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TABLE OF CONTENTS

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Growth Accounting and Total Factor Productivity in Brunei Darussalam: A Comparison with ASEAN and GCC Countries

Koh Wee Chian

Abstract

This paper presents the first growth accounting exercise and total factor productivity growth estimates for Brunei Darussalam over the period 1981–2011, and makes a comparison with ASEAN and GCC countries. The results show that Brunei has the lowest GDP and labour productivity growth among the countries. This is primarily due to Brunei having the lowest contribution from total factor productivity and capital input growth. Brunei's growth has largely been driven by its labour input but this contribution has also been declining, suggesting the need to explore other growth avenues. A viable strategy involves increasing productive investments to build up the country's capital stock to address the relatively low levels of investment and declining capital per worker, and concurrently emphasising human capital, R&D and innovation with a longer term view.

Keywords: growth accounting, total factor productivity, Brunei Darussalam, ASEAN, GCC

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1 Introduction

Total factor productivity (TFP) growth, or technical progress, is central to accelerating and sustaining economic growth as informed by the Solow-Swan growth model (see Solow, 1956; Swan, 1956). Notwithstanding the controversies in measuring TFP, since it is a residual factor (the so-called Solow residual), growth accounting is a useful tool in decomposing growth into contributions by capital, labour and TFP. This fundamental growth decomposition is important to understand whether growth is mainly intensive or extensive[1], and can help governments devise appropriate policies.

The importance of productivity drivers to spur growth in Brunei Darussalam has been made explicit in the Tenth National Development Plan (2012–2017) and special funds have been set up. The Human Resources Development (HRD) Fund, administered by the Department of Economic Planning and Development (DEPD), has an allocation of B$250 million to continue building the nation's human capital through improving the quality of education and workforce capability. The allocation for research and development (R&D), under the purview of the newly established Brunei Research Council (BRC), has also been increased to B$200 million, while the Small and Medium Enterprises (SME) Development Fund receives B$100 million to encourage entrepreneurship and assist in the development of SMEs.

From both historical and fundamental perspectives, it is imperative to first understand the sources of economic growth and productivity trends in Brunei. Existing studies in the literature that focus on the Asian region (e.g. Sarel, 1997; Park, 2010) systematically exclude Brunei from their analysis largely due to data availability issues. Likewise, the Asian Productivity Organization (APO) does not provide TFP estimates for Brunei. The objective of this paper is therefore to provide the first growth accounting exercise and TFP estimates for Brunei over the period 1981–2011 using an international dataset, including a comparison with regional ASEAN peers and countries with similar economic structures, such as those in the GCC.[2] This paper, which takes an aggregate approach, also differs from the ongoing productivity studies by the Centre for Strategic and Policy Studies (CSPS) which involve primary data collection and analysis at the sectoral and firm level.

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1 *Intensive* growth refers to the use and diffusion of new technologies in mainly driving growth, i.e. assimilationist view or growth by "inspiration". Extensive growth refers to the use of more primary inputs such as accumulation of capital or increase in labour participation rates, i.e. accumulationist view or growth by "perspiration". See Krugman (1994), Collins and Bosworth (1996) and Felipe (1997).

2 ASEAN is the Association of South East Asian Nations and it has 10 members – Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. GCC is the Gulf Cooperation Council and it has six members – Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates.

The rest of the paper is organised as follows. Section 2 presents a growth accounting framework and a brief discussion of measurement issues. Data sources and the growth accounting calculations are described in Section 3. Section 4 provides a discussion of the results for Brunei as well as a comparison with ASEAN and GCC countries, and Section 5 concludes.

2   A Growth Accounting Framework

The standard growth accounting framework assumes a neoclassical production function with two inputs and constant returns to scale, which usually takes the form of a Cobb-Douglas production function:

$$Y_t = A_t K_t^\alpha L_t^{1-\alpha} \tag{1}$$

where Y is the economy's output, A is total factor productivity, K is the capital stock, L is the number of workers, t is a time subscript, and α is a parameter reflecting the output elasticity with respect to capital, which takes a value between 0 and 1.

Taking logs and differentiating both sides of equation (1) with respect to time, we get:

$$\frac{\Delta Y}{Y} = \frac{\Delta A}{A} + \alpha \frac{\Delta K}{K} + (1 - \alpha) \frac{\Delta L}{L} \tag{2}$$

Equation (2) shows that output growth can be decomposed into three components: total factor productivity growth; contribution of the growth rate of capital stock; and contribution of the growth rate of labour.

Among the issues commonly raised with regards to this growth accounting approach is the assumption of constant returns to scale (CRS), implying that output elasticities are equal to the share of inputs. What this suggests is that the growth performance of countries experiencing increasing returns to scale will not be adequately captured by a production function with CRS.[3] Nevertheless, since output elasticities are unobserved, making this CRS assumption has an important empirical application, as only the labour or capital shares are required, which can be collected from national accounts data. Another important issue to note is that an accounting relationship is different from a causal relationship, as emphasised in Aghion and Howitt (2007). The growth accounting approach is a mechanical decomposition and not a theory of growth; causal questions can only be answered by testing economic theories. Other issues relate to

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3 See Romer (1986) for endogenous growth models with increasing returns and spillovers.

measurement problems of factor inputs, for example, in estimating capital stock and making quality adjustments for labour. Also, since TFP is measured as a residual, it includes quality improvements that are not reflected in the primary inputs and also subsumes measurement errors.

A common approach to constructing capital stock is to use the perpetual inventory method (see OECD, 2001) which necessitates making certain assumptions.[4] Therefore, instead of directly constructing a capital stock series for Brunei, this paper makes use of the latest version of the Penn World Tables (PWT8.0) (see Feenstra et al., 2013), which systematically estimates capital stock for 167 countries and is useful for cross-country comparisons. To address the issue of labour quality adjustment, equation (1) is modified using two variants: (i) defining labour input as the product of number of workers times their average human capital (see Inklaar and Timmer, 2013); and (ii) adjusting labour by 8% per additional year of schooling (see Park, 2010).

To focus on productivity instead of growth, equation (2) can be re-arranged to yield:

$$\frac{\Delta Y}{Y} - \frac{\Delta L}{L} = \frac{\Delta A}{A} + \alpha \left(\frac{\Delta K}{K} - \frac{\Delta L}{L} \right)$$

(3)

The left hand side is the growth rate of output per worker, or labour productivity growth. The right hand side consists of two terms, TFP growth and the growth rate of capital per worker multiplied by the capital share. Equation (3) therefore decomposes labour productivity growth into the contribution of TFP growth and the contribution of *capital deepening*.[5] It also highlights the importance of TFP to sustained increases in output per worker. Since there are limits to labour growth (as labour force and participation rates cannot increase without bounds) and capital growth (since capital is subject to diminishing returns in this model), the only way for sustained growth is therefore through continual improvements in TFP, which encompass better technologies, increased efficiency in work processes and other innovations.

The growth accounting calculations therefore include both equations (2) and (3) to provide decompositions on the sources of economic growth and productivity growth.

3   Growth and Productivity from 1981 to 2011

Seven ASEAN nations and five GCC member states are included in the growth accounting exercise – Brunei Darussalam, Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam,

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4 See Park (2010) for a discussion

5 *Capital deepening* refers to the increase in the amount of capital per worker, as opposed to *capital widening*, which refers to the increase of capital stock just to keep pace with an increasing labour force and capital depreciation.

Bahrain, Kuwait, Oman, Qatar, and Saudi Arabia.[6] The data required for the growth accounting calculations and its variants are GDP, capital stock, number of employed workers, labour shares, human capital index, and years of schooling. The variables and data sources are listed in Table 1.

Table 1.

Definition of variables and data sources

Variables	Definition	Source[1]
GDP	Real GDP (2005 B$ millions)	PTW8.0
Capital stock	Capital stock (2005 US$ millions)	PWT8.0
Employment	Employment ratio multiplied by population aged 15-64	APO, WDI
Labour share[2]	Share of labour compensation in GDP	PWT8.0
Human capital index	Index of human capital per person, based on years of schooling (Barro and Lee, 2013) and returns to education (Psacharopoulos, 1994)	PWT8.0
Years of schooling	Average years of total schooling (interpolated)	Barro and Lee, 2013

1 PTW8.0 – Penn World Table version 8.0; APO – Asian Productivity Organization; WDI – World Bank World Development Indicators

2 The labour shares for Brunei and Vietnam are not available in PWT8.0. For Brunei, the labour share from Brunei's input-output table for 2005 is used; this is calculated as 0.689. For Vietnam, the sample average of Thailand is used.

The baseline TFP growth is calculated as:

$$\Delta \ln(A_t) = \Delta \ln(Y_t) - \alpha \Delta \ln(K_t) - (1 - \alpha)\Delta \ln(L_t) \tag{4}$$

The two variants which include quality adjustment for labour are calculated as:

$$\Delta \ln(A_t) = \Delta \ln(Y_t) - \alpha \Delta \ln(K_t) - (1 - \alpha)[\Delta \ln(L_t) + \Delta \ln(h_t)] \tag{5}$$

$$\Delta \ln(A_t) = \Delta \ln(Y_t) - \alpha \Delta \ln(K_t) - (1 - \alpha)[\Delta \ln(L_t) + 0.08\Delta s_t] \tag{6}$$

where h is the human capital index, and s is the number of years of schooling.

3.1 Brunei Darussalam

The sources of economic growth for Brunei over the period 1981–2011 are shown in Table 2. The main drivers of growth are the primary inputs, particularly labour. Brunei's employment growth rate averaged 3.8 per cent from 1981–2011, while the labour force participation rate has increased from 59.6 per cent in 1981 to 68.3 per cent in 2011, as more females enter the workforce (31.3

6 Cambodia, Lao PDR, Myanmar and United Arab Emirates are excluded due to data availability issues.

per cent to 58.3 per cent over the same period). While the public sector is the largest employer for Brunei citizens, the private sector is dominated by foreign workers, especially in low- and semi-skilled jobs in the construction industry. In 2009, foreign workers made up 68 per cent of the private sector workforce.[7] Average TFP growth has been negative across the three decades, suggesting that growth has been largely extensive. This is perhaps unsurprising given Brunei's economic structure, which depends heavily on the capital-intensive oil and gas sector supported by the labour-intensive services sectors, including the government, with little emphasis on R&D and innovation prior to the Tenth National Development Plan. As discussed in Section 2 above, there are limits to growth based on factor accumulation; this can be seen in the declining contribution of labour input growth in Table 2.

Table 2.

Growth decomposition for Brunei Darussalam, 1981–2011 (%)

Period	GDP growth	TFP growth	Capital input growth	Labour input growth
1981–1985	-3.3	-7.4	1.0	3.1
1986–1990	-1.6	-5.7	0.9	3.1
1991–1995	3.2	-0.7	1.5	2.3
1996–-2000	1.4	-2.3	1.3	2.3
2000–2005	2.1	-0.8	0.4	2.5
2006–2011	0.9	-2.6	0.9	2.0
1981–2011	**0.5**	**-3.1**	**1.0**	**2.6**

Source: Author's calculations

Tables 3 and 4 display the results with adjustments for labour quality. Since labour is augmented by human capital enhancements, the contribution of labour input will be higher, and correspondingly the contribution of TFP worse. The conclusions remain unchanged after adjusting for labour quality – labour input growth is the main contributor of GDP growth over the past three decades, while the lack of technical progress has been impeding growth.

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7 For more detailed discussion on the issues pertaining to Brunei's labour market, see Cheong and Lawrey (2009), Koh (2011) and Razak (2011).

Table 3.

Growth decomposition for Brunei adjusted by human capital index, 1981–2011 (%)

Period	GDP growth	TFP growth	Capital input growth	Labour input growth
1981–1985	-3.3	-8.1	1.0	3.9
1986–1990	-1.6	-6.5	0.9	3.9
1991–1995	3.2	-1.1	1.5	2.7
1996–-2000	1.4	-2.5	1.3	2.5
2000–2005	2.1	-1.1	0.4	2.8
2006–2011	0.9	-2.8	0.9	2.2
1981–2011	**0.5**	**-3.5**	**1.0**	**3.0**

Source: Author's calculations

Table 4.

Growth decomposition for Brunei adjusted by years of schooling, 1981–2011 (%)

Period	GDP growth	TFP growth	Capital input growth	Labour input growth
1981–1985	-3.3	-8.1	1.0	3.8
1986–1990	-1.6	-6.4	0.9	3.8
1991–1995	3.2	-1.4	1.5	3.0
1996–-2000	1.4	-3.0	1.3	3.0
2000–2005	2.1	-1.5	0.4	3.2
2006–2011	0.9	-3.3	0.9	2.7
1981–2011	**0.5**	**-3.8**	**1.0**	**3.3**

Source: Author's calculations

Turning to the contribution of labour productivity growth, Table 5 shows that the growth rate of output per worker has largely been negative over the past three decades, attributed primarily to negative TFP growth. However, capital deepening has also been negative on average, indicating declining capital per worker, i.e. workers have fewer capital resources to work with.

Table 5.

Labour productivity growth decomposition for Brunei Darussalam, 1981–2011 (%)

Period	Labour productivity growth	TFP growth	Capital deepening	Capital stock growth	Employment growth
1981–1985	-7.8	-7.4	-0.4	3.2	4.6
1986–1990	-6.2	-5.7	-0.5	3.0	4.6
1991–1995	-0.2	-0.7	0.5	4.9	3.4
1996–-2000	-2.0	-2.3	0.3	4.2	3.4
2000–2005	-1.6	-0.8	-0.7	1.3	3.7
2006–2011	-2.2	-2.3	-0.2	2.6	3.2
1981–2011	**-3.3**	**-3.1**	**-0.2**	**3.2**	**3.8**

Source: Author's calculations

3.2   ASEAN and GCC Countries

This section compares Brunei's growth and productivity performance from 1981–2011 with those of ASEAN and GCC countries to see whether there are significant differences. Table 6 displays the growth decomposition results without labour quality adjustments.

There are a few striking and interesting observations. First, Brunei has the lowest average GDP growth among the countries. Second, Brunei has the lowest TFP growth and capital input growth contribution but has the second highest labour input growth contribution (behind the Philippines). Third, negative TFP growth is a common phenomenon in oil-producing countries. Fourth, TFP growth is not the main contributor of GDP growth in the high performing ASEAN nations, supporting the view of Krugman (1994) and Young (1992; 1994; 1995) that the key to success in these countries has been "perspiration" rather than "inspiration".

These findings are worrying for Brunei for two reasons. First, the main contributor of economic growth of Brunei, labour input, is on the decline even after adjusting for labour quality and it is difficult to see its contribution growing at a much higher rate. For instance, Qatar has very high employment growth through importing mass foreign workers, but the contribution of labour input to growth is much lower compared to the contribution of capital input. Second, the contribution of TFP growth is not as high as expected in countries such as Singapore, Malaysia and Thailand which have relatively higher investments in R&D and innovation. It is difficult to ascertain the extent of growth contribution the current special funds (B$550 million over five years) earmarked in the Tenth National Development Plan will have, though it is expected that such funds will

increase in size in subsequent development plans and have significantly positive effects on productivity and growth in the medium to long run. However, given the experience of the other ASEAN countries, it is reasonable to expect that TFP growth can contribute only about one-fifth to GDP growth, which suggests a need to look into the remaining component, capital input.

