

Population Age Structure Change and Labour Productivity: Evidence from Brunei Darussalam

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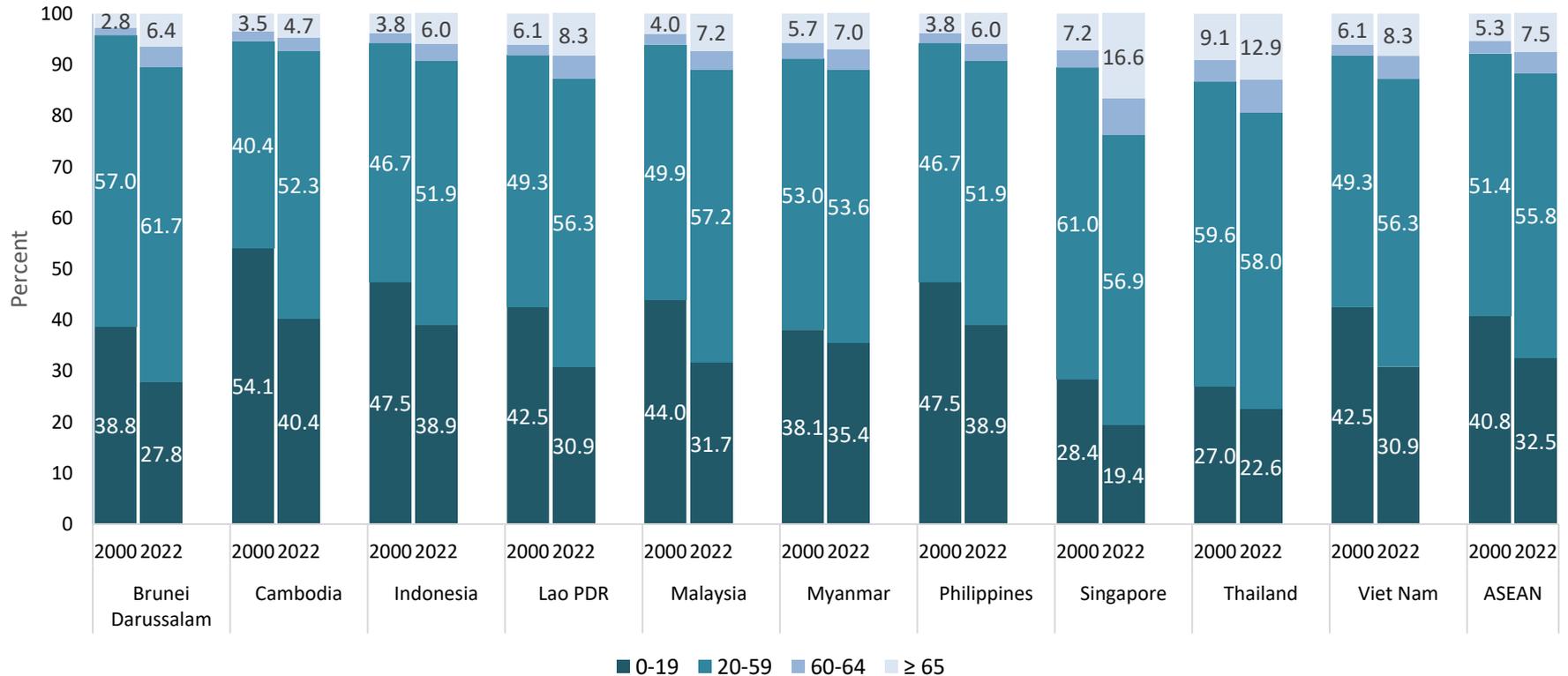
Brunei Darussalam

Executive Summary

- Analysis of the long-term relationship between population age structure and labour productivity in Brunei Darussalam using a vector error correction model.
- The age productivity profile contradicts the traditional inverted U-shaped pattern over time. Negative association between prime adults and labour productivity. Positive relationship between elderly and labour productivity, contrary to the extent literature. Productivity is observed to manifest at a later stage.
- Recommend policymakers to identify and prescribe labour policies that effectively address the distinct requirements of various age cohorts within the workforce.

