high variance for annual real per capita GDP growth; taking the 5-year average reduces this variability substantially. The mean country-year had 9.1% of its population between ages 55–69.

Fig. 1 shows a historical albeit weak correlation between the share of the population age 55–69 and economic growth. Using country means to center the 5-year average GDP per capita growth data, prior to modelling, country observations with high shares of their population between ages 55–69 have slightly lower than average real per capita GDP growth (correlation = −0.0358, $p < 0.05$).

Table 1
Descriptive statistics, 1990–2017, 180 countries.

	Mean	Median	Minimum	Maximum	Standard Deviation	n
Annual real per capita GDP growth (%)	1.9	2.2	−105.0	87.7	6.3	4679
5-year average real per capita GDP growth (%)	2.1	2.0	−23.6	36.7	3.6	3955
20-39 share of total population (%)	30.4	29.8	20.6	60.5	4.0	4679
40-54 share of total population (%)	15.2	14.7	6.9	27.7	4.6	4679
55-69 share of total population (%)	9.1	7.4	2.3	21.1	4.6	4679
YLD per 10000 population	202.6	187.3	111.2	7251.9	292.3	4679

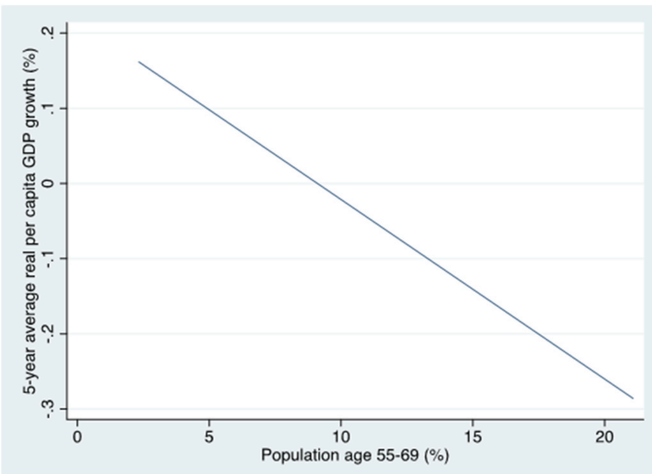

Fig. 1. Line of best fit, 55–69 year old population share vs. mean-centred 5-year average real per capita GDP.

The main model results are in Table 2. The initial models confirm the findings in the literature of an inverse-U or hump-shaped relationship between population age shares and economic growth. Using both annual and 5-year average growth as dependent variables (columns 1 and 2, respectively), we find that increases in the young working-age and older working-ages are associated with slowdowns in economic growth, while increases in the size of the mid-working age population are associated with higher economic growth. The models of 5-year average annual growth have comparatively better goodness of fit (R^2 of 0.380 compared to R^2 of 0.153). In this model (column 2), according to point estimates, a 1 percentage point increase in the 55–69 year old share of the total population is associated with a reduction in real per capita GDP growth of 0.674 percentage points.

Dropping the young working age and mid-working age population shares in Model 2 to avoid within-country correlations between population age shares, the coefficient on the 55–69 year old population share remains negative and statistically significant at $p < 0.001$ (Table 2, columns 3 and 4). Incorporating the main effect of the inverse of YLDs among 55–69 year olds in Model 3 (Table 2, columns 5 and 6), we find the point estimate of the inverse of YLDs is positive but not statistically significant in the case of the annual GDP growth model. In the 5 year

Table 2
Model results for pooled sample of all countries.

VARIABLES	(1) Annual GDP growth (Model 1)	(2) 5-year average GDP growth (Model 1)	(3) Annual GDP growth (Model 2)	(4) 5-year average GDP growth (Model 2)	(5) Annual GDP growth (Model 3)	(6) 5-year average GDP growth (Model 3)	(7) Annual GDP growth (Model 4)	(8) 5-year average GDP growth (Model 4)	(9) Annual GDP growth (Model 5)	(10) 5-year average GDP growth (Model 5)
20–39	−0.192***	−0.159***								
	(0.0514)	(0.0337)								
40–54	0.156*	0.219***								
	(0.0750)	(0.0511)								
55–69	−0.645***	−0.673***	−0.454***	−0.523***	−0.459***	−0.558***	−1.011**	−1.281***	−0.869**	−1.107***
	(0.108)	(0.0800)	(0.101)	(0.0779)	(0.0983)	(0.0794)	(0.330)	(0.241)	(0.296)	(0.216)
1/YLD per person (55–69)					0.950	7.086**	−5.814	−1.766	0.319	0.967
					(4.561)	(2.708)	(6.956)	(4.318)	(6.288)	(4.076)
55–69 x 1/YLD per person (55–69)							96.07	126.7***	101.1*	137.3***
							(51.25)	(38.38)	(47.05)	(36.13)
ln(real GDP per capita)$_{t-2}$									−0.0910***	
									(0.0113)	
ln(real GDP per capita)$_{t-3}$										−0.0909***
										(0.00602)
Country FE										
Year FE										
Constant	0.0694**	0.0826***	0.0224	0.0501***	0.0167	0.00775	0.0567	0.0597*	1.460***	1.474***
	(0.0246)	(0.0134)	(0.0186)	(0.0101)	(0.0325)	(0.0190)	(0.0454)	(0.0269)	(0.179)	(0.0977)
Observations	4679	3955	4679	3955	4679	3955	4679	3955	4498	3955
R-squared	0.153	0.380	0.150	0.370	0.150	0.372	0.150	0.373	0.249	0.573