Table 6.

Growth decomposition for ASEAN and GCC countries, 1981–2011 (%)

Country	GDP growth	TFP growth	Capital input growth	Labour input growth
Brunei	0.5	-3.1	1.0	2.6
Indonesia	5.4	0.2	4.0	1.2
Malaysia	5.9	0.8	3.5	1.6
Philippines	3.2	-2.1	2.6	2.7
Singapore	6.8	1.3	4.1	1.5
Thailand	5.5	1.3	3.6	0.7
Vietnam	6.8	0.4	5.1	1.3
Bahrain	3.5	-1.9	3.3	2.1
Kuwait	3.6	-2.2	4.9	0.9
Oman	6.0	-0.6	4.5	2.1
Qatar	7.5	-0.2	5.9	1.8
Saudi Arabia	2.1	-2.1	2.7	1.5

Source: Author's calculations

Table 6 also shows that Brunei's capital input growth contribution to GDP growth is less than half the contribution of labour input growth, whereas in other countries the average multiple is three. This observation points to a viable option of increasing investment and the capital stock. As shown in Table 5 in Section 3.1, employment growth has outpaced capital stock growth, resulting in declining capital per worker. Brunei's share of investment in GDP at 14.2 per cent averaged over 1981-2011 is also the second lowest among the countries, trailing only Kuwait. The averages for the ASEAN and GCC countries are 26.4 per cent and 19.3 per cent respectively.

Table 7 displays the labour productivity growth decomposition for the ASEAN and GCC countries. As expected, Brunei has the lowest labour productivity growth. Brunei also has the lowest capital stock growth, suggesting potential gains through increasing productive investments. Public finances will need to be re-prioritised, by allocating a higher proportion of the government budget to development expenditure instead of current expenditure (which consists mainly of wages, salaries and gratuities). The existing share of development expenditure is only about 30 per cent of total government spending.

Table 7.

Labour productivity growth decomposition for ASEAN and GCC countries, 1981–2011 (%)

Country	Labour productivity growth	TFP growth	Capital deepening	Capital stock growth	Employment growth
Brunei	-3.3	-3.1	-0.2	3.2	3.8
Indonesia	2.8	0.2	2.6	7.3	2.6
Malaysia	2.8	0.8	2.1	7.5	3.1
Philippines	-3.0	-2.1	-1.0	4.5	6.2
Singapore	3.3	1.3	2.1	7.3	3.5
Thailand	3.9	1.3	2.6	6.0	1.7
Vietnam	3.7	0.4	3.3	8.8	3.0
Bahrain	-2.4	-1.9	-0.5	5.2	6.0
Kuwait	-0.5	-2.2	1.7	6.3	4.1
Oman	-1.2	-0.6	-0.6	6.4	7.2
Qatar	-1.2	-0.2	-1.0	7.4	8.7
Saudi Arabia	-1.9	-2.1	0.2	4.3	4.0

Source: Author's calculations

4   Conclusion and Policy Implications

This paper presents the first growth accounting exercise and total factor productivity growth estimates for Brunei Darussalam over the period 1981–2011, and makes a comparison with ASEAN and GCC countries. An important finding is that Brunei has the lowest GDP and labour productivity growth among the countries, primarily due to negative TFP growth, while the main contributor of GDP growth has largely been labour input growth. The government has recognised the importance of TFP growth and is moving towards a growth strategy that focuses on human capital, R&D and innovation as the main drivers in building a knowledge economy, as emphasised in the Tenth National Development Plan. Another important finding is that Brunei has the lowest capital stock growth rate, which has been outpaced by employment growth over the past three decades, resulting in lower capital per worker. With a much lower level of investment share in GDP compared to the other countries, a possible course of action for Brunei to explore is to increase investments in productive assets and grow the nation's capital stock in the short and medium term, while at the same time invest in human capital, R&D, innovation and technology with a longer term view.

Growth accounting is not without its flaws, in particular the measurement of TFP as a residual. In addition, it does not inform about what drives TFP growth and which types of productive investments to make. Nevertheless, this growth decomposition is a fundamental exercise that is useful in understanding the sources of growth and productivity, as well as for cross-country comparisons. A natural next step is to investigate the main factors behind negative TFP growth in oil-exporting countries using a panel data regression-based approach, for example, as in Bosworth and Collins (2003) and Park (2010). This involves regression TFP growth on important explanatory variables such as initial income, trade openness, geography, institutional quality and macroeconomic policy variables as well as intangible factors such as human and R&D capital, which allows for quantifying the determinants of TFP growth.

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Trade Openness and Economic Growth of Brunei Darussalam

Jones Odei Mensah and Isaac Abekah-Koomson

Abstract

Brunei's economy has been growing at a slow and steady rate for the past 50 years mainly on the back of oil and gas production. Recent calls for diversification into other sectors of the economy imply that eventually international trading activity will be higher. This paper explores the relationship between the level of trade openness and growth in the Brunei contest employing OLS regression, Granger causality and the ARDL bounds testing cointegration technique. The results suggest that openness and physical capital are not important in explaining both the short run and long run dynamics of GDP growth. In contrast, human capital and inflation show a significant impact on GDP growth in the short run but not in the long run. Given that the benefits of opening up the economy to international trade are yet to be realised in full in the economy of Brunei, pursuing policies that promote international competition will enhance productivity growth. It is also prudent to pursue any policy that helps promote investment and development of import substitution industries. The paper concludes with other policy recommendations.

Keywords: Openness, Economic Growth, Cointegration

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1.0 Introduction

Brunei Darussalam has a small but wealthy economy, which has been growing at a slow and steady rate. For the past 50 years, Brunei has achieved high per capita incomes with an average inflation rate of 1.5% over the past twenty years (BEDB, 2011). The country is one of the two higher income economies in Southeast Asia; the other is Singapore. The country enjoys a high quality of life with an estimated BN$49,000 per capita income – the second highest in the ASEAN region (Department of Economic Planning and Development, 2014). Statistics from global ranking of countries by the IMF and World Bank place Brunei among the highest income economies in the world with GNI per capita ranging from US$12,746 or more (World Bank, 2015).

Under its Investment Incentives Order 2001, prospective investors also enjoy a wide range of incentives, including up to a possible 20-year exemption from corporate tax, exemption from import duties and taxes on raw material, machinery, equipment, component parts, accessories and adjustment of capital allowance and losses. The banking sector monitoring, reform of the financial system and support for small and medium-sized companies are also among the government's priorities, as part of promoting trade with neighbouring nations. Brunei shows a surplus trade balance, although it has been on a declining trend in recent times, i.e. it dropped from BN$11,150.1 million in 2011 to BN$9,788.4 million in 2013 (Department of Economic Planning and Development, 2014). The main import commodities are machinery, transport equipment, manufactured products, foodstuffs and chemicals. The origins of Brunei's imports include ASEAN, the European Union, China, Australia, Hong Kong, Japan, the Republic of Korea, U.S.A and others. Brunei exports crude petroleum mainly to Australia, India, China, the Republic of Korea, Japan, New Zealand and other ASEAN countries. The main destinations for Brunei's natural gas are Japan and the Republic of Korea. Exports of crude petroleum declined from BN$7,824.4 million in 2012 to BN$6,397.5 million in 2013, representing a drop of 18%. Similarly, natural gas exports dropped by 3.8% from 2012 (BN$7,706.1 million) to 2013 (BN$7,413.6 million). Brunei showed moderate growth during the mid-2000s, due to high oil and gas prices. Recently, growth has suddenly become sluggish to the point of being negative (-1.8%) in 2012-2013 and the 2014 outlook is hardly optimistic.

The present paper explores the relationship between the level of trade openness and growth in the context of Brunei. The nexus between higher trade openness and improvement in growth is a contentious one in development and international economics. The fundamental question of whether higher trade openness causes further growth has received tremendous attention in the literature. However, no satisfactory answer has been offered yet. Most of the World Bank and

IMF policy mandates tend to be in support of openness policies and outward-oriented programs rather than an inward oriented policy. Policies for the promotion of international trade are among the more important factors promoting economic growth and convergence in developing countries (International Monetary Fund, 1997). According to the Organisation for Economic Co-operation and Development (1998), more open and outward-oriented economies consistently outperform countries with restrictive trade and foreign investment regimes. It is also argued that openness policy is primarily associated with economic growth, especially in countries with enough human capital and a favourable working environment (political stability) to effectively absorb new information (see Edwards, 1992; Levin & Raut, 1997; Schafer, 2006)

However, some scholars have found negative associations between openness and growth, among them Rodriguez & Rodrik (2001) and Atoyebi et al. (2012). They argued that openness promotes economic development only if it is followed by an appropriate infrastructural development such as good roads, less bureaucracy, electricity and human capital. Without appropriate growth support policies, extreme openness might weaken fragile domestic industries and social welfare. Atoyebi et al. (2012) studied Nigeria and found that this oil-dependent economy displayed a negative growth association with growth openness policies.

Although many small oil-producing nations have been captured in the debate, empirical evidence is lacking for Brunei. Thus, we examine the causal relationship between higher trade openness and economic growth in Brunei. We further study the long run relationship of the subject matter using the cointegration technique.

The results suggest that openness and physical capital are not important in explaining either the short run or the long run dynamics of GDP growth in Brunei. In contrast, human capital and inflation show a significant impact on GDP growth in the short run but not in the long run.

This paper is organized as follows: Section 2 presents the econometric techniques employed as well as the data sources. The results are presented in Section 3. Finally, Section 4 concludes.

2.0   Model Specification and Data

2.1   Model Specification

Output growth can be traced to growth in inputs and multifactor productivity using the Cobb-Douglas production function (Cobb & Douglas, 1928). According to this function, rising output

over time is accounted for either by growth in inputs or improvement in productivity (Auerbach & Kotlikoff, 1998). The Cobb-Douglas function is of the form.

$$Y_t = AK_t^{\delta} L_t^{\beta} e^{\varepsilon_t}$$

[1]

where Y is the flow of output, A is the total factor productivity, which captures growth resulting from other factors not included in the model, K is the capital stock, which consists of both foreign and domestic capital, L is the labour, ε_t is the stochastic disturbance term and e is the base of the natural logarithm. To change from the exponential form requires that we take the natural logarithm of both sides of the Cobb-Douglas function:

$$\ln Y_t = \ln A + \delta \ln K_t + \beta \ln L_t + \varepsilon_t .$$

[2]

Differencing the log form gives the growth equation below

$$y_t = a + \delta k_t + \beta l_t + \varepsilon_t$$

[3]

where y, k, l and represents the growth rates of output, capital stock and labour, respectively. δ and β represent the elasticity of output with respect to capital stock and labour, respectively while $a = \ln A$ determines the economy's production capacity. The model has been a workhorse of many empirical studies, such as those of Bernanke and Gurkaynak (2002) and Mankiw et al. (1992). Abbas (2000) empirically applied the Solow growth model using the Cobb-Douglas production function. Moinul et al. (2006) expanded the neoclassical aggregate production function or Cobb-Douglas function to estimate the effects of private investment, economic freedom and openness on economic growth in the Least Developed Countries. For the purpose of this paper, the following functional form is specified for Brunei:

$$Y_t = a + \beta_i X_t + \varepsilon_t$$

[4]

where Y is the real GDP, is the constant term, β_i represents the coefficients to be estimated, X_t is a vector of the variables that determine growth, which include physical capital or investment (K), human capital (H), which we proxy with secondary school enrolment, inflation rate (P) and level of openness (O). Thus, by substituting the log transformations of the variables we have:

$$ln Y_t = a + \beta_1 ln K_t + \beta_2 ln H_t + \beta_3 ln O_t + \beta_4 ln P_t + \varepsilon_t$$

[5]

where $ln Y_t$ refers to the log of real GDP per capita at time t, used as proxy for economic growth, $ln K_t$ represents gross domestic investment as a percentage of GDP, $ln O_t$ denotes the

log of exports plus imports as a percentage of real GDP, which represents trade openness. The inflation rate, derived from changes in GDP Deflator at time t, is represented by $ln\,P_{t,}$; $ln\,H_t$ denotes secondary school enrolment, a proxy variable for human capital, a percentage of the gross population at time t. ε_t is a stochastic error term or white noise residual in the equation which captures all the unexplained variations in the output growth. The constant term,, measures the efficiency with which inputs are used to generate output, i.e. productivity. For the reason that reflects the influence of a diversity of factors, such as improvements in the quality of physical and human capital inputs and improvement in technology, it is hard to measure directly (Auerbach & Kotlikoff, 1998).

2.2 Granger Causality

The Granger causality, pioneered by Granger (1969) and later expanded by Granger (1988), is a statistical notion of causality based on forecast power. Briefly, the Granger causality test is based on the fact that the future cannot be used to predict the past since time does not run backwards. Given two stationary time series X and Y, if the lag values of X included in an equation can statistically improve the prediction of the current values of Y then X is said to Granger cause Y. The linear inter-relationship between the two variables can be represented with the following model

$$Y_t = \sum_{i=1}^{n} \alpha_i Y_{t-i} + \sum_{i=1}^{n} \beta_i X_{t-i} + u_t \qquad \text{[6a]}$$

$$X_t = \sum_{i=1}^{n} c_i X_{t-i} + \sum_{i=1}^{n} \vartheta_i X_{t-i} + \epsilon_t \qquad \text{[6b]}$$

where u_t and ϵ_t are two uncorrelated white noise processes, n is the maximum number of lags considered and $\alpha_i, \beta_i, c_i, \vartheta_i$ are coefficients to be estimated. The test that X does not Granger cause Y is conducted under the null hypothesis $H_0: \beta_1 = \beta_2 = \ldots = \beta_n = 0$ against the alternative $H_1: \beta_1 \neq \beta_2 \neq \ldots \neq \beta_n \neq 0$. Likewise, the test that Y does not Granger cause X is conducted under the null hypothesis $H_0: \beta_1 = \beta_2 = \ldots = \beta_n = 0$ against the alternative $H_1: \vartheta_1 \neq \vartheta_2 \neq \ldots \neq \vartheta_n \neq 0$. Rejection of the null hypothesis implies that there is Granger causality.