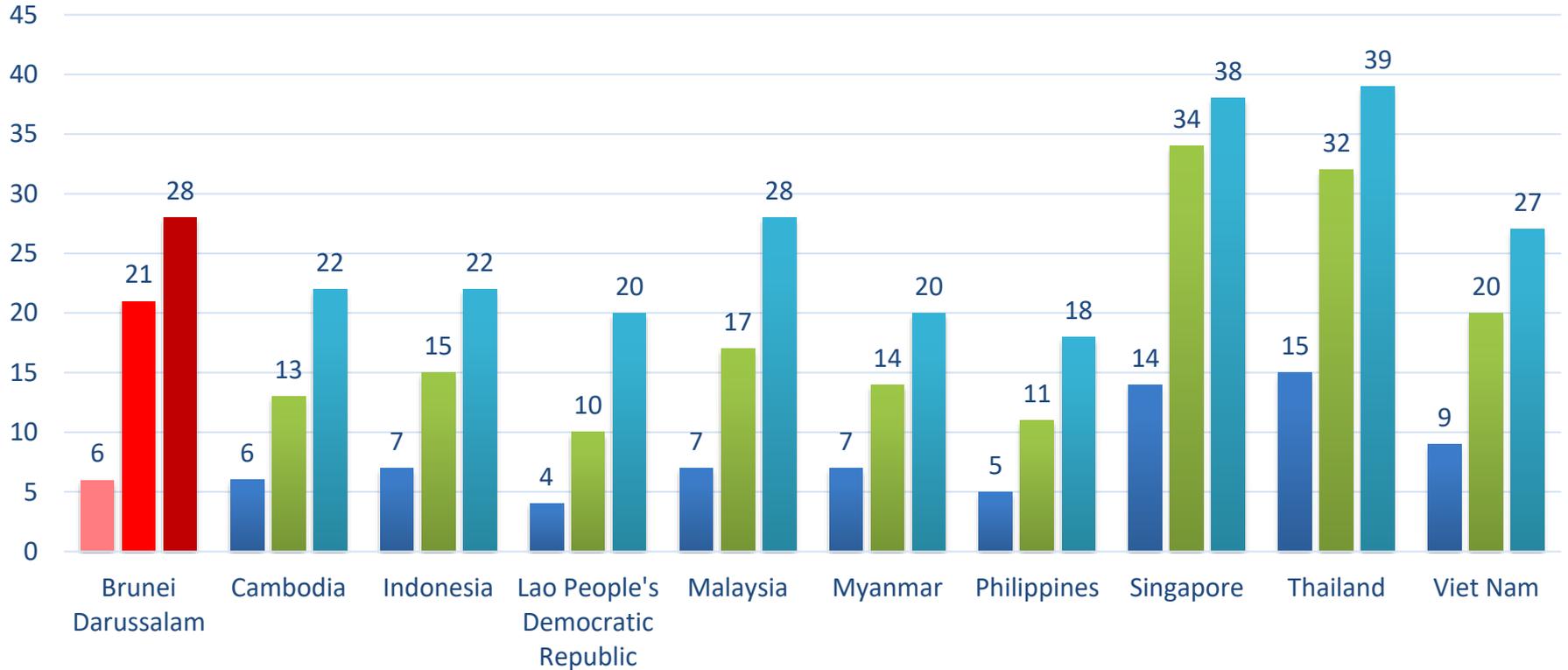
- Population ageing is the most significant feature of global demography; every country is projected to experience an **increase in the share of people aged 60 and over** in the coming decades.
- The UN projected that by 2050, the number of individuals aged 65 years or above across the world will be **twice the number of children aged under 5 and almost equivalent to the number of children under 12 years**.
- **1 in 4 people** in Asia will be over 60 years old by 2050 (Asian Development Bank, 2020).

ASEAN Population by Age Structure, 2000 and 2022



Source: ASEAN (2023)

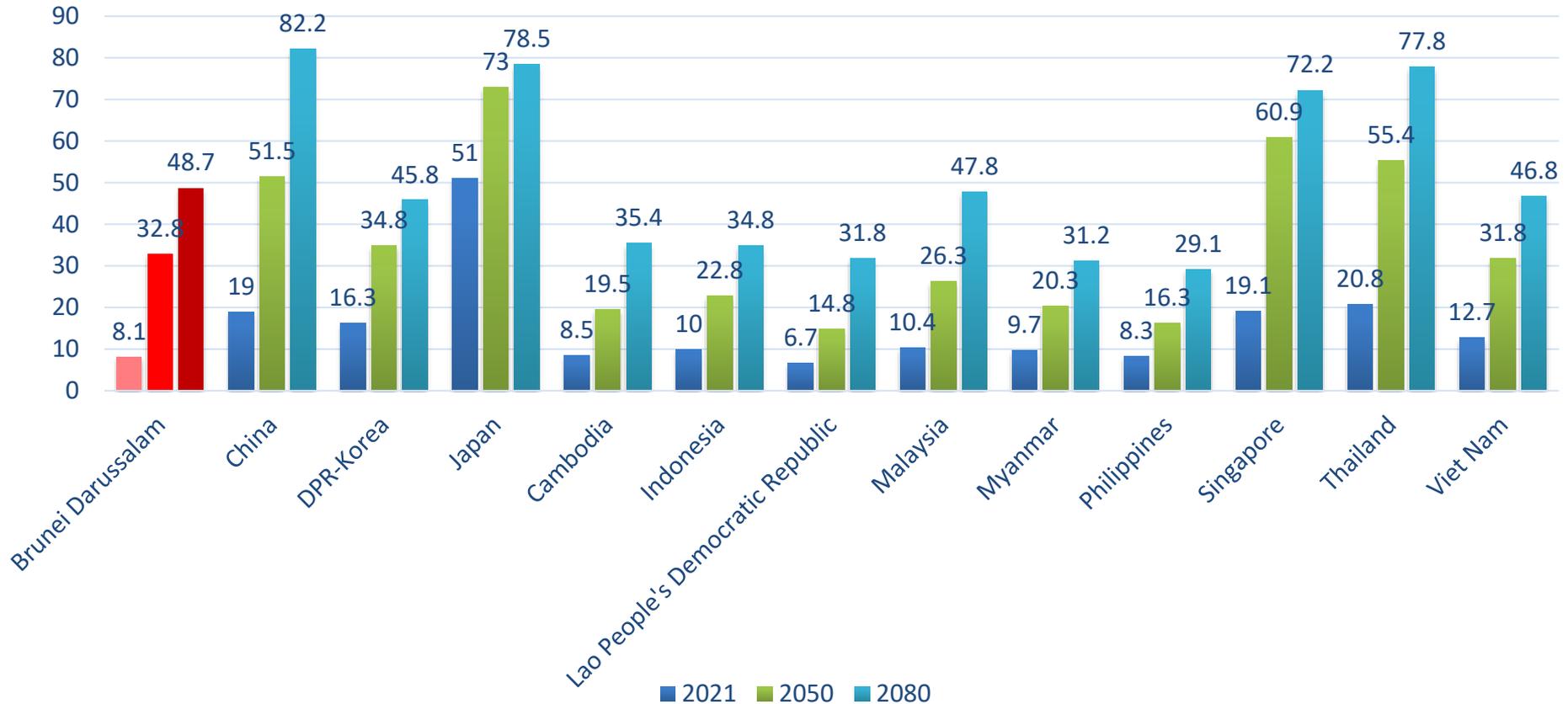
Percentage of population aged 65 years and above, ASEAN countries