average GDP growth model the coefficient is positive and significant at $p < 0.01$, suggesting that better health among the 55–69 year old population is associated with higher GDP growth irrespective of the size of that population. Model 4 (Table 2, columns 7 and 8) incorporates both main effects, the interaction between the inverse of YLDs and the 55–69 year old population share, and country and year fixed effects. In both models, the interaction is positive, but only in the 5 year average GDP growth model is the interaction statistically significant at $p < 0.001$ (Beta = 126.7). Lastly, the inclusion of lagged GDP per capita levels (Table 2, columns 9 and 10) in Model 5 is statistically significant at $p < 0.001$ and negative, suggesting slower GDP growth in countries at higher levels of economic development per person; the interaction term is positive and significant in both of these models (Beta = 101.1, $p < 0.05$ for the annual growth model; Beta = 137.3, $p < 0.001$ for the 5-year average growth model).

Models with interaction terms are notoriously challenging to interpret (Brambor et al., 2006). To better understand the potential moderating effect of health on economic growth conditional on the size of the older working age population, we explore the results of Model 5 (Table 2 Column 10) as our preferred model specification, although it is important to note that model coefficients are reasonably stable across the specifications tested. Fig. 2 presents predicted real per capita GDP growth for all sizes of the older working age population in the sample, comparing a good health scenario (i.e. where the inverse of YLDs is assumed to be one standard deviation above the sample mean) and a poor health scenario (i.e. where the inverse of YLDs is one standard deviation below the mean). Point estimates indicate that larger older working age populations are associated with slower real per capita GDP growth under both scenarios, although there is some overlap in confidence intervals within each of the scenarios. Among very small-sized populations between ages 55–69 there is no statistical difference in predicted real per capita GDP growth between the good health and poor health scenarios, while for country-years with larger shares of the population at older working ages, the difference between having that population in good health vs poor health becomes statistically significant at 95% confidence levels. At the mean share of the population at age 55–69 across all country-years over the sample period (9.1%), the model predicted real GDP growth for the good health scenario (2.93%, 95% CI 2.65; 3.22) and poor health scenario (0.92%, 95% CI 0.54, 1.29) are statistically different from each other at 95% confidence levels.

We next present a contour plot based on the preferred model specification to further explore the interaction between the share of the older working-age population and the health of that population (Fig. 3). This shows how the model predicted relationship between the share of the older working-age population (x-axis) and real per capita GDP growth (contours) varies depending on the health of the older working age population (y-axis); the interaction term is what causes the curvature of the contour lines. Larger populations aged 55–69 are generally associated with lower predicted real per capita GDP growth. However, for country-years where the inverse of YLDs among 55–69 year olds is high (i.e. the older working age population is in relatively good health), economic growth is predicted to be higher. At the highest levels of good health on the y-axis, the effect of the size of the older working-age population on real per capita GDP growth is effectively eliminated, so that countries are predicted to have similar levels of GDP growth irrespective of the size of their 55–69 year old population.

6. Simulation

To further facilitate interpretation of the model results, we simulate the effects of improved health at older ages on future real per capita GDP growth for a selection of countries. Again using the preferred model specification, we compare a scenario where YLDs for 55–69 year olds for 2017 are held constant for each country over the forecast period through 2100 to an alternative scenario where YLDs are held constant but 5% lower than in 2017. This enables us to quantify the gains in real per capita GDP growth associated with a healthy older working-age population on a country-by-country basis.

Fig. 4 contains simulated results from 2020 to 2100 for 7 diverse countries at varying stages of age-demographic transition: Austria, Brazil, Egypt, Finland, Singapore, South Africa and Thailand. In all countries, real per capita GDP is expected to grow faster if older working-age people are in better health with fewer YLDs. A 5% improvement in YLDs is associated with at minimum 0.3% predicted additional annual real per capita GDP growth (Egypt and South Africa in 2020). Across all 180 countries, the largest predicted annual gain associated with a 5% improvement in YLDs is in Singapore (1.4% in 2027). The simulation suggests that these sustained health improvements among the older working-age population would be expected to increase real per capita GDP in Singapore by 179% in total between 2020 and 2100, the largest aggregate effect of any country over the projection period.