2.3 Testing for a long run relationship

Essentially, cointegration is used to check if the independent variables can predict the dependent variable mostly in the future (long run). In order to test the long run relationship among the variables, we use the bounds cointegration testing approach proposed by Pesaran et al. (2001) within the ARDL framework. The advantage of the ARDL bounds test is that it works regardless

of whether the regressors are not stationary or have mixed order of integration, that is a mixture of I(0) and I(1) variables. It is worth noting that this approach is not appropriate for I(2) series. Another advantage is that it is yields robust cointegration results even with small samples (Pesaran et al., 2001). Moreover, different variables can be assigned different lag-lengths in the model. The ARDL framework for equation (5) is given as

$$\Delta lnY_t = a + \sum_{i=1}^{p} \emptyset_i \Delta lnY_{t-i} + \sum_{i=0}^{p} \theta_i \Delta ln\,K_{t-i} + \sum_{i=0}^{p} \gamma_i \Delta ln\,H_{t-i} + \sum_{i=0}^{p} \varphi_i \Delta lnO_{t-i} +$$
$$\sum_{i=0}^{p} \omega_i \Delta lnP_{t-i} + \pi_1 ln\,K_t + \pi_2 ln\,H_t + \pi_3 ln\,O_t + \pi_4 ln\,P_t + \varepsilon_t \qquad\qquad [7]$$

where Δ is the difference operator and ε_t is the random error term which is assumed to be serially independent. $\emptyset_i, \theta_i, \gamma_i, \varphi_i, \omega_i$ and π_i are coefficients to be estimated. The other regressors can equally be used as dependent variables and are tested for long run relationships. In order to conduct the bounds test for the long run relationship, we rely on an F-test of the hypothesis, $H_0: \pi_1 = \pi_2 = \pi_3 = \pi_4 = 0$ against the alternative $H_1: \pi_1 \neq \pi_2 \neq \pi_3 \neq \pi_4 \neq 0$. Rejection of H0 implies a long run relationship. In order to make this decision, the computed F-statistic is compared with lower and upper bounds at the critical values provided in Pesaran et al. (2001). The lower bound is under the assumption that all variables are I(0) whereas the upper bound is based on the assumption that all variables are I(1). The decision rule is that if the computed F-statistic falls below the lower bound, then there is no cointegration. If the F-statistic exceeds the upper bound, then there is cointegration. Finally, if the F-statistic falls within the bounds, the result is inconclusive. If we are able to establish the presence of cointegration, then we proceed to estimate the long run and short run error correction models. For the purpose of this study, the long run and short run models are not stated since there is no evidence of cointegration.

2.2   Data and Summary Statistics

This empirical work employs historical annual time series data on real gross domestic product, inflation, openness to trade, secondary school enrolment and investment for the period of 1970-2010 to examine the contribution of higher openness to growth. Other relationships such as educational policy (school enrolment), investment and the level of inflation will be tested against the economic growth of Brunei Darussalam.

The data for the empirical analysis are from two separate sources: World Bank Development Indicators (WDI) and Penn World Version 7.1. Brief details of each variable are given in Table 1.

Table 1.

Variable Sources

Variable	Notation	Source of data
Real Gross Domestic Product (GDP)	Y	Penn World version 7.1
Openness At 2005 Constant Prices (%)	O	Penn World version 7.1
Investment Share of PPP Converted GDP per capita at current prices	K	Penn World version 7.1
School Enrolment, Secondary (% Gross)	H	World Development Indicator (WDI)
Inflation Rate	P	World Development Indicator (WDI)

Note: Data for Brunei from Penn World is available only up until 2010

There are two categories of openness proxies; there is a measure of trade volumes and measures of trade restrictions. This study uses the measure of trade volume, which is the sum of exports and imports divided by GDP. The second category includes measures of trade barriers that include average tariff rates, export taxes, total taxes on international trade, and indices of non-tariff barriers.

Figure 1 presents the log of the series over the period 1970-2010. The dynamic paths of the series are dissimilar, as can be seen from the figure.

Figure 1.

Log Series of Variables
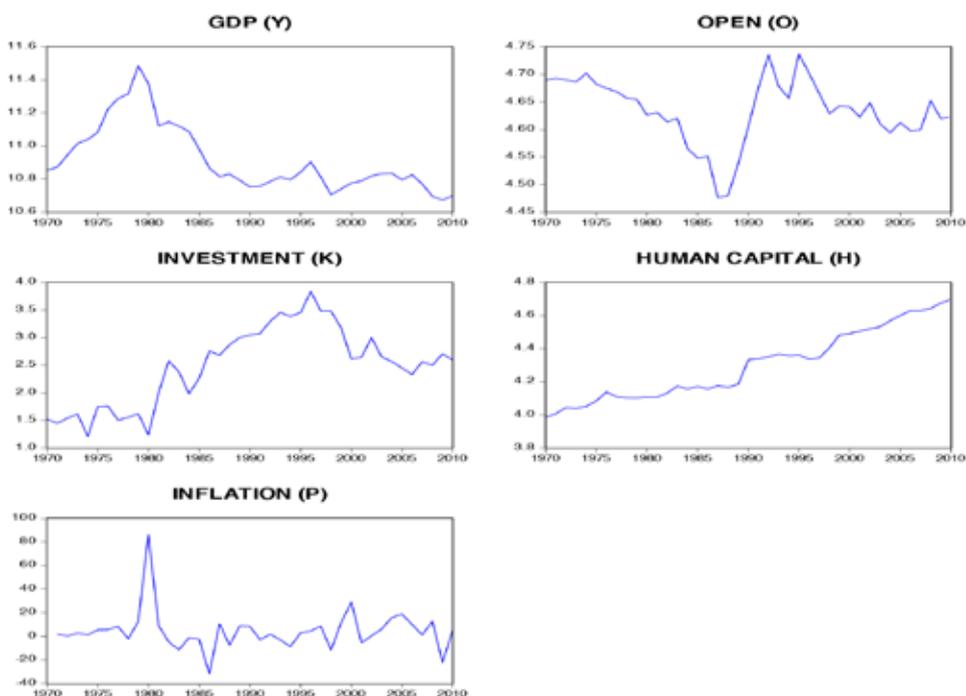
Note: The figure shows the plots of the variables over the period 1970-2010.

Table 2 shows the descriptive statistics for the variables. The mean figure for real GDP is 10.9204, which as expected is greater than the mean values of the other variables. Around this same period, the standard deviations of the variables are low compared to their mean values, suggesting little volatility within the period under review. With the exception of Y and P, the other variables are normally distributed given that the probability value for the Jarque-Bera test is not statistically significant.

Table 2.

Descriptive Statistics

	Y	O	K	H	P
Mean	10.9204	4.6326	2.5008	4.3092	4.3481
Median	10.8310	4.6359	2.5859	4.3340	2.7537
Std. Dev.	0.2045	0.0588	0.7054	0.2105	17.0318
Skewness	1.1073	-0.7496	-0.1763	0.3492	2.5592
Kurtosis	3.3045	3.6479	2.0749	1.7776	14.8662
Jarque-Bera	8.3288	4.4453	1.6335	3.3033	278.3421
Probability	0.0155	0.1083	0.4419	0.1917	0.0000

Note: The table reports the summary statistics for the log of variables at annual frequency from 1970 to 2010. H, K, P and O denote human capital, physical capital, inflation and openness, respectively.

Table 3 shows the correlation matrix, together with the p-values shown in parenthesis, for the variables from 1970-2010. A quick glance at the figures in column 2 indicates that investment (K), human capital (H) and inflation (P) have a significant correlation with real GDP growth (Y). Conversely, trade openness does not show any significant correlation with Y. In general, the correlation between the independent variables is low, which implies that there is a low possibility of having problems related to multicollinearity.

Table 3.

Correlation Coefficients

Correlation (Probability)	Y	O	K	H	P
Y	1.0000				

O	0.1395	1.0000			
	(0.3908)	-----			
K	-0.6957	-0.0650	1.0000		
	(0.0000)	(0.6903)	-----		
H	-0.6903	-0.0608	0.5298	1.0000	
	(0.0000)	(0.7095)	(0.0004)	-----	
P	0.3079	0.0611	-0.3046	-0.0177	1.0000
	(0.0533)	(0.7078)	(0.0560)	(0.9135)	-----

Note: The table presents the estimated correlations between the variables over the period 1970 to 2010. P-values are shown in parenthesis. H, K, P and O denote human capital, physical capital, inflation and openness, respectively.

3.0   Empirical Analysis

3.1   Unit Root Test

According to Phillips (2001), a time series is stationary if its mean and variance are constant over time and the covariance between two values from the series depends on the length of time separating the two values, and not on the actual times at which the variables are observed. The Augmented Dickey-Fuller test is a formal test among many other tests for unit root in a time series sample. According to ADF testing protocol procedure, a random variable is considered as stationary if the absolute ADF value is higher than any of the absolute MacKinnon values.

Table 1 presents the ADF unit root test on all the series, where each of the series has unit root and becomes stationary after first difference, except inflation, which is stationary at different level. Thus, we proceed to take the first difference of the variables that require first differencing. The

change in a variable also known as its first difference, is given by Figure 2 shows that all the series are stationary after taking the first difference.

Table 4.

Augmented Dickey-Fuller Unit Root Test

	Trend		Trend and Intercept		Order of Integration
	Levels	1st Difference	Levels	1st Difference	
Ln Y	-1.0259	-4.4627 [a]	-2.3312	-4.4626 [a]	$I(1)$
ln O	-2.0509	-5.5083 [a]	-1.9907	-5.5083 [a]	$I(1)$
ln K	-1.6518	-6.0529 [a]	-0.7119	-6.0529 [a]	$I(1)$
ln H	0.2835	-5.8333 [a]	-2.3636	-5.8333 [a]	$I(1)$
ln P	-5.5554 [a]		-5.4907[a]		$I(0)$

Note: a denotes significance at 1% level. Lag length for the test is based on AIC.

Figure 2.

First Difference of Variables
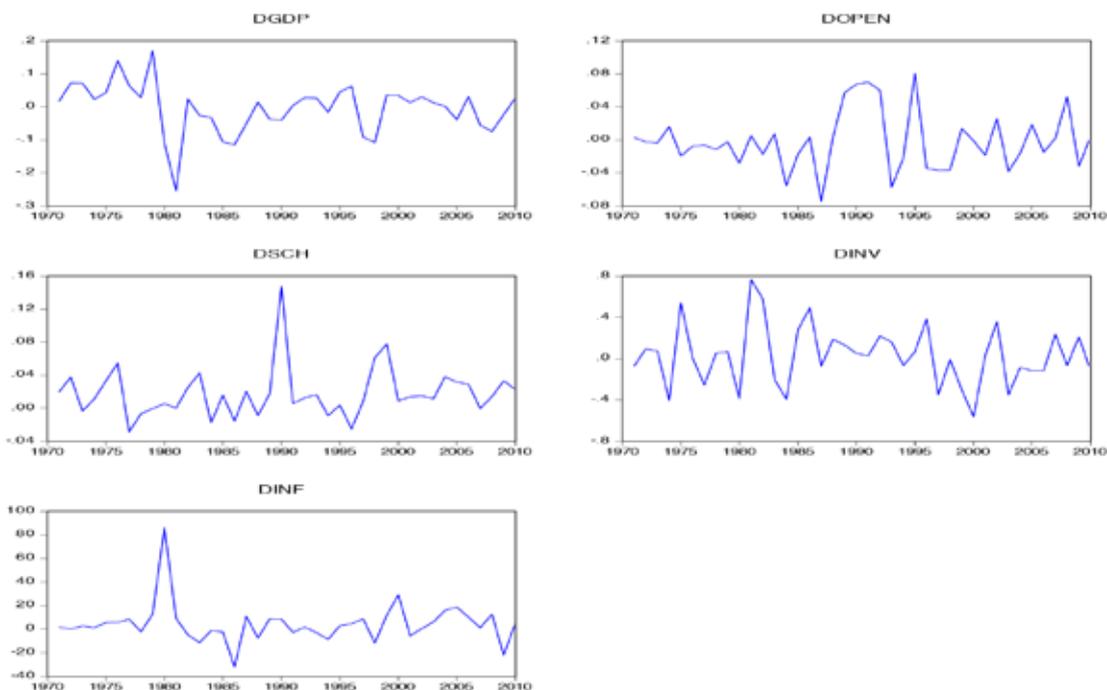
Note: The figure shows the stationary result of each instrument variable used in the study

3.2 Regression Results

The estimated ordinary least squares (OLS) regression results are shown in Panel A of Table 5 Panels B and C show the measures of goodness-of-fit and the diagnostic tests, respectively.

The individual regression coefficients have different implications for the economic growth of Brunei Darussalam. Trade openness, measured as exports and imports as a ratio of GDP, is the variable of interest. The estimated coefficient for openness (O) is found to be positive but statistically insignificant as the p-value exceeds the threshold of 5%. This finding is in contrast with the theoretical reasoning that posits that openness policies would improve growth. In addition to openness, the investment coefficient shows an unexpected sign (-0.0723) and is statistically insignificant. This is inconsistent with existing theories that incremental changes in investment (always) improve economic growth.

The coefficient for human capital (0.3615), which represents the educational or literacy level of Brunei Darussalam, is revealed to be positive and statistically significant. Secondary school enrolment was used as a proxy for this variable. The implication is that any increase in secondary school enrolment rate or improvement of the educational system has a positive stimulating effect on economic growth and development in Brunei Darussalam. Policies that result in increased secondary school enrolment or improving this is a catalyst for increased economic growth and greater social welfare in this society, hence for its economy. The inflation rate, expressed as the percentage change in CPI, is among the coefficients that show a negative and significant relationship with real GDP. This result is as expected and consistent with findings of previous authors such as Borensztein et al. (1998), Ayanwale (2007) and Li (2004). Current research by Frimpong and Oteng-Abayie (2010) indicates that an inflation rate above the threshold level of 11% can have negative impacts on economic growth. However, since Brunei has been able to maintain a low inflation rate over the years this should not be a cause for concern.'

Table 5.

OLS Regression Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Panel A: OLS Results				
a	-0.0129	0.0173	-0.7433	0.4627
H	0.3615[b]	0.1580	2.2875	0.0289
K	-0.0723	0.0625	-1.1565	0.2560
P	-1.0932[c]	0.6079	-1.7983	0.0816
O	0.0046	0.2776	0.0166	0.9868
$AR(1)$	0.3452[c]	0.1780	1.9394	0.0613
Panel B: Goodness-of-fit				
Adjusted R^2	0.2544		DW	2.0183
F-statistic	2.1836			
	(0.0806)			
Panel B: Diagnostics				
BGLM F-stat	0.1154			
	(0.9679)			
ARCH LM	1.3560			
	(0.2706)			

Note: The table presents the estimated OLS regression results over the period 1970 to 2010. H, K, P and O denote human capital, physical capital, inflation and openness, respectively. b and c denote statistical significance at 5% and 10%, respectively. BGLM denotes the Breusch-Godfrey serial correlation LM Test. ARCH refers to the Heteroskedasticity Test.

The R^2 and adjusted R^2 are measures of goodness-of-fit of the model, which examine the correlation between the sample values and the predicted values. They denote the percentage change in the dependent variable (Y) which is explained by the independent variable. Over the space of 40 years, the estimated regression shows a very low coefficient of determination, R^2, equivalent to 26% and adjusted R^2 of 13%. In effect, the independent variables explain about 25 % of the variation in real GDP growth. The error term or residual literally holds approximately 75% of exogenous variables, which have possibly been omitted from the regression analysis. The F-statistics, 2.183, is statistically significant, giving the impression that variations in the independent variables significantly affect the growth of Brunei economy. The Durbin-Watson Statistic is an impressive 2.018298, showing no sign of a first order serial autocorrelation.

3.2.1   Diagnostic Tests

To check for robustness of the regression estimates, we conducted heteroskedasticity and autocorrelation tests on the error residuals. Panel C of Table 5 shows the Breusch-Godfrey Serial Correlation LM Test (BGLM) and the ARCH LM test for heteroskedasticity. The F-statistic for the BGLM test is 0.1154 and the corresponding p-value, 0.9679, indicates the absence of serial correlation in the error residuals. This is further confirmed by the Q-statistic probabilities shown in the correlelogram of residuals in the appendix. The large p-value for the ARCH test also supports the null hypothesis of homoskedastic errors, which is a desirable outcome.