Source: United Nations (2022)

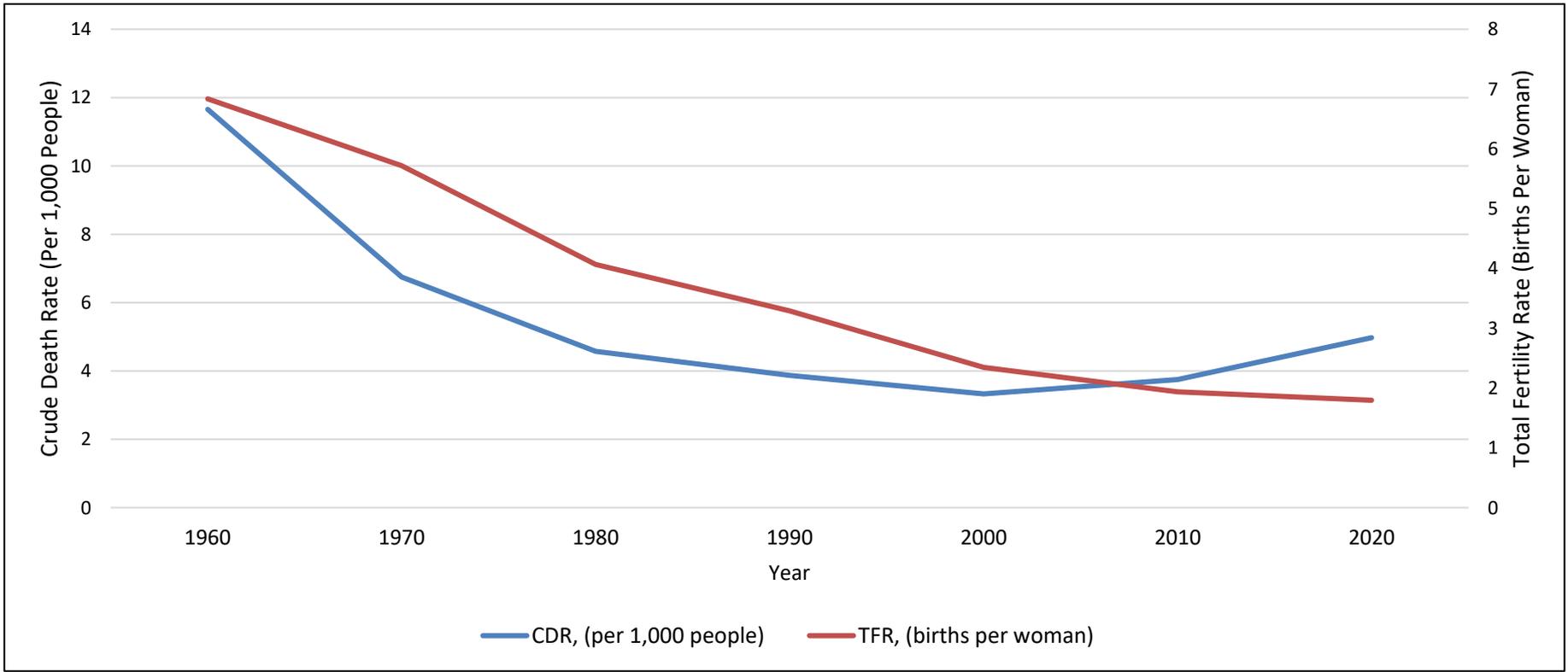
■ 2021 ■ 2050 ■ 2080

Old-Age Dependency Ratio (65+/15-64)



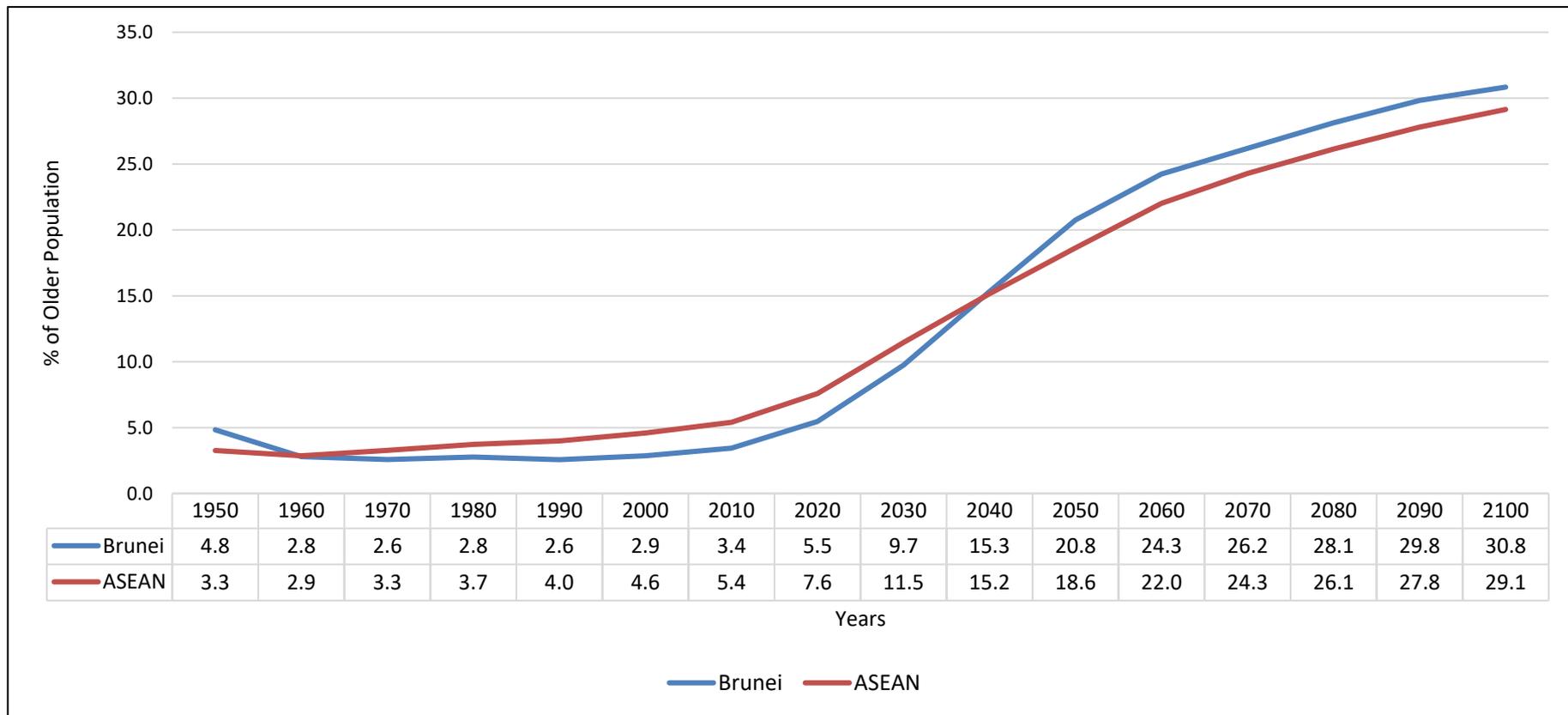
- The fastest ageing nation in ASEAN is Brunei Darussalam (United Nations, Population Division, 2019; OECD, 2020). (see next slide figure)
- Brunei's population aged 80 years and over are expected to increase by 6-fold from 2020 to 2050 (OECD, 2020).

Crude Death Rate and Total Fertility Rate, Brunei, 1960-2000

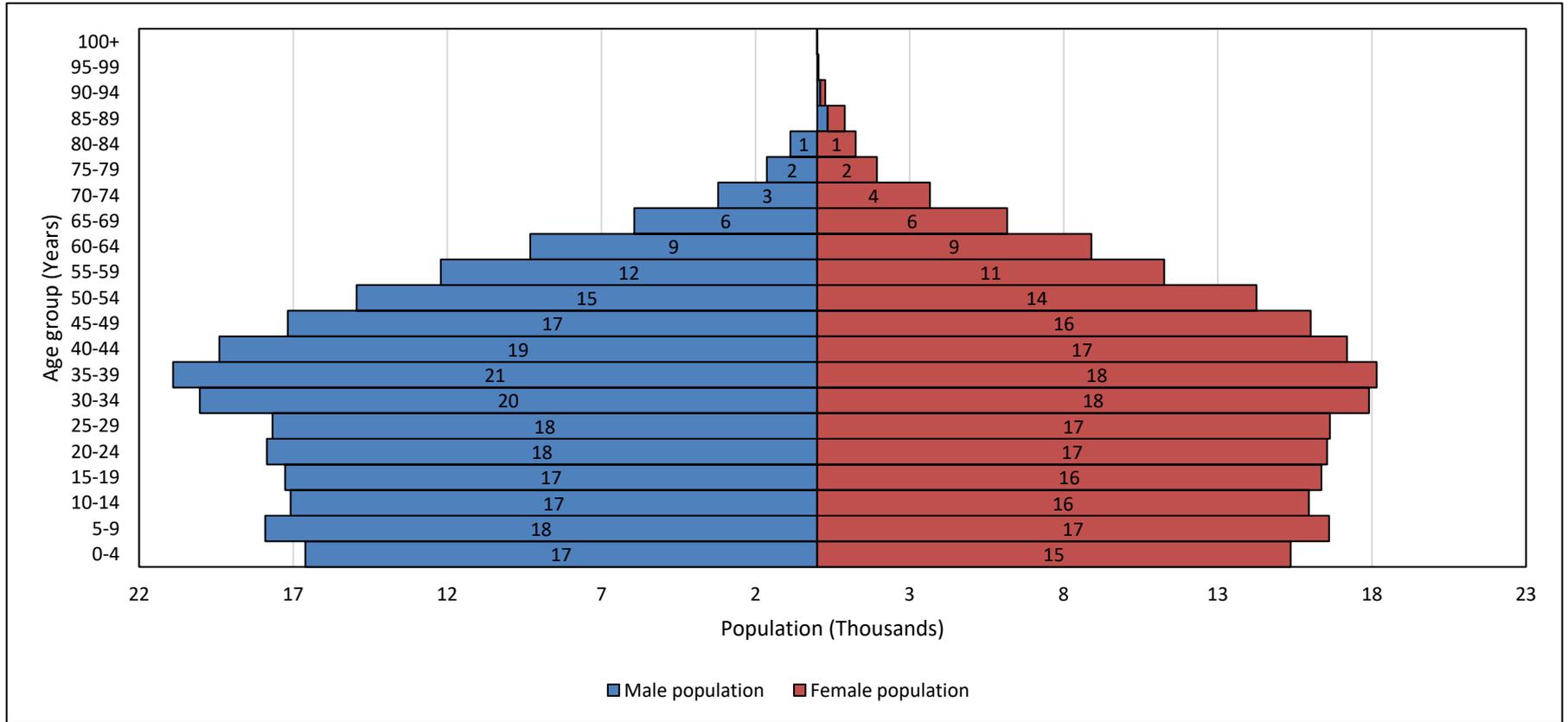


Source: United Nations (2022)

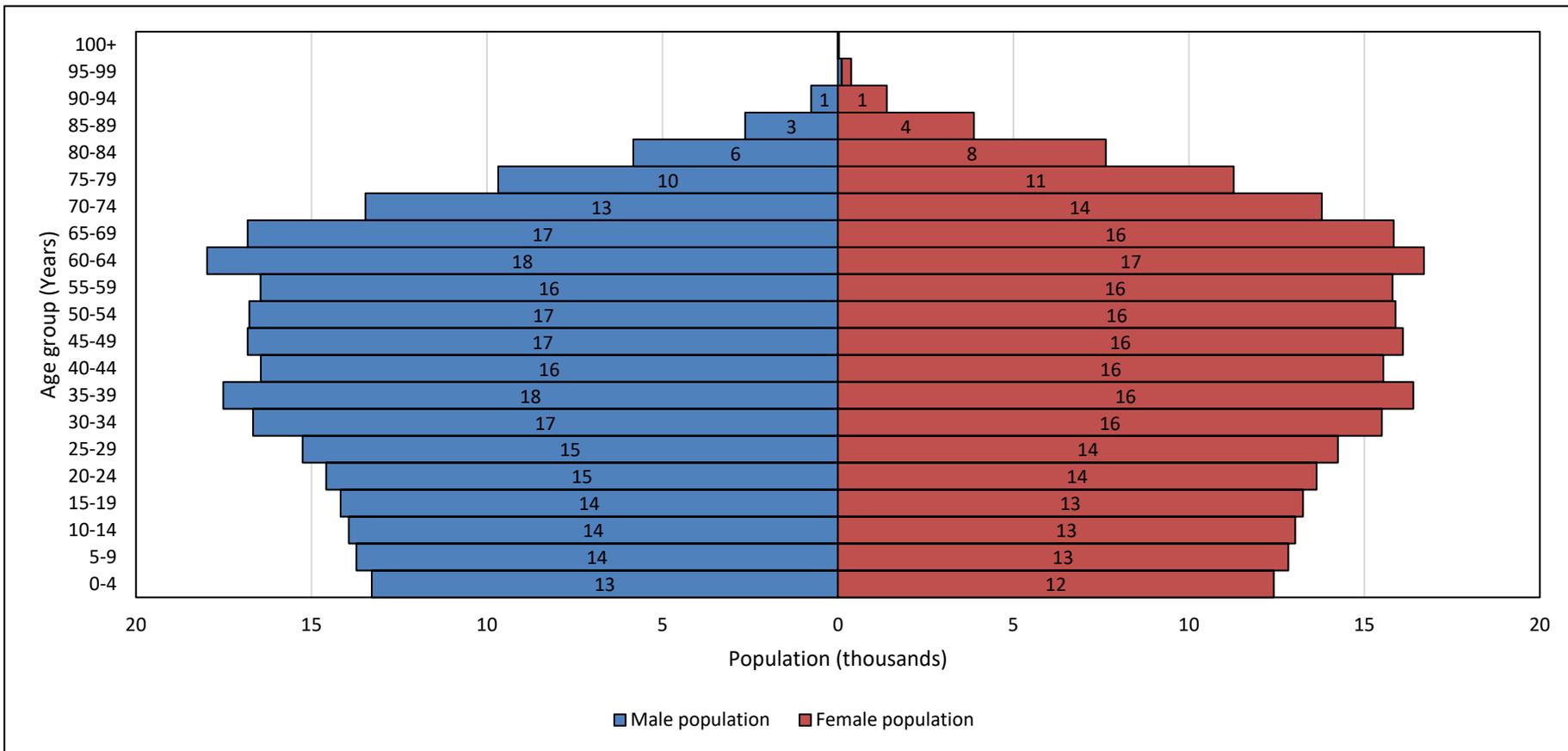
Growth of older population (aged 65+ years) in ASEAN and Brunei 1950-2100



Population Pyramid, Brunei, 2021

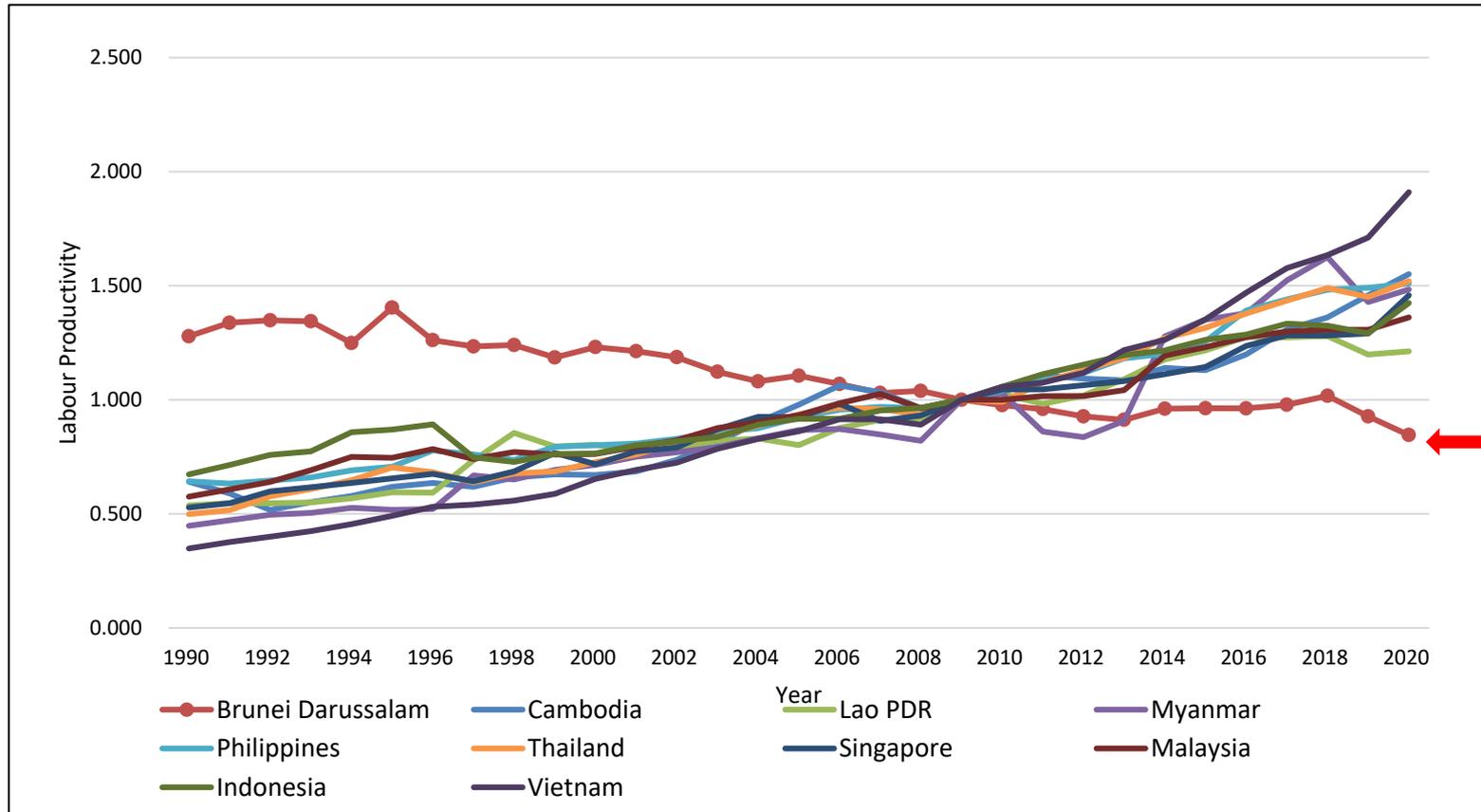


Population Pyramid, Brunei, 2050



Source: Department of Economic Planning and Statistics (2023)

Labour Productivity in ASEAN countries, 1990-2021



Source: Asian Productivity Organization (2023)

Micro-level

Negative relationship between Age and Productivity

- Age and productivity U-shaped curve (Abert and Crepon, 2004; Bruno and Hirte, 2006; Prskawet et al., 2007).
- Elderly encounter challenges in adapting to novel work methodologies, a diminishing reservoir of information (De Grip and Vanloo, 2002).
- Deteriorating cognitive capacities by the age of 50 (Verhaegen and Salthouse, 1997; Skirbekk, 2003).

Positive relationship between Age and Productivity

- Older workers possess a greater degree of job experience (Disney, 1996; Dixon, 2003).
- Learning enhances productivity in relation to seniority (Aubert and Crepon, 2003).
- Older employees typically maintain consistent ties with employers, while younger employees often experience numerous jobs and employer changes (Gregg and Wadsworth, 1999).

Macro-level

The relationship between Age and Productivity

- Age of 50-64 positive impact on productivity. Age group over 65 negative impact. Lower age group uncertain (Lindh and Malmberg, 1999).
- Age of 15-29 negative and positive for 50-64 (Frini and Jedidia, 2018).
- Older workers have little adverse effect on productivity (Tang and Macleod, 2006).

- Data

- Yearly data on Brunei from 1991 to 2021

- Sources: Asian Productivity Organization (APO), World Development Indicators (WDI) and Department of Economic Planning and Statistics (DEPS)

- $Productivity = \alpha + \theta_1 YL_t + \theta_2 PL_t + \theta_3 AL_t + \theta_4 Capital_t + \mu_t$
- Where *Productivity* is the labour productivity (based on hours worked), YL_t is the young adults, PL_t is the adults, AL_t is the elderly, $Capital_t$ is the gross fixed capital formation and μ_t is the error term.
- $YL = \frac{Labor\ force\ aged\ 15-29}{Population\ aged\ 15-29}$; $PL = \frac{Labor\ force\ aged\ 30-49}{Population\ aged\ 30-49}$; $AL = \frac{Labor\ force\ aged\ 50-59}{Population\ aged\ 50-59}$

Variable	Mean	Std. Dev.	Min	Max
productivity	1.118	0.1611	0.872	1.425
age1529	57.909	2.234	53.2	60.4
age3049	81.887	3.345	78.2	86.8
age5059	57.364	6.446	51.1	69.2
gfcf	26.453	10.206	10.437	41.314

VECM Estimation Results

	D (Productivity)	D (YL)	D (PL)	D (AL)	D (GFCF)
D_logproductivity					
L_ce1	-0.0379***	0.0232*	-0.000882	-0.0634***	4.37
	(0.00829)	(0.00934)	(0.00614)	(0.0143)	(2.29)
LD.logproductivity	-0.669***	-0.129	-0.0928	0.0484	-33.45
	(0.125)	-0.111)	(0.0729)	(0.17)	(27.18)
LD.log (YL)	-1.865***	-0.729**	-0.312	-1.018*	-169.5**
	(0.327)	(0.268)	(0.176)	(0.41)	(65.73)
LD.log (PL)	1.634**	0.934*	0.315	0.345	274.2**
	(0.487)	(0.401)	(0.264)	(0.615)	(98.41)
LD.log (AL)	-0.584**	-0.468***	-0.171*	-0.342	-63.24*
	(0.158)	(0.128)	(0.0844)	(0.197)	(31.47)
LD.gfcf	0.00598***	0.000717	0.000518	-0.000293	0.489
	(0.0013)	(0.00115)	(0.000754)	(0.00176)	(0.281)
cons	-0.0178***	-0.00439	0.00117	0.00778	-0.897
	(0.0052)	(0.0046)	(0.00302)	(0.00705)	(1.128)

Standard errors in parentheses

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

p<0.001

- $$Productivity = -16.9 + \frac{12.4}{(13.0)}YL - \frac{32.6}{(8.76)}PL + \frac{19.5}{(6.67)}AL + \frac{0.0915}{(0.0173)}gfcf + \mu_t$$
- Insignificant long-run relationship between young adults and productivity
- Negative long-run relationship between prime-age adults and productivity
- Positive long-run relationship between elderly and productivity

1. Employed Population

- Most adults in Brunei are employed in relatively low-productive industries.
- Yet, oil and gas sector accounts for an average of 45% of Brunei's GDP.

2. Labour Force Participation rate

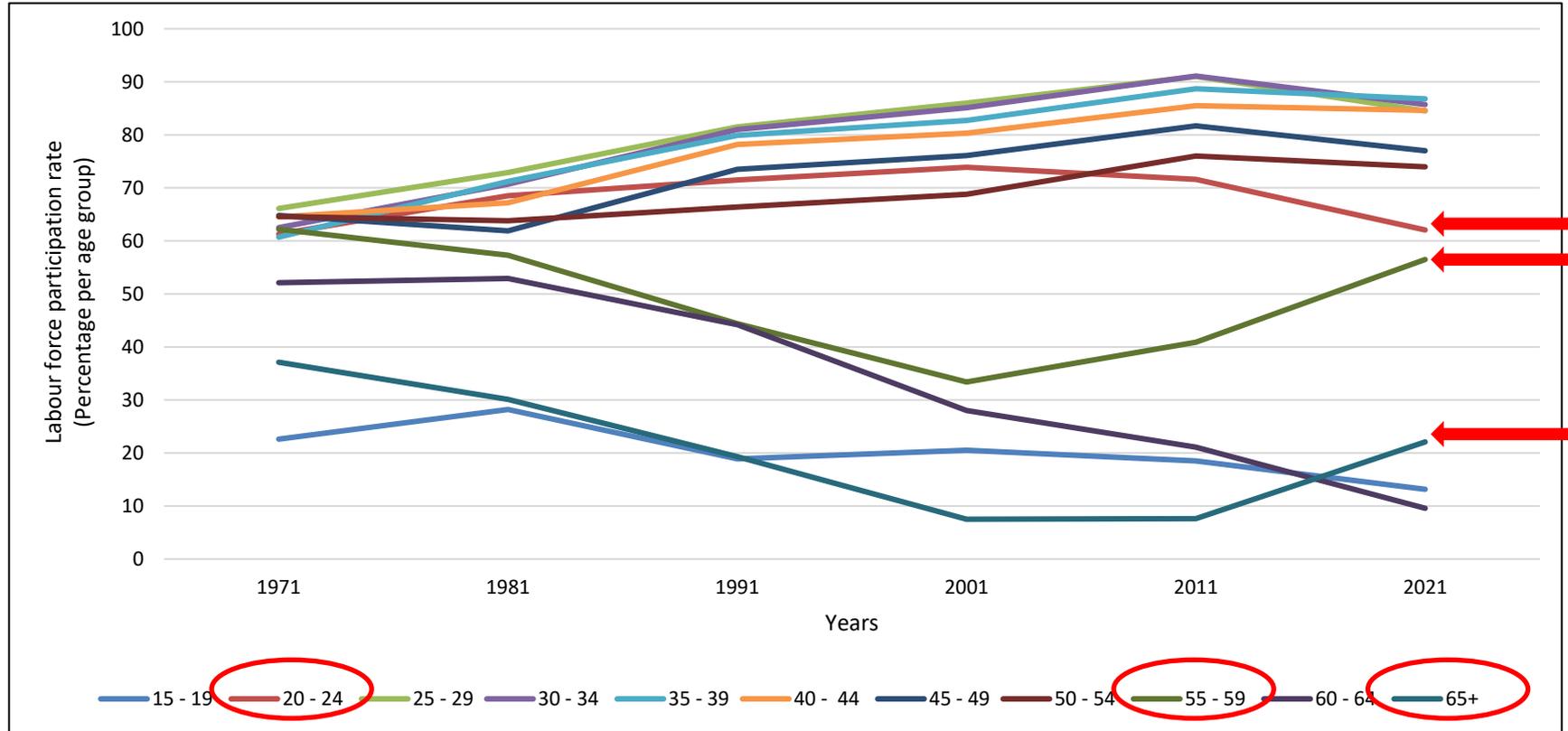
- There is an increase in labour force participation rates for older population groups in Brunei.
- Interestingly, an increase in labour force participation rates is observed for those over 65 years old.

Employed population by type of economic activity

Employed population by type of economic activity	2020	2021	2022
Agriculture, Forestry and Fishery	1.3	1.4	1.5
Mining and Quarrying	5.6	3.8	4.7
Manufacturing	4.3	9.1	6.5
Electricity, Gas, Water Supply and Other Industrial Activities	1.4	1.5	1.4
Construction	12.2	9.2	8.9
Wholesale and Retail Trade	17.4	15.7	15.3
Accommodation and Food Service	5.2	6.0	7.6
Transportation and Storage	2.9	2.7	3.1
Information and Communication	2.2	2.4	2.2
Financial and Insurance Activities	2.2	2.0	2.4

Employed population by type of economic activity	2020	2021	2022
Real Estate Activities	0.5	0.5	0.4
Professional, Technical, Administrative and Support Services	6.3	6.9	8.0
Public Administration	22.6	21.9	21.0
Education	7.3	7.0	8.2
Human Health and Social Work Activities	2.6	3.0	3.0
Activities of Households as Employers of Domestic Personnel	4.0	5.0	3.6

Labour Force Participation rate



Source: Department of Economic Planning and Statistics (2023)

- Brunei, despite its high GDP per capita and comprehensive welfare system, faces socio-economic challenges due to slow GDP growth, relatively high unemployment rates and fiscal deficit exacerbated by an ageing population.
- This study indicates, that there is a significant relationship between demographic shifts and labour productivity with older workers showing higher productivity compared to middle-aged counterparts.

1. Raising the retirement age to tap into ageing workforce productivity, mitigating socio-economic impacts of population ageing.
2. Implement active ageing strategies in the workplace and job market to alleviate the burden on healthcare systems, ensuring economic contribution without compromising older workers' health.
3. Further studies are recommended to determine why prime adults (30-49) have a negative and significant relationship in terms of productivity in Brunei.