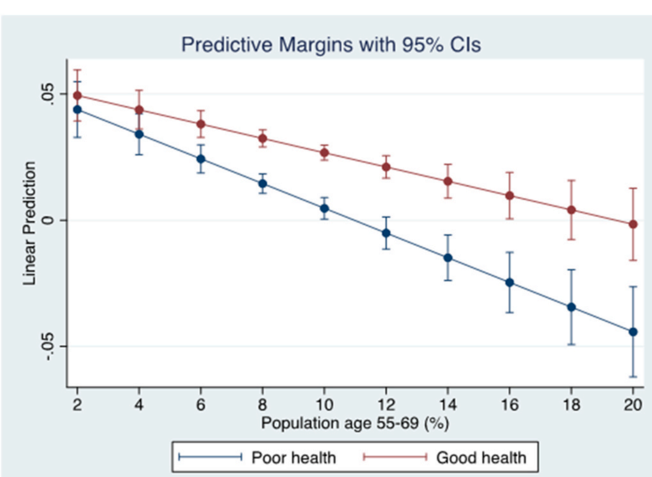

Fig. 2. Predicted 5-year average real per capita GDP growth and the share of the population at older working-age (55–69), good health vs poor health scenarios. Note: Good health is defined here as 1 standard deviation below the mean of the inverse of YLDs among 55–69 year olds; Poor health is defined as 1 standard deviation above the mean of the inverse of YLDs among 55–69 year olds.

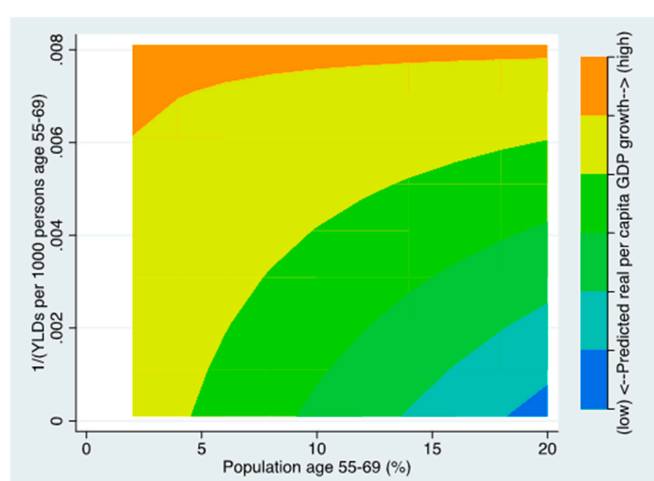

Fig. 3. Contour plot of population age share 55-69, inverse of YLDs, and real GDP growth based on Model 5.

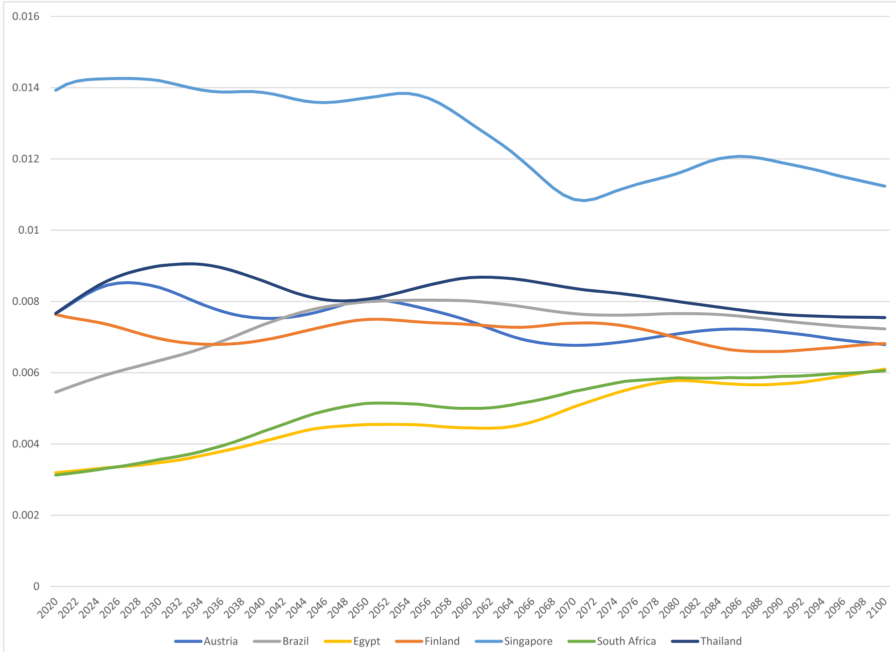

Fig. 4. Forecasted gains in real per capita GDP growth associated with a 5% improvement in YLDs, selected countries, 2020-2100.