Multicollinearity exists when the independent variables in the model are correlated. In other words, two or more of the independent variables contribute overlapping information. To find out whether there is multicollinearity, a formal test needs to be conducted. Although it does not affect our predictive capabilities, it affects the interpretation of the regression coefficient. The variance inflation factor (VIF) is a formal test used to detect multicollinearity. The test calculates the coefficient of determination, , between each independent variable in the model. If a VIF for a β parameter is greater than 5, then multicollinearity is present in the model. Table 6 shows the VIF calculations for the model. Following a 5% rule of thumb, all the Brunei-Darussalam variables exhibit no trace of overlapping.

Table 6.

Variance Inflation Factor

Variable	Uncentered VIF	Centered VIF
ln H	1.3566	2.1590
ln K	1.4000	1.9847
ln O	1.0361	2.1590
ln P	1.5446	1.6339

Note: Table shows the uncentered and centered variance inflation factors. If the VIF for a β parameter is greater than 5, then multicollinearity is present in the model

3.3 Granger Causality

As a further step to verify the results obtained from the OLS estimation, we conducted a Granger causality test to find the causal linkage between GDP growth and the various independent variables under the null hypothesis that there is no causality. The results are presented in Table 7. From Table 7, we can infer that there is no causal relationship between the Real Gross Domestic Product (Y) and openness (O) as well as school enrolment (H). In the case of inflation and growth, the result in table 7 below suggests that the direction of the causality is from growth

to inflation as the Granger causality statistic is significant at the 5% level. However, there is no reverse causation from inflation to growth since the Granger causality statistic is statistically insignificant. Finally, for physical capital the result suggests that the direction of the causality is from growth to capital but not otherwise. The inference here is that as the economy grows more, the amount of investment inflows, which could be FDI, is likely to improve as well.

Table 7.

Granger Casualty Tests Results

Dependent Variable	Null Hypothesis	P- Value	Decision
	Y does not Granger Cause O	0.9849	Accept H0
	O does not Granger Cause Y	0.5248	Accept H0
	Y does not Granger Cause H	0.14988	Accept H0
Y	H does not Granger Cause Y	0.9183	Accept H0
	Y does not Granger Cause P	0.0066	Accept H0
	P does not Granger Cause Y	0.1797	Accept H0
	Y does not Granger Cause K	0.0104	Accept H0
	K does not Granger Cause Y	0.2236	Accept H0

Note: Reject H0 if the p-value > the critical value; otherwise rejection of H0 means there is no Granger causality.

3.4 Cointegration Testing Analysis

Based on the outcome from Granger causality, the result exhibits ambiguity, since there is no clear path by which the future prospect of Brunei Darussalam can be predicted by the dependant variable. Therefore, a cointegration analysis is carried out to determine the existence of a long run relationship between the real GDP and its covariates (inflation, investment, secondary school enrolment and openness to trade). Essentially, cointegration is used to check if the independent variables can predict the dependent variable mostly in the future (long run). By using cointegration test analysis on the historical data, we can predict the future performance prospects of the Brunei economy. The long run relationship among the variables was examined using the bounds cointegration testing approach proposed by Pesaran et al (2001) within the ARDL framework. This approach is more appropriate since we have a mixture of $I(0)$ and $I(1)$ variables; that is not all the series are stationary at all levels.

Table 8 presents the results of the bounds test of cointegration for growth, openness and the other variables. From the result, we do not reject the null hypothesis of no cointegration when GDP growth is normalised in the model, since the F-statistic is below the lower bound critical values at 1%, 5%, or 10%. This result suggests that there is no long run steady state relationship between GDP growth and the independent variables. It also implies that openness, inflation,

physical capital and human capital are not long run forcing determinants of growth in Brunei. In other words, the previous investment driven policy, the secondary enrolment rate, the mechanism controlling the inflation rate in Brunei and the current openness policy structure give no impetus to the economic performance of Brunei Darussalam in the long run.

Table 8.

Bounds Test For Cointegration Relationship

Critical value bounds of the *F*-statistics intercept and no trend						
K	90%		95%		99%	
	I (0)	*I* (1)	*I* (0)	*I* (1)	*I* (0)	*I* (1)
4	2.20	3.09	2.56	3.49	3.29	4.37
Model		Calculated F-statistic			Inference	
$F_i(gdp|open, inv, inf, sch)$		1.7149			No Cointegration	

Note: Critical values are extracted from Pesaran et al. (2001); k is the number of regressors.

4.0 Conclusions and Policy Implications

A large body of literature has investigated the relationship between openness and growth. Yet the nature of relationship between trade openness and growth remains controversial, calling for further empirical analysis. This paper has investigated the impact of trade openness on the rate of economic growth of Brunei. As a secondary aim, the paper investigated the impact of other factors, such as human capital, physical capital and inflation rate, on the rate of economic growth for Brunei. The empirical analysis was carried out using OLS regression, Granger causality tests and the bounds cointegration approach within the ARDL framework.

Based on the OLS regression results, we do not find a statistically significant relationship between openness and rate of economic growth. Similarly, there is no significant relationship between physical capital and growth. However, we found human capital and inflation to be significant determinants of growth in Brunei. The paper also investigated the long run relationship between GDP growth and its covariates using the bounds cointegration approach within the ARDL framework. The test result indicates that there is no long run relationship between openness, economic growth and the other variables for the period 1970-2010. Thus, openness and physical capital are not important in explaining both the short run and long run dynamics of GDP growth. In contrast, human capital and inflation show significant impact on GDP growth in the short run but not in the long run.

Taken together, these results suggest that the opening up of Brunei's economy to international trade has not yet had a statistically significant impact on the growth of its economy. Given the positive and significant impact of the human capital proxy on growth, policies promoting higher

education and skills development are likely to have a positive impact on its growth and could be pursued vigorously. Maintaining the current rate of low inflation should continue to guarantee the macroeconomic stability of Brunei. This is needed to attract foreign investment and might help bolster Brunei's growth.

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APPENDIX

Table A1.

Correlogram of Residuals

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	0.035	0.035	0.0183	
		2	0.049	0.048	0.0594	0.807
		3	0.018	0.015	0.0653	0.968
		4	-0.002	-0.006	0.0654	0.996
		5	-0.136	-0.138	0.5085	0.973
		6	-0.007	0.002	0.5100	0.992
		7	-0.105	-0.093	0.8813	0.990
		8	-0.065	-0.055	1.0585	0.994
		9	-0.180	-0.174	2.8681	0.942
		10	0.038	0.038	2.9883	0.965
		11	0.006	0.018	2.9954	0.982

Note: The table shows the Q-statistic probabilities adjusted for 4 dynamic regressors.

Macroeconomic Consequences of Potential Population Ageing in Brunei

Muhammad Shahid Siddiqui

Abstract

UN population projection shows that Brunei will face more stringent ageing growth than the global average and even the US ageing growth, if it follows business as usual policy strategies. In the absence of addressing ageing issues, Brunei will observe ageing effects in its macroeconomic activities with a decline in its per capita output, consumption and savings. To mitigate the ageing effects, Bruneian policies should address the issues of low fertility rate and potential old age dependency. To raise the fertility rate, levelheaded social strategies such as some monetary transfer, further rationalization of paid maternity leave for working women, and the initiatives of childhood education and care allowances contingent with family income could be helpful. These incentive policies, however, should be contingent on a monitoring mechanism that can control the dynamics of fertility rate whenever it exceeds a desired level in the future. To reduce old age dependency, policies should be made that: i) promote human capital with the emphasis on financial literacy and ii) ensure access to diverse financial products through capital market diversification. Strategies along these lines would enable young and middle generations to enhance their productivity and savings, which ultimately would motivate these generations to work longer than their predecessors. The link between high life expectancy and longer retirement age would partially resolve the issues of labour supply shortage. As productivity growth is considered as a core to reduce the macroeconomic issues of ageing, in-depth investigation in this direction requires a country-specific study on age-productivity linkages.

This paper was presented by Muhammad Shahid Siddiqui while he was working as a Senior Research Fellow at CSPS. He received his Ph.D. in Economics from the University of Ottawa, Canada. In addition, he has high experience of conducting research and policy analyses at inter-continental level, including North America, South Asia, and South East Asia. His research interests include environmental and energy economics and macroeconomic modeling. He has published his research and analytical works in reputed international journals.

1.0   Population Ageing in Brunei

Population ageing is occurring in almost all countries at different rates. Based on the United Nations (UN) population forecast, the world will face this ageing issue throughout the 21st century. This is an outcome of declining fertility rates that, along with the declining mortality and thus increasing life expectancy, are accounting for a significant transformation in the global age structure. A low fertility rate (with high life expectancy) promotes a situation where ageing not only grows over time but it also grows across generations. People of age 60 and above will be representing around 21 per cent (i.e., around 1.5 billion) of the projected world population by 2035. This share will further increase to around 27 per cent by 2050. It can be seen from Figures 1(a)-1(b) that the trends of the shares of seniors (i.e., 60+) relative to the economically active people (i.e., 15-59) and the young (i.e., 0-14) are continuously increasing.

Now let us review the current and the projected demography of Brunei and compare it internationally. Currently, Brunei is among the countries that are experiencing a lower proportion of seniors (i.e., 60+) relative to the working age groups (i.e., 15-59) and the young generation (i.e., 0-14) as compared with world average levels (Figures 1a-1b). However, a continuous decline in the fertility rate in Brunei would cause its seniors to grow faster than their counterparts in the world (on average) and even in the United States (US). The trend in the fertility rate in Brunei, which has already crossed below the trend of the world average fertility rate in late 1990s, is expected to fall below that of the US trend after 2035 (Figure 1(c)). Therefore, the ratio of seniors relative to the economically active population will be higher in Brunei than the world average by 2025 and the US by 2045 (Figure 1(b)). Brunei will also exceed the world ratio of seniors to the young population by 2020, while it will exceed the same ratio for the US by 2040 (Figure 1(d)).

In addition to the international comparison, it will also be interesting to review the distribution of the Bruneian population by age cohort over time. The pyramids in Figure 2 show the dynamic changes in Brunei's demography by age groups. In 2005, the Bruneian population was quite concentrated among the people below age 40 with the largest age cohort 30-34. By 2050, the pyramid showed a shift of the population towards the ageing people with the largest age cohort 45-50. By 2075, the population distribution would become quite reversed (i.e., a shift

Figure 1.

**Projected Population Ageing and its Sources, by Selected Countries and globally**
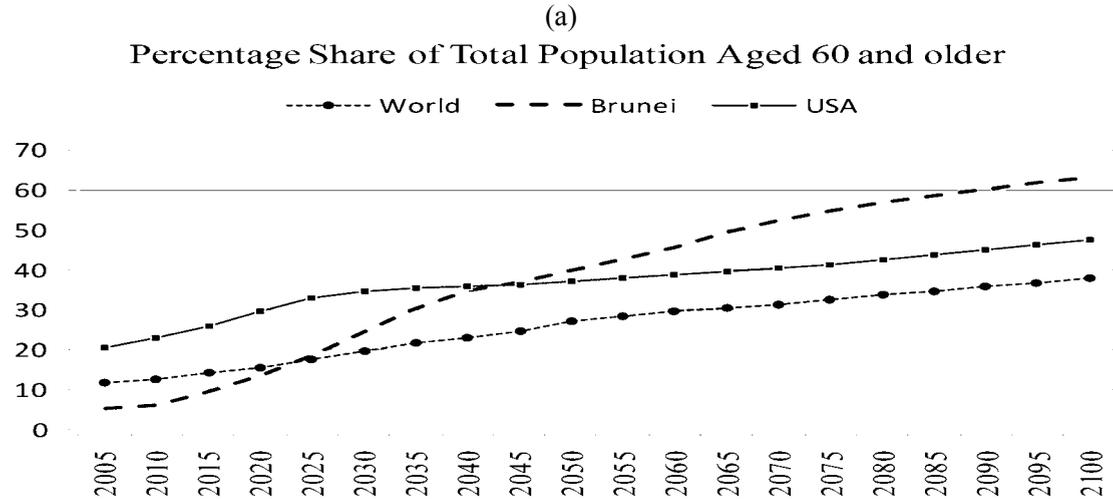
(a)

Source: United Nations, Department of Economic and Social Affairs, Population Division (2013).

(b)

Source: United Nations, Department of Economic and Social Affairs, Population Division (2013).

(c)

Source: United Nations, Department of Economic and Social Affairs, Population Division (2013).

(d)

Percentage Share of those Aged 60 and Older relative to the Age Group 0-14

---•--- World — — — Brunei —■— USA
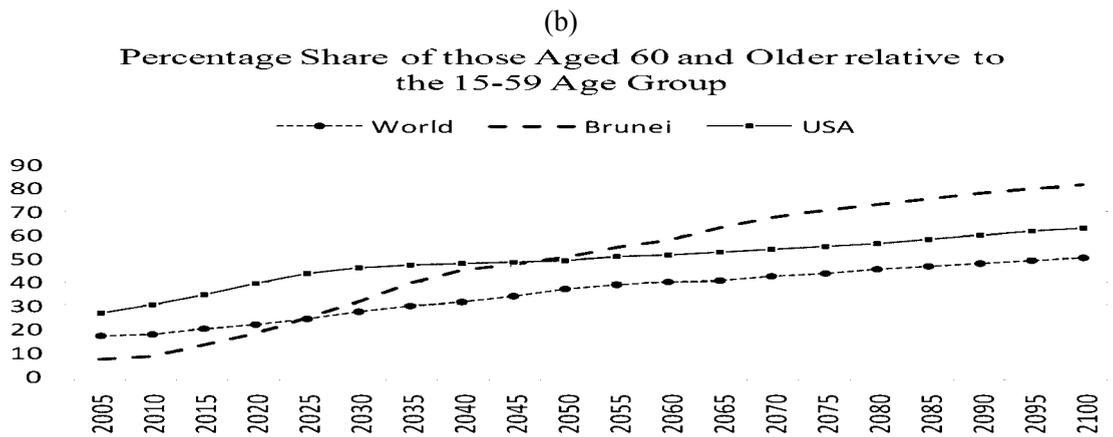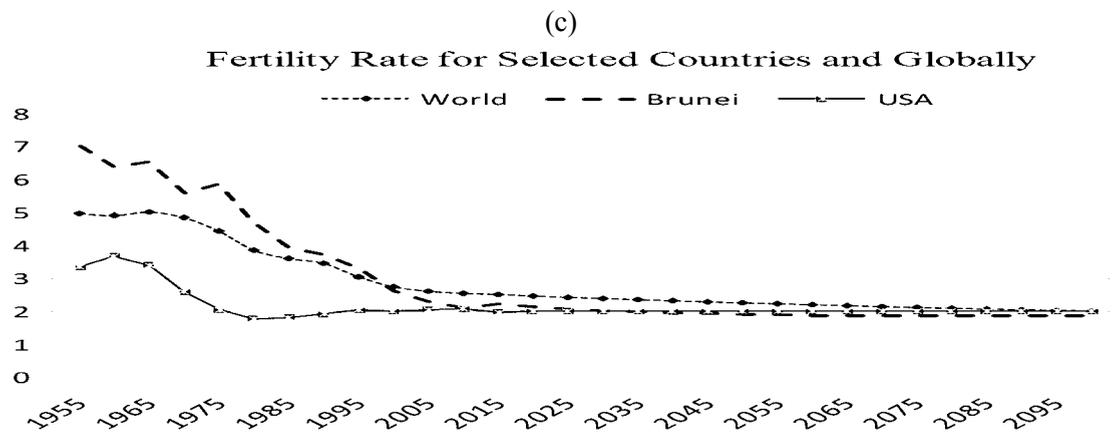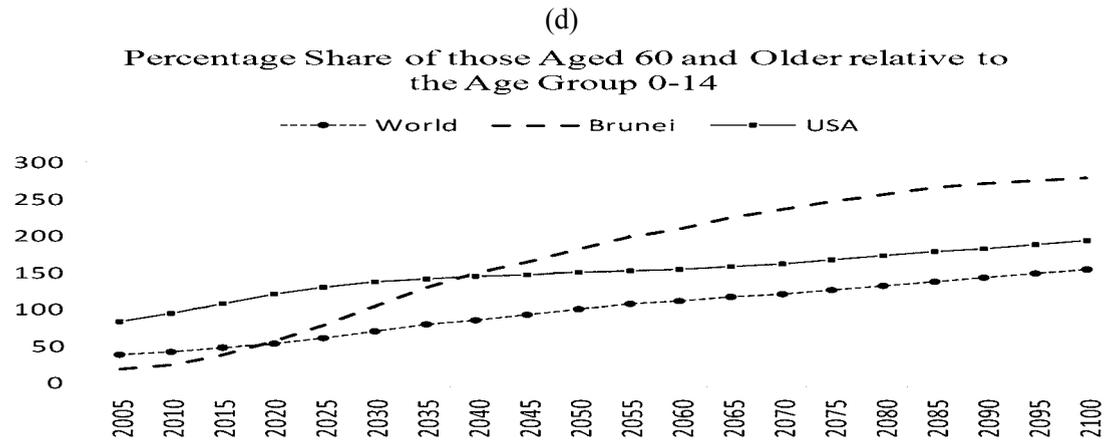
Figure 2.

Population Distribution of Brunei, by Age Cohort over Time (Estimated and Projected)
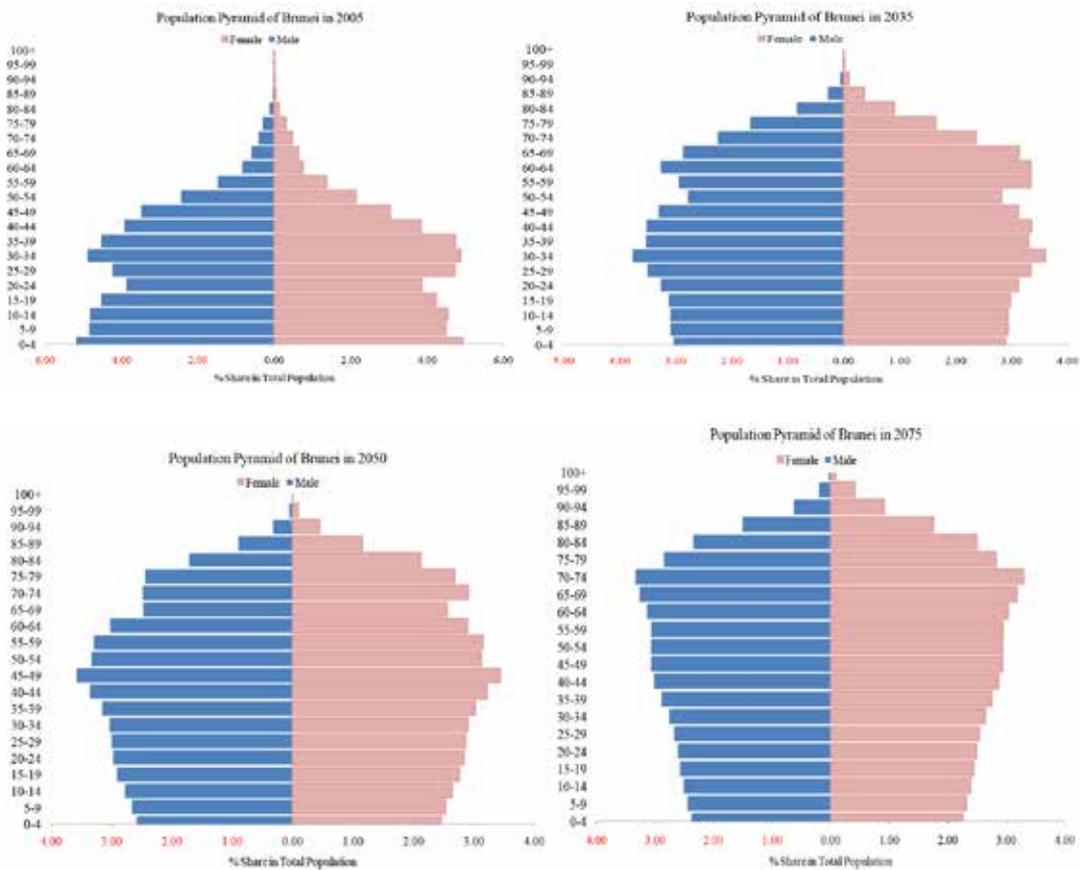
towards a cone shape as compared to 2005; a large portion of the population would be moving towards an more aged profile with the largest age cohort 70-74. These projections indicate that

Brunei will enter population ageing in the near future. Therefore, identifying the ageing issues and their pros and cons in the country's economy will remain crucial from a policy perspective. However before discussing the ageing-induced issues, it will be worth mentioning the possible causes of low fertility and mortality rates that are the roots of population ageing.

2.0   Causes of Low Fertility and Mortality Rates

The literature on demography has suggested several causes of low fertility rates. The most prominent is female participation in education and workforce without having levelheaded[8] social infrastructure such as childcare facilities, family collaboration, housekeeping sharing with the partner, and monetary transfer support from government. One of the most promising aspects of societies in the 20th century was to recognize women's rights in the participation of socio-economic activities at regional and global levels. Naturally, the work-family time balance and the efforts in economic participation generate constraints for women and thus compromises as regards childbearing, which is another significant aspect associated with them. The main outcome of such constraints for women is the delay in birth (Becker, 1981; McDonald, 2000). Therefore, women require policy intervention that can minimize their tradeoff between childbearing and their career aspirations.

Until the 1980s, many industrialized countries experienced a significant negative relation between female socio-economic participation (i.e., in education and workforce) and fertility rate (Figures 3 and 4). However, the negative relation becomes weaker for many developed countries after the 1980s due to changes in the institutional context such as childcare availability and attitudes towards working mothers; nonetheless the participation of females in education and workforce in these countries has also increased over time (Figures 3 and 4). Many countries have introduced policies such as baby bonus, paid maternity and parental leaves, and early childhood education and care benefits to enhance their fertility rates. For example, the social expenditure per head for maternity and parental leaves in Sweden has increased from US$ 180 in 1995 to US $309 in 2011 (Table 1). Similarly the childcare allowance per head in Australia increased from US $42 in 1995 to US $254 in 2011. Therefore, the cross-country correlations of the total fertility rate and female labour force participation rate for 10 OECD countries turned from negative to positive co-movements over time (Figure 5); a similar intuition is also provided by Engelhardt et al. (2004).

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8 The term levelheaded infrastructure refers to a "high class or efficient" infrastructure. This term is commonly used in the literature of science and social science (see Pligt, Ester, and Linden 1983; Anderson, K.L., 1933)

Figure 3.

Link in the Trends between Female Labour Force Participation and Fertility Rate in Selected Countries
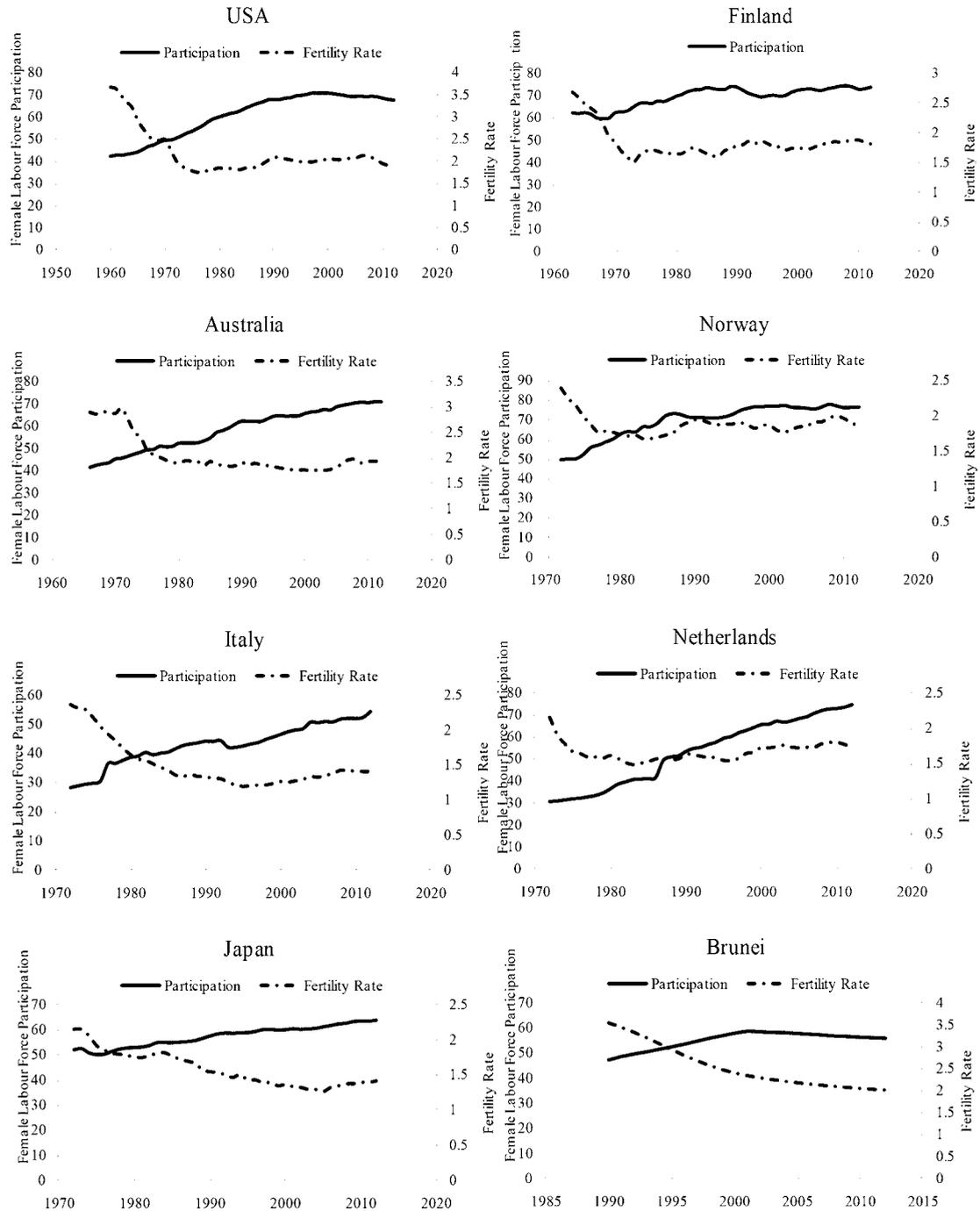
Source: Data for total fertility rate (births per woman) is taken from the World Development Indicators while the data for the female labour force participation rate is taken from OECD.

Figure 4.

Link in the Trends between Female Tertiary Education and Fertility Rate in Selected Countries
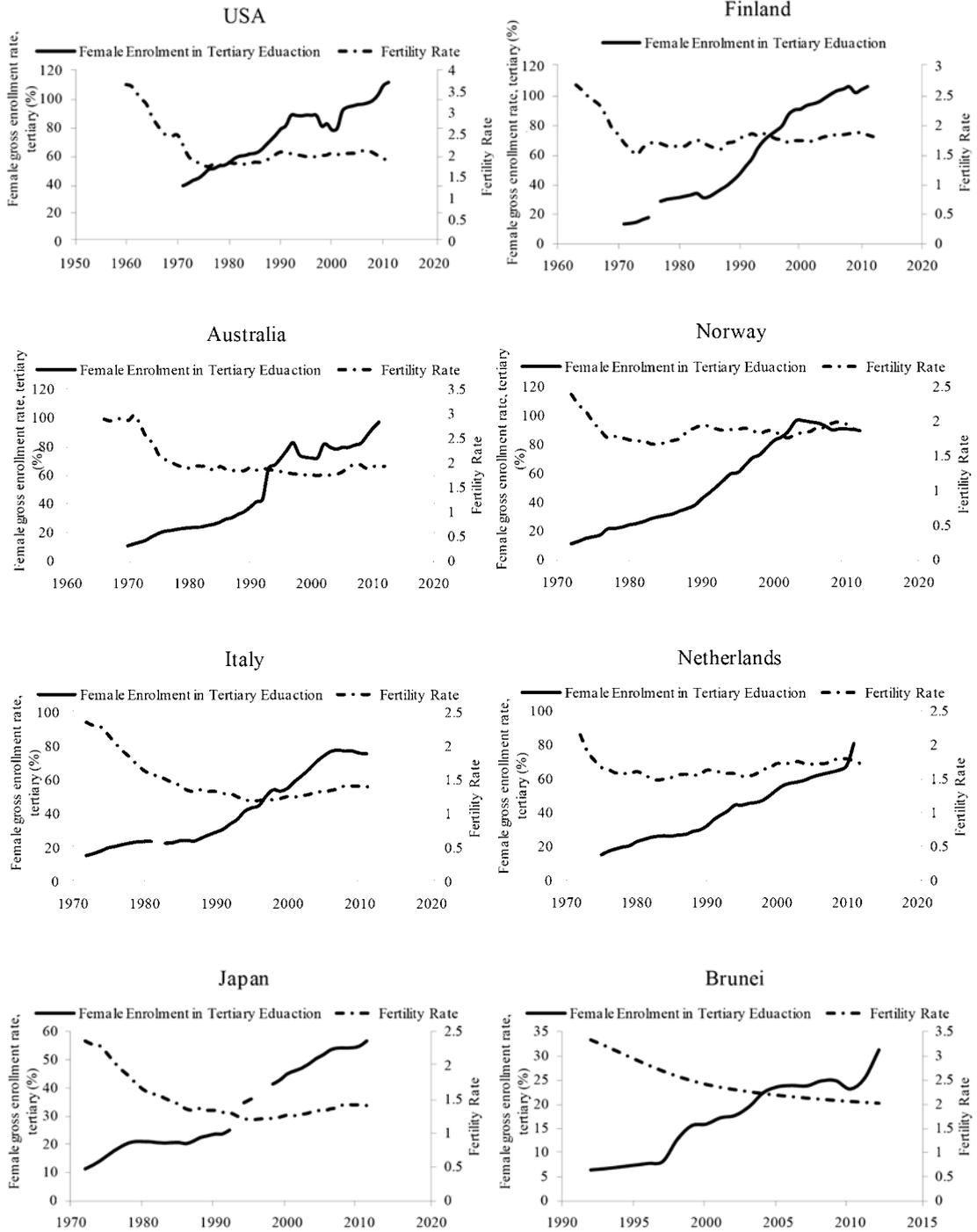
Source: The World Development Indicators

Table 1.

Public and Private Social Expenditure per Head (at Current Prices and Current PPPs, in US dollars)

Country	1995	2000	2007	2010	2011
	Family Allowance				
Australia	248	608	644	699	743
Canada	145	186	299	307	304
Finland	288	270	284	295	295
France	243	273	407	417	421
Japan	25	37	101	217	236
Sweden	205	234	289	281	290
	Maternity and Parental Leave				
Australia	2.9	8.6	42	55	70.9
Canada	36	33	106	115	117
Finland	202	164	228	277	282
France	65	99	102	107	106
Japan	22	27	44	62	67
Sweden	180	151	259	296	309
	Early Childhood Education and Care				
Australia	42	106	164	237	254
Canada	28	42	80	89	92
Finland	196	247	327	396	425
France	151	309	362	432	453
Japan	54	77	112	144	155
Sweden	302	295	537	623	664

Source: OECD

Table 5.

Cross-Country correlations of the total fertility rate and female labour force participation rate for 10 OECD countries*, 1972-2012
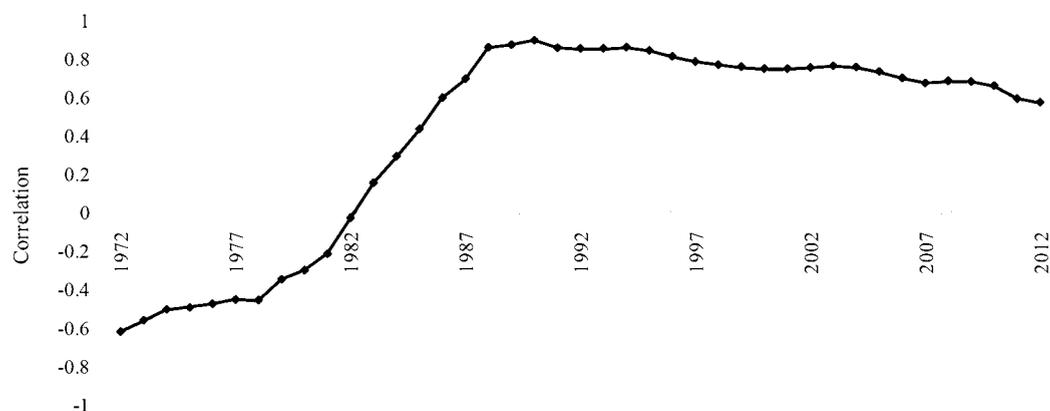
Source: Data for total Fertility rate (births per woman) is taken from the World Development Indicators while the data for the females' Labour force participation rate is taken from OECD. "*" include Australia, Finland, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, and the United States

Now let's review the trends in fertility rate and female socio-economic participation in Brunei. The fertility rate in Brunei is continuously declining; even though the female gross enrolment and labour force participation rates in Brunei are still low relative to the other sevlected countries (Figures 3 and 4). Hence, to match the female socio-economic participation in Brunei with those in advanced countries, the females in Brunei should be encouraged to enhance their participation in tertiary education and ultimately professional activities. However, it also requires complementary

policy strategies that should match the facilities that the working women in advanced countries acquire with the facilities which the women in Brunei currently receive to manage their resources and time constraints in their work-family balance. The low mortality rate, which leads to increased life expectancy, is basically the main cause of population ageing. There are several possible reasons for the reduced mortality rate such as improvements in healthcare facilities, occupational environment, nutritional intake, life style, earnings and education. Remarkable advancement in medical technology in term of diagnosis of diseases as well as their treatment (including therapies) is one of the factors that reduce mortality. For example, Cutler et al. (1999) conducted clinical studies and assessed that the heart attack mortality fell by almost one-third between 1975 and 1995 due to the progression in medical treatment used in the management of acute myocardial infarction. Fries et al. (1996) found that the consistent use of modified antirheumatic drug-based treatment could reduce the long-term disability in patients with rheumatoid arthritis by up to 30 percent. Innovation in cataracts has considerably reduced blindness in old age (Costa, 1998). Similarly, Kahn (1998) emphasized that the new medications have increased diabetic quality of life. Hence, the advancement in medical treatment causes almost all countries in the world to reach a low mortality rate (World Mortality Report, 2013). The mortality rate in Brunei was more than 200 per 1000 adults in 1960. Recently, it reduced to less than 100 per 1000 adults by 2012. This, among other factors, causes positive impacts on life expectancy in Brunei, which increased from around 62 years (both sexes) in 1961 to around 78 years in 2012 (Figure 6(a)).

Rising incomes can increase individuals' affordability of consuming better food, housing, sanitation, and medical care. In contrast, a low income, with low qualities of basic human needs, causes poor health conditions. For example, crowded conditions can cause valvular heart disease (through rheumatic fever), tuberculosis, and other respiratory diseases. Barker and Lackland (2003) emphasized that areas of England and Wales with high stroke mortality were characterized in the past by poor living conditions. As income is one of the factors that can positively influence life expectancy, Figure 6(b) shows a positive link between the trends in per capita GDP and life expectancy in Brunei. Based on the data used in Figure 6(b), there is a strong correlation (0.85) between per capita income and life expectancy in Brunei.

Another factor that causes positive impacts on life expectancy through health care, lifestyle, and others is education. Many studies find evidences of a strong positive relationship between education and adult health (Elo & Preston, 1995; Ross & Wu, 1995). For example, studies show that education helps people in the cessation of smoking, drinking and other addictions. Since higher levels of education are associated with the heavy discount of current consumption relative to the future, highly educated people behave more rationally about their health and lifestyle than those with less education. Similar evidence is seen between higher education and life expectancy

for Brunei in Figure 6(c); there is a strong positive correlation (0.97) between the trends in tertiary education and life expectancy.[9]

Figure 6.

Possible Causes of Increased Life Expectancy in Brunei

(a)

Link between Adult Mortality Rates and Life Expectancy in Brunei

Source: WDI

(b)
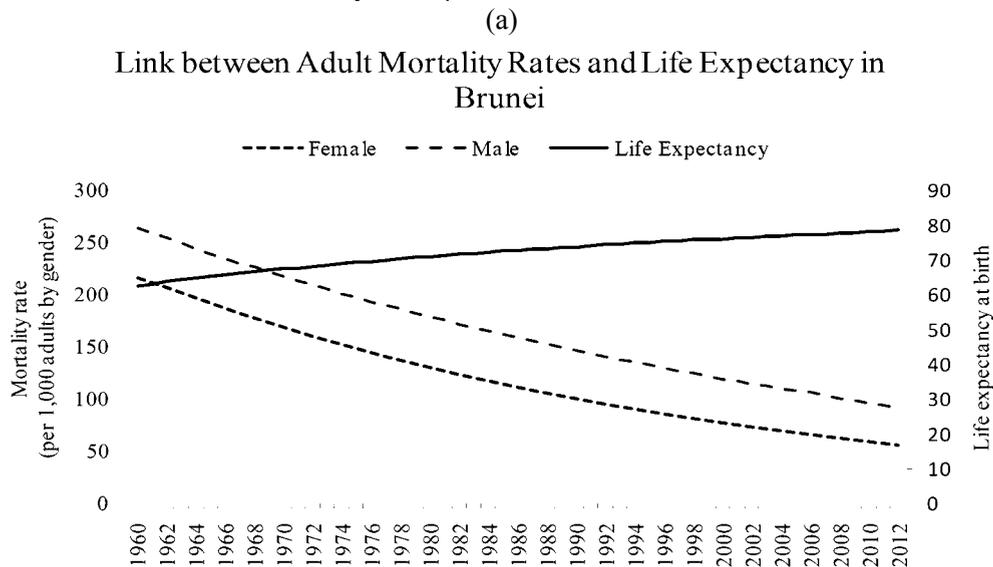
Link between Income per Capita and Life Expectancy in Brunei
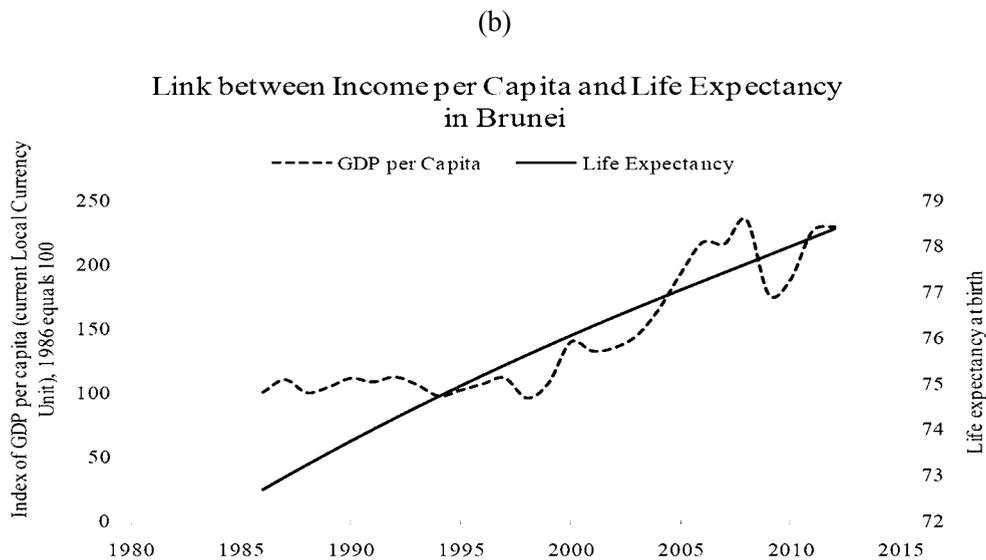
Source: WDI

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9 The link between education and life expectancy can further be investigated by using a more advanced statistical approach such as Granger causality, which might be desirable but not feasible for this paper due to data and time constraints. However, the message of linking between these two variables is delivered even from the correlation approach.

(c)

Link between Tertiary Education Attainment and Life Expectancy in Brunei

Source: WDI
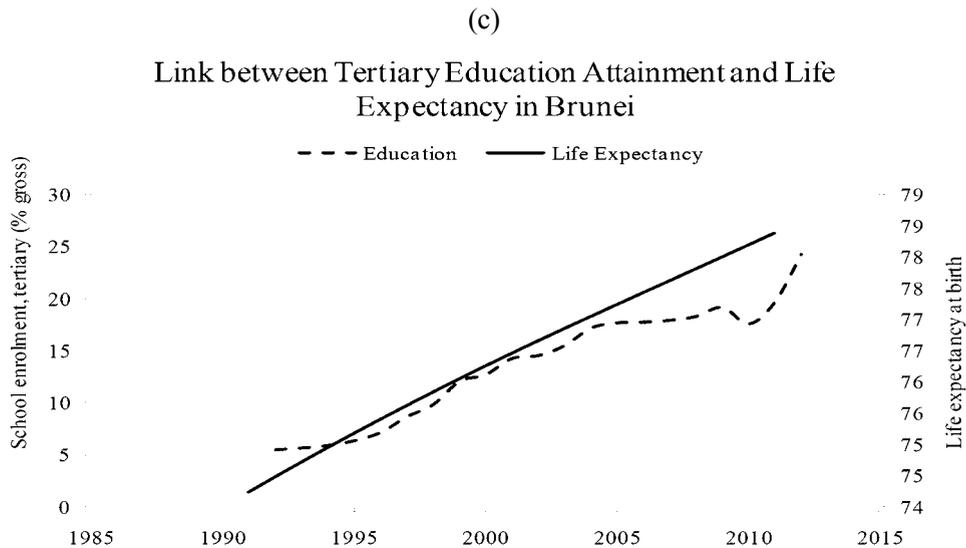
Overall, the increase in life expectancy, due to the scientific and social developments mentioned above, per se is a positive achievement of the society. Here the main focus of the strategies should be to streamline the learning and saving opportunities for each generation so that they can modify their economic decisions in accordance with their life expectancy.

However, the causes of declining fertility rates need to be addressed as they account for the main issue of population ageing: the growing share of ageing people relative to the younger generations. Therefore, an increase in the fertility rate is, in fact, highly contingent on the incentives that the policy would provide to women. However to control the dynamic of the fertility rates, it also requires a monitoring mechanism such that whenever the trend in the fertility rate exceeds a desired level in the future, the policy should also respond to that situation accordingly. This monitoring approach will allow the policy makers to stabilize the population by age-cohort over time. Notice that the monitoring mechanism embeds alternative policy options depending on the trend of fertility rate over time.

3.0   Issues Related to Population Ageing

Population ageing is associated with several socio-economic issues that a country could experience such as changes in public social expenditure, saving behaviour, labour supply and productivity, and industrial structure.

3.1 Public Social Expenditure

Population ageing can affect public social spending through non-contributory social schemes such as the provisions of healthcare, pension and housing facilities. The impact of ageing on national healthcare expenditure depends on how healthy the senior people are in their additional life.

Figure 7.
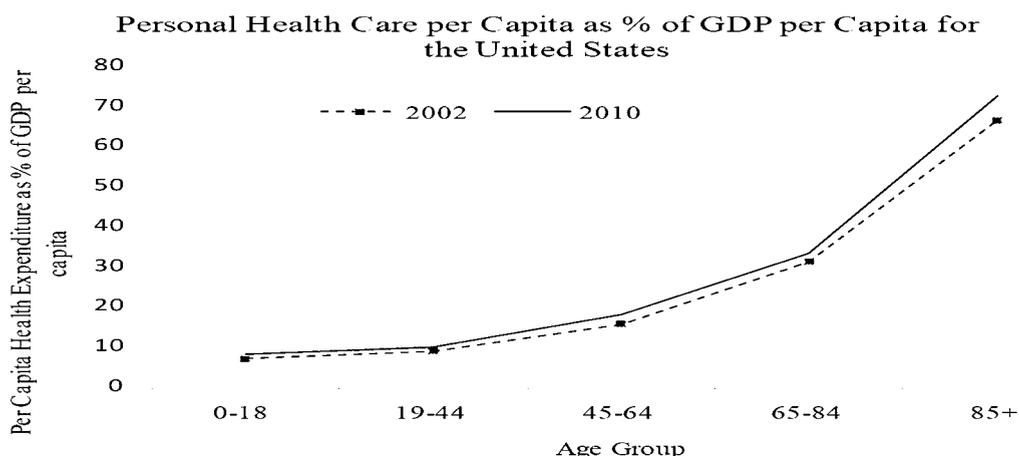
Source: Centers for Medicare and Medicaid Services, Office of the Actuary, National Health Statistics Group

Table 2.

Expected Health Care Expenditure by Age and Sex at Different Classes of Hospital Wards in Singapore (In Singapore Dollars)

Class of Wards	Gender	Age Cohort		
		0-14	15-64	65 and Above
A	Male	222.4	233.8	1175.9
	Female	188.9	216.3	1036.9
B1	Male	185.4	194.0	980.0
	Female	157.4	180.0	864.0
B2	Male	74.6	78.5	394.6
	Female	63.4	72.6	34.8
C	Male	64.1	67.4	338.8
	Female	54.4	62.3	298.7

Source: Reisman (2009)

Note: the data in the table is taken from Figures 2.16a-2.16d of Reisman's book on Social Policy in an Ageing Society: Age and Health in Singapore.

Figure 8.

Public Health Expenditure by Age Groups across Regions in 2013 (as % of GDP per Capita)
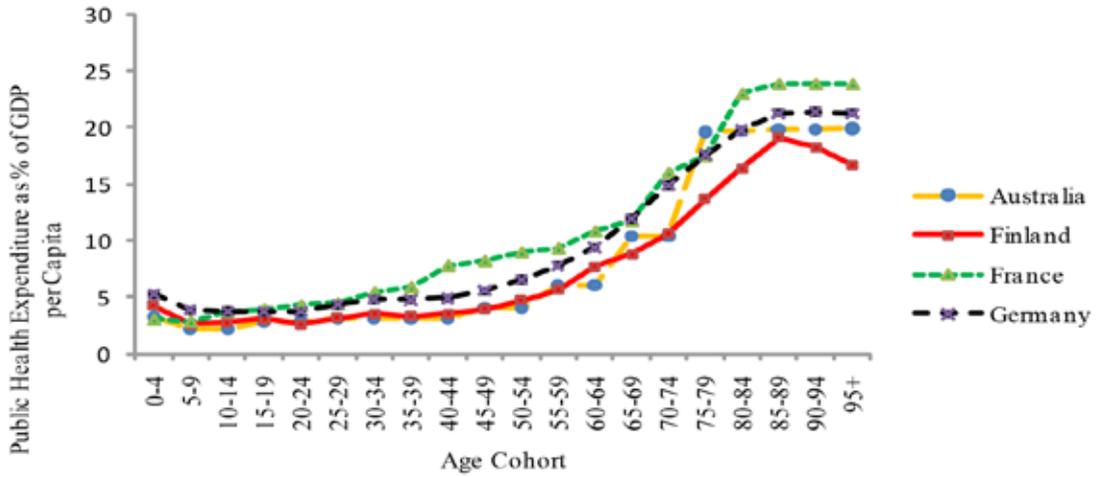
Figure 9.

Government Expenditure by Age Groups in Canada in 2011 (In billions of Canadian 2011 Dollars)
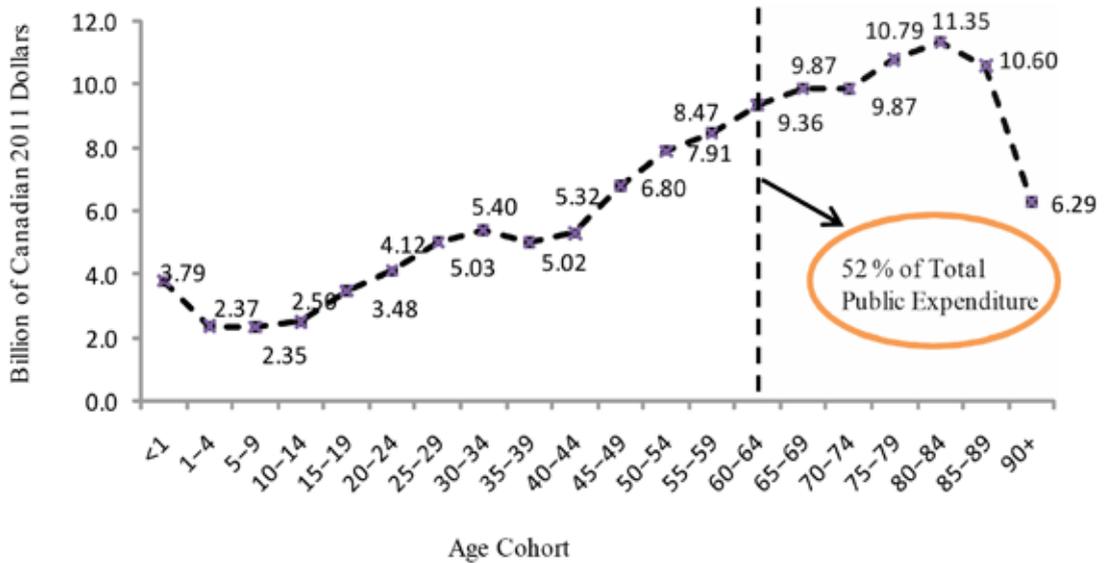
Figure 7 shows that the seniors spend more on personal health relative to the young generation in the US, while this expenditure gap has increased over time (i.e., between 2002 and 2010). This shows that the per capita health expenditure, among ageing people in the US, increases faster than the increase in the per capita national income. If this evidence can be generalized for other countries, especially for those which provide universal health coverage, then ageing is expected to increase their public healthcare expenditure. The magnitude of the effect, however, depends on several things, such as the number of ageing people and the general health conditions among seniors.

Reisman (2009) estimated the healthcare expenditure in Singapore by age and sex for different classes of wards (Table 2). For each class of ward, the people aged 65 and above spend quite a lot more than the other age cohorts. Similarly, the per capita public healthcare expenditure in some selected countries such as Australia, Finland, France, and Germany showed a positive link with the age profile (Figure 8). While reviewing the total government healthcare expenditure in Canada by age cohort, it shows that the people aged 60 and above covered around 52 per cent of government healthcare expenditure (Figure 9), given the fact that Canada offers a universal healthcare system.

To visualize the potential healthcare aspects of population ageing in Brunei, the expected public healthcare expenditure on seniors of age 60+ are estimated (Table 3), which is based on the total government health expenditure in Brunei in 2010. Since the data for public health expenditure by age group is not readily available for Brunei, therefore, to decompose total public health expenditure in Brunei by age 0-59 and 60+, the Canadian data for the total government health expenditure by age groups in 2011 is used. Here, there is a similarity in two countries in the sense that both follow the universal healthcare system. The Canadian data shows that the 60+ age group covers around 52 per cent of total Canadian public health expenditure in 2011. However, there is a gap in the size of the 60+ age group in the two countries. For instance in 2010, the share of the 60+ age group in the Bruneian population is around 5.7% relative to around 25% of the same age group in the Canadian total population. Therefore, the Canadian share of health expenditure by the seniors is adjusted to the share of the relevant age group in Brunei for 2010. By using the above approach for the age-specific decomposition of health expenditure in Brunei, the public health expenditure by age 60+, in Brunei, is estimated around BND 45.93 million in 2010. This 2010 estimate is used as a benchmark to develop several other scenarios on the public health expenditures on Brunei's seniors (i.e., age 60+) for the projected periods. Notice that the above calculation provides an approximation that might vary from the actual value, which requires more precise data information. Also, the estimates in Table 3 are not

Table 3.

Alternative Scenarios of Selected Public Social Expenditures through Projected Population Ageing in Brunei

Reference year	Projected Population of Age 60 and older*	Projected Old Age Dependency Ratio*	Expected Public Health Expenditure on Seniors of Age 60 and older (In million of Brunei 2010 Dollars)**				Old Age Pension ++ (OAP) In Million of BND
			Expenditure increases with growth rate of senior population (Scenario I)	Expenditure increases with 70% of growth rate of senior population (Scenario II)	Expenditure increases with 65% of growth rate of senior population (Scenario III)	Expenditure increases with 50% of growth rate of senior population (Scenario IV)	
2015	36977	13	59	41	38	30	111
2020	54449	18	87	61	57	44	163
2025	74560	24	119	83	78	60	224
2030	97816	32	156	110	102	78	293
2035	120033	39	192	134	125	96	360
2040	136405	45	218	153	142	109	409
2045	145219	47	232	163	151	116	436
2050	154715	51	248	173	161	124	464
2055	163707	54	262	183	170	131	491
2060	170639	58	273	191	177	136	512
2065	179561	63	287	201	187	144	539
2070	185935	67	297	208	193	149	558
2075	190189	70	304	213	198	152	571
2080	192765	73	308	216	200	154	578
2085	194266	75	311	218	202	155	583
2090	194972	78	312	218	203	156	585
2095	194837	80	312	218	203	156	585
2100	193670	81	310	217	201	155	581

The calculation is not inflation adjusted and reflected mostly 2010 BND. Inflation adjustment may increase the monetary value of the table.
* The projected population is based on medium fertility rate (i.e., 2.06) used by United Nations, Department of Economic and Social Affairs, Population Division (2013). ** The calculation is based on total government health expenditure in Brunei in 2010. This aggregate value is decomposed into expenditure on age 0-59 and 60+ by using the Canadian data of government health expenditure by age groups in 2011. The Canadian data shows the age group 60+ and covers around 52 per cent of the Canadian public health expenditure in 2011. Since the age of 60+ in Brunei is around 5.7% of the total population in 2010 (i.e., based on Brunei Darussalam Statistical Yearbook 2011) relative to around 25% in the Canadian the same year, it is estimated that the age group 60+ in Brunei covers around 11% of Brunei's total public health expenditure in 2010. '++ calculation is based on per capita BND250 per month.

Source: United Nations, Department of Economic and Social Affairs, Population Division (2013). National Health Expenditure Trends, 1975 to 2013, Canadian Institute for Health Information. Health Information Booklet 2012, Ministry of Health, Brunei Darussalam,Brunei Darussalam Statistical Yearbook 2011.

inflation adjusted, so they reflect the OAP and old age public healthcare expenditure at 2010 Brunei dollars. Addressing inflation adjustment will further increase the size of public social expenditure.

Scenario I reflects a situation in which the Bruneian seniors would be quite healthy in the future. This causes the public health expenditure on seniors to increase by only 50% of their population growth; still the size of public health expenditure on this age group will reach to more than double (i.e., around 96 million of 2010 Brunei dollars) in 2035 relative to the benchmark year 2010. Scenarios II and III allow public health spending for the seniors to increase by 65% and 70% of their population growth, respectively. These flexibilities would cause the size of public expenditure for this group to increase to around 125 million and 134 million 2010 Brunei dollars by 2035, respectively. Scenario IV refers to a more plausible situation, in which the health

expenditure on the seniors increases with the same growth of their population. However, this scenario accounts for the public health expenditure for this group to reach around 192 million 2010 Brunei dollars by 2035. Certainly, there are many other scenarios that could be generated depending on the assumption of health conditions of the Bruneian seniors over time.

Another outcome of population ageing in Brunei would be the increase in Old Age Pension (OAP) expenditure. Based on the estimated and projected population by the UN (Table 3), the estimates of OAP will increase from around BND 66 million in 2010 to 360 million 2010 Brunei dollars in 2035. Table 3 also shows the old age dependency ratio (i.e., the percentage share of retired people relative to the economically active age group), which will increase from 13 percent in 2015 to 51 percent by 2050. A high dependency ratio could make it difficult for Brunei to adopt any Pay-As-You-Go (PAYG) approach in the future to support its non-contributory social security schemes. Therefore, the non-contributory social security expenditures, at a high dependency ratio, will lead to a high public debt-to-GDP ratio because of the difficulties for the government in increasing public savings due to the increase in public social expenditure on seniors. An alternative approach would be the compulsory superannuation schemes to increase retirement and other contribution rates by the employers and employees; which would however be challenging if the additional rate makes the overall contribution rate reasonably high. Moreover, implementing this approach may lead to another issue of crowding out of private and public savings from capital investment if the pension fund is not linked to portfolio diversification.

3.2   Change in Saving Behaviours

Ageing can affect not only the size but also the composition of private savings. The size effect is dominated by the general impression that old age dependency leads to dissaving, while the composition effect depends on crowding out of discretionary savings due to the additional pension savings that people undertake because of increase in life expectancy. Notice that private discretionary saving is a main source of capital investment in an economy.

Let's first discuss the composition effect. According to the simple life-cycle theory (e.g., Ricardian Equivalence Hypothesis), an additional unit in the mandatory social security scheme would crowd out one unit of voluntary or discretionary private saving (Barro, 1974). The intuition is that households may accumulate less non-pension net worth in response to higher future promised social security and pension benefits. However, the simple life-cycle theory has some limitations as it does not take into account the growth factor and other motives such as liquidity constraints, precautionary saving, portfolio options and bequests. For example, if people save due to one of these motives (such as precautionary saving), a small increase in pension saving may not substantially crowd out voluntary private savings.

There is a broad range (i.e., 0 to 1) of crowding out between households' pension and non-pension savings that the literature empirically shows. Feldstein (1974) found that an additional dollar of social security would offset 30-50 cents of private savings. Gale (1998) found offset effects upwards of 80 cents per dollar. Certainly, there is a lot of other research that shows different magnitudes of crowding out effects, which are contingent on the timing and demography of data, methodology, and the treatment of sample selection bias. However, the common thing in the literature is that the increase in pension saving, somehow, has a crowding out effect on non-pension private savings depending on the country-specific situation; countries are heterogeneously at different stages of population ageing. For instance, the US showed population ageing earlier than Brunei, while the latter is expected to have a more stringent ageing issue that the former faces (Figure 1(b)). In term of the policy perspective, the message transmitted from this discussion is that a policy towards an additional mandatory social security contribution should be linked with supporting policies that are designed to motivate age-specific voluntary and discretionary private savings.

The size effect is related to the variation in households' motivation for saving depending on their age. Generally, longevity (or increase in life expectancy) has positive effect whereas dependency (i.e., age near or after retirement) has a negative effect on savings. Thus, the two sides of households' life-cycle can affect aggregate households' saving by offsetting each other. The life-cycle theory suggests that rational people discount their current consumption by saving more for their future consumption (or retirement purpose) to make their consumption smooth over a lifetime. To make the longevity-induced increase in savings more dominating, policies to promote asset portfolio diversification and financial literacy can play significant roles, because longevity may lead to a growing amount of saving generated by pension reform.

Thus, the knowledge and options of portfolio composition with some share of risky assets (i.e., volatility in the assets' prices) would offer a higher expected return on productive capital. Poterba (2004) shows the probability that households (by age cohort) own different types of financial products. Based on his findings, there is a high probability that economically active people would prefer to hold risky assets such as common stocks and bonds, while these products are less likely to be held by retired people (i.e. 65+ in the US). It is expected that the longevity would motivate economically active people to increase their portfolio in the risk-based financial market. Therefore, policies should make it plausible that the relevant generation has financial literacy and access to the target financial markets.

3.3   Labour Supply and Productivity`

The impacts of population ageing, brought about by low fertility and mortality rates, are also reflected in the labour market. Europe, which is among the pioneer regions that observed ageing issues (Figure 10), now faces a non-trivial decline in the economically active population as well as future workforce groups (i.e., 0-14). In the short-term, the shortage of labour supply could, somehow, be managed through an increase in the retirement age and flexible immigration policies in the continent. The latter option, however, would lead to long-run distributional changes in the region.

The UN population projection for Brunei is analogous to Europe beyond 2020 (Figures 10-11). After 2020, Brunei could experience an ageing-induced shortage in the local labour supply through several dimensions: i) a sharp increase in the population of seniors (i.e., 60+) would lead to a direct effect on the size of the local labour force ii) a decline in the size of the economically active population would refer to the second round effect of the ageing on the local labour supply; the declining trend of this group would also reduce the scope of longevity effects on the total private savings iii) a continual decline in the size of the future workforce, which would also limit the scope of human capital growth in the country (notice that human capital is generally accumulated either

Figure 10.
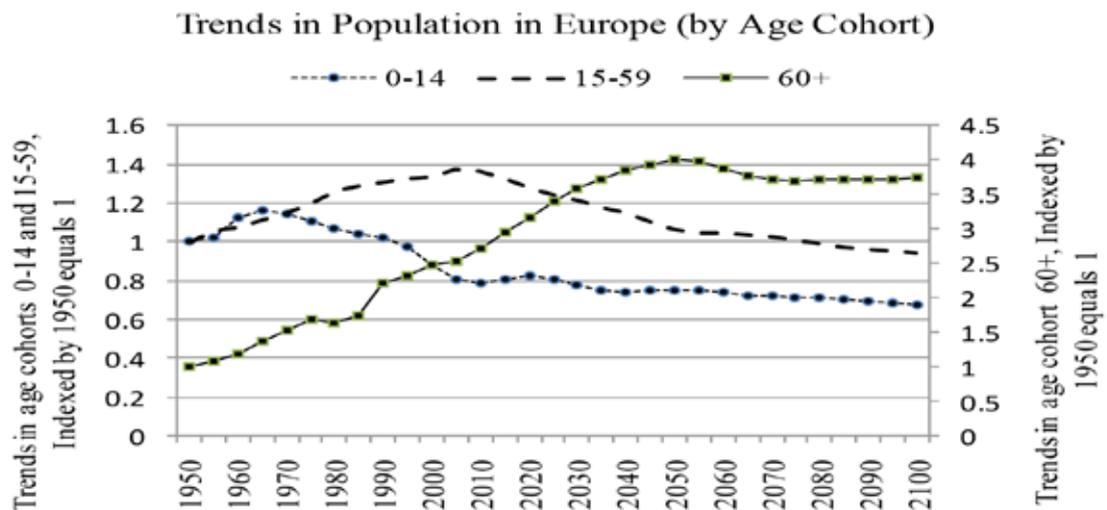
Trends in Population in Europe (by Age Cohort)

Source: United Nations, Department of Economic and Social Affairs, Population Division (2013)
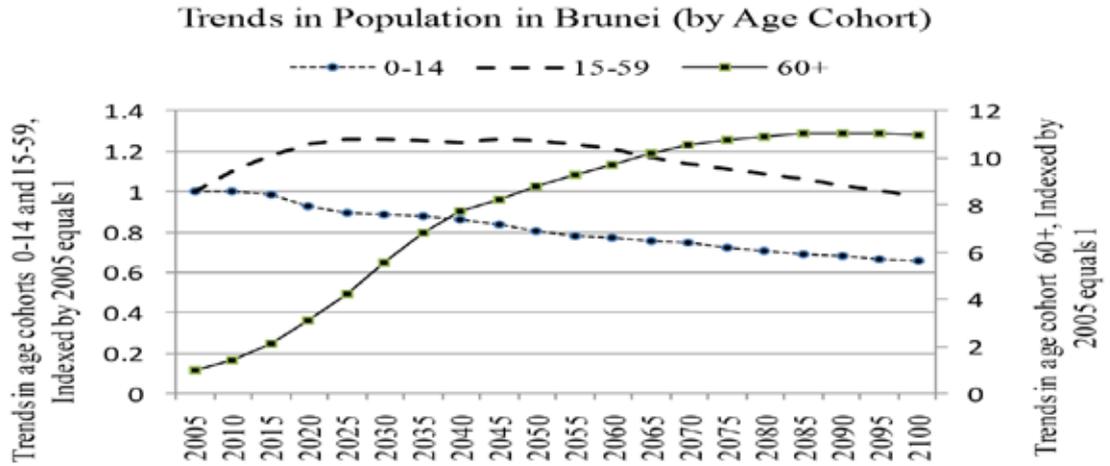
Figure 11.

Source: United Nations, Department of Economic and Social Affairs, Population Division (2013)

Figure 12(a).

Estimated relative labour productivity by age of sales staff and office workers (Age 45 = 1.0)
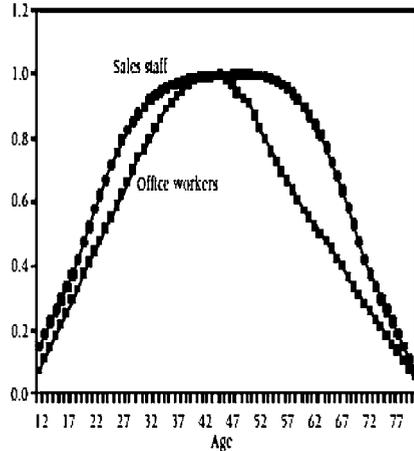
Source: Kotlikoff and Wise (1989).

Figure 12(b).

The modern age profile of earned income
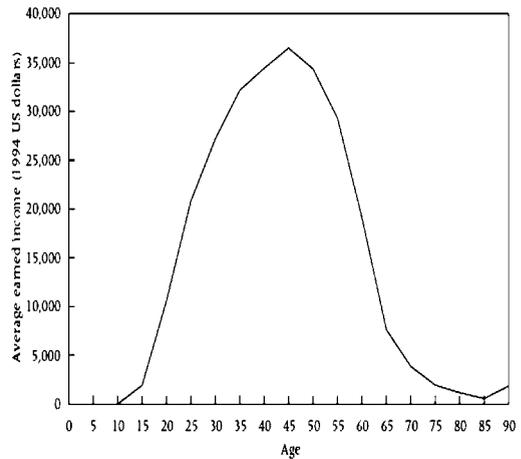
Source: Edwards (2008)

before joining professional careers or in the early stage of professions). Hence, the ageing issue in Brunei would affect not only the local labour supply but also the saving behaviour and the knowledge endowment of the country. However, as discussed earlier, the issue of the local labour supply could be mitigated by increasing the retirement age and hiring foreign workers. The policy that is linked with the retirement age can, to some extent, alleviate the ageing issues related to the local labour supply, social security expenses and saving. However, whether the increase in retirement age can improve labour productivity is still uncertain.

Some of the literature suggests that unless there is an increase in productivity, population ageing will take the economic growth towards tail off (Scarth, 2007). The literature on ageing and productivity can be broadly categorized into econometric-based and growth-based. Most of the econometric-based literature shows an inverted-U shaped link between age structure and productivity. While evaluating the productivity by age-cohorts, Mincer (1974) found that moving 5 percent of the population from the 20–30-year age category to the 40–50-year age category would increase wages (and output) by 1–2 percent, and would decrease output afterward. Kotlikoff and Wise (1989) evaluated the age-productivity relation by using confidential data originating from a major US service enterprise. They found that the peak age for productivity for sales staff and office workers is at 45 (Figure 9a). Edwards (2008) used current population survey data (1992–1996) for the US male per capita earning incomes by age cohorts and found inverted-U shaped links between age structure and productivity with a peak age between 45-50 (Figure 9b). Feyrer (2008) used cross-country data for 87 countries during 1960-1990 and showed an inverted-U shaped relation between age composition and labour productivity with the peak age 40-49. There are several other examples (Jones, 2005) that showed the age-productivity relation as an inverted-U shaped. The core of all this literature is that the extension of the retirement age may partially resolve the labour supply but would not represent optimal labour productivity, which could be obtained mainly by a middle-aged labour force.

Contrary to the econometric models, the literature on endogenous growth models shows a positive impact of longevity (i.e., life expectancy) on productivity. Generally, the literature on endogenous growth models can be represented by Romer's (1986) learning by doing, Lucas's (1988) human capital, and Romer's (1990) R & D activities. Using the Romer (1986) learning by doing approach, Futagami and Nakajima (2002) showed that the longevity or delay in retirement would cause economic growth, which would be increasing because people would save more to increase their consumption after retirement. Notice that under this model the extra saving would go for capital investment, which under perfect production spillovers would cause an economy to grow with increasing returns to scale. Gruescu (2007) introduced population ageing to Lucas's human capital model, and showed that the income per capita is positively associated with labour productivity. Under this formulation, the lower the population growth rate is, the higher the skilled labour productivity that would be needed to keep positive per capita income growth. Increasing skilled labour productivity (through education and training) may, therefore, be seen as a policy tool to sustain economic growth under conditions of population decline. Prettner (2009) introduced ageing in an overlapping generation model with the features of endogenous R&D activities as suggested by Romer (1990). He showed that a decrease in mortality, which corresponds to population ageing, fosters economic growth. The intuition is that individuals who live longer are more likely to postpone current consumption into the future and increase

Table 4 shows the composition of Bruneians' monthly expenditures in different goods and services by different age groups. Since the data is based on 2005, let's assume that the tastes and preferences of the Bruneian seniors (i.e., 60+) are persistent over the projected periods. Under these assumptions, ageing in Brunei would raise the demand for goods such as food, beverages, and house-furnishing and maintenance products, and for services such as recreation and culture related products.

On the other hand, the demand would be reduced for goods such as clothing and footwear products and for services such as restaurants, hotel, and transport related products. Notice that households expenditure on health is very minimal in Brunei due to the universal health coverage. However, as discussed earlier, the ageing related public health expenditure in Brunei will be quite high in the coming decades.

Table 4.

Composition on Monthly Households Expenditures in Brunei Goods and Servcices (In %)

Goods and Services	Age Groups				
	0-24	25-39	40-49	50-59	60+
Food and Non_Alcoholic Beverages	10.4	12.0	12.9	14.5	19.0
Tobacco and Alcoholic Beverages	1.0	0.4	0.5	0.3	1.0
Clothing and Footwear	4.6	3.1	3.3	3.1	2.7
Housing, Water, Electricity, Gas and other Fuels	38.6	36.9	30.7	30.4	28.9
Furnishing, Household Equipment and Routine Household Maintenance	4.7	7.3	7.6	7.3	8.3
Health	0.2	0.7	0.5	0.7	0.8
Communication	4.3	4.2	4.6	5.2	5.1
Recreation and Culture	4.6	5.1	5.7	5.2	5.6
Restaurants and Hotels	10.5	4.9	4.9	6.2	4.8
Transport	16.8	16.2	16.5	17.4	15.3
others	4.3	9.2	12.8	9.7	8.5

Source: Household Expenditure Survey 2005

4.0 Macroeconomic Outcomes of Ageing

Ageing leads to change in almost all major elements of the macroeconomic structure of an economy that comprises aggregate output, saving, and consumption. Let's first explain the impact of ageing on aggregate output of the country through the following identity:

$$\frac{Y}{N} \equiv \frac{Y}{L} * \frac{L}{N} \quad (1)$$

Where Y, N, and L refer to aggregate output, total population, and economically active age groups, respectively. Equation (1) shows that the output per capita is a function of the labour productivity and support ratio (i.e., the share of people aged 15-59 in total population). Due to

population ageing, the support ratio in Brunei will decline (Figure 13), which requires labour productivity to increase to keep the same level of output per capita. However, as discussed above, age-specific productivity could be inverted-U shaped, which makes difficult for an economy to overcome the low support ratio by raising productivity through their ageing population. Now let's assess the impact of ageing on aggregate saving, which can be decomposed as follows:

$$\frac{S}{N} \equiv \frac{S}{L} * \frac{L}{N} \quad (2)$$

where S indicates the aggregate saving of an economy, while Equation (2) shows that the per capita saving equals the product of the saving per worker and the support ratio. Since the support ratio is expected to have a declining trend in Brunei (Figure 13), it requires savings per worker to increase. However, the saving would increase if the households are economically rational (i.e., they know financial information) and prefer to heavily discount (i.e., they have access to efficient financial markets) their current consumption over future. Another macro aspect that ageing influences the welfare of the economy, which can be represented as:

$$\frac{C}{N} \equiv \frac{Y}{N} - \frac{S}{N} \quad (3)$$

Where C indicates the aggregate consumption of an economy. After plugging Equations (1)-(2) into Equation (3), the per capita consumption can be shown as:

$$\frac{C}{N} \equiv \frac{L}{N} \left[\frac{Y}{L} - \frac{S}{L} \right] \quad (4)$$

Equation (4) shows that the per capita consumption is an increasing function of the support ratio and the labour productivity, while the increase in savings per worker would cause the current consumption to be deferred till the future. Again, due to a decline in the support ratio in Brunei (Figure 13), the per capita consumption is expected to have declining pressure unless the economy is able to enhance a sufficient level of labour productivity to offset the effects of the declining support ratio.

Figure 13.

Support Ratio between Countries and Globally
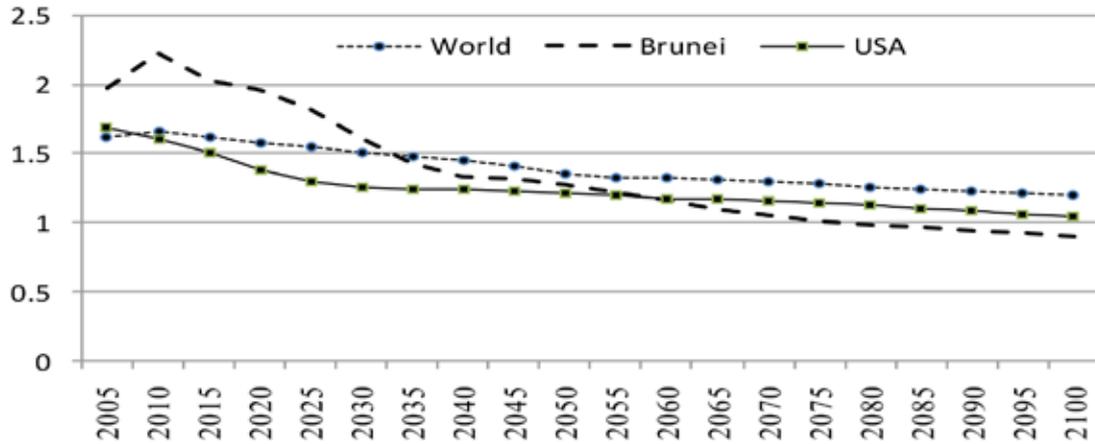
Source: United Nations, Department of Economic and Social Affairs, Population Division (2013).

In the system of national accounts, a decline in per capita consumption would lead to a decline in the GDP growth of the economy unless the effect of reducing the consumption is offset by increase in the investment and exports; however, both are challenging. The former demands a diversified capital market so that the aggregate savings could be transformed into capital investment. The latter refers to the competitiveness and ultimately the improved productivity, which is a non-trivial task for an ageing economy.

5.0   Conclusions

Ageing is a global issue, which is faced by many countries but in different times. Europe faced ageing earlier than the US, while Brunei is expected to face ageing issues starting from the coming decade. The UN population projection shows that Brunei will face even more stringent ageing growth than the average global level and even the US, if it does not include the ageing issue in its business as usual policy strategies. If ageing issues are not addressed, the country will observe ageing effects in its macroeconomic activities with a decline in its per capita output, consumption and saving. The impact of this would also be reflected in the fiscal and financial stability of the economy. Ageing will affect fiscal expenditure through the increase in public social expenditures on pensions, healthcare and other non-contributory public plans. Ageing will also affect financial stability, for instance, if the future retirement expenses are financed through an increase in mandatory contribution rates. Under this case, there would be crowding out of pension savings with other discretionary private savings, which act as backbones of productive investments in the economy.

As the main causes of ageing are low fertility and high life expectancy, addressing these issues in the country's strategic policies would reduce the above adverse macroeconomic impacts of ageing. To augment the fertility rate, strategies that could improve the levelheaded social infrastructure would be helpful, such as: i) baby bonus ii) monetary transfer to working women in case of maternity or further rationalization of paid maternity leave and ii) universal childcare allowances dependent on the family income as well as the age of the child. These incentives would minimize women's tradeoff between the childbearing and their career aspirations. These policy incentives