7. Discussion

In this paper we consider the relationship between health and disability at older working-ages and economic growth in the context of population ageing. We find broadly consistent results across a range of model specifications. While a larger share of the older working-age population at ages 55–69 has historically been associated with slower real per capita GDP growth, we find that if the population in that age range has low levels of disability, the expected adverse economic effects are reduced or even eliminated altogether. Below we discuss the results in more detail and consider policy implications.

Our models find small but significant effects of changes in population age shares on real per capita GDP growth. Point estimates from our preferred model (Table 2 Column 10) indicate a 1 percentage point change in the share of the population aged 55–69 is associated with a reduction in GDP growth of 1.1 percentage points. It is important to note however that between 1990 and 2017 in our sample of 180 countries, the median annual change in the share of the population aged 55–69 is 0.058 percentage points, which implies an effect of just 0.06% on real per capita GDP growth in the median country-year based on model coefficients. This suggests that population age-structure on its own plays only a minor role in determining year to year economic growth anyways, regardless of the health or disability status of that population.

We employ a range of approaches – margins, contour plots, and simulations – to understand the interaction between the health and size of the older working-age population. We find that even relatively small differences in health at older ages can have statistically significant effects on how population ageing affects economic growth, although there was no difference in predicted real per capita GDP growth in Fig. 2 when older-working age populations were small. Additionally, the contour plot (Fig. 3) suggests that for country-years with large older working-age populations, the health of that population has played an instrumental role in determining how ageing affects economic growth, whereas for country-years with very small older-working age populations (approximately 5% of total population or less) the health of the older-working age population is of less relevance to economic growth. This is to be expected, particularly in settings where people aged 55–69 years old may be less likely to contribute to the formal economy. Nevertheless, the simulation results reveal that improvements in health at older ages are likely to have positive economic effects in the coming years, even amongst countries that are at an early stage of the age-demographic transition.

While there are a number of possible pathways linking population age-structure to economic growth, in this paper we focus our attention on the role of ageing of the labour force. Consistent with the literature, our initial models find a negative association between increases in the share of people at both younger and older working-ages and economic growth. For younger working-age adults, this result may potentially be explained by inexperience or high rates of youth unemployment in some settings, whereas for older working-age adults, the negative coefficient might be explained by low productivity or high rates of exiting the workforce (Van Rijn et al., 2014; Axelrad, 2018). Both of these mechanisms are affected by health and disability. It is therefore reassuring that we consistently find a significant positive interaction between disability and the share of the population at ages 55–69, as it not only provides some support for the aforementioned causal pathways linking an ageing labour force to economic growth, but also suggests that adverse economic effects associated with an ageing labour force are amenable to policy intervention.

There are a number of limitations to this analysis. First, while the methods we use cannot confirm that age shares have a causal effect on economic growth in the first place, we base our analysis on the approaches used commonly in the literature. Additionally, although we assume that the primary pathway linking the older working-age share of the population to economic growth is through participation in the labour force, the reduced form analysis makes use of the entire population at working ages rather than just those in the active labour force. This has some drawbacks because it is imprecise and does not reflect the actual percentage of the population in the labour market at each age. However, using the active labour force would also be problematic because it is likely to be endogenous with health if people leave the labour force due to poor health. It is also possible that population health, measured as YLDs, could also affect the overall age distributions, for example, if people in poor health die prematurely since this would affect survival into older age groups. We believe this is unlikely to be a major problem for our analysis since we focus on working-ages, where in most countries the probability of survival is relatively high irrespective of within-country variations in health and disability rates.

Further, it is important to note that many of the historical relationships between age and work may change in the future anyways as the nature of work changes, resulting in variability in how age and health affect labour productivity and labour market decisions; our models are unable to capture this. Lastly, although it is well known that IHME data is modelled in some countries, it is the only source with age-specific YLDs available across time for all countries.

This paper demonstrates the economic gains associated with promoting healthy and active ageing of the labour force. Policymakers concerned about the adverse economic effects of population ageing and an ageing workforce should consider the potential benefits associated with investing in health, rather than use population ageing as an excuse to dismantle the welfare state (Cylus et al., 2019; Greer et al., 2021). Investments in health can lead to economic gains for countries at all stages of age-demographic transition; those countries with relatively young populations in particular may reap significant benefits by acting early to promote healthy and active ageing.

Credit author statement

Jonathan Cylus: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft preparation, Writing- Review and editing, Visualization, Lynn Al Tayara: Data curation, Formal analysis, Investigation, Writing – original draft, Writing- Review and editing.

Declaration of competing interest

None.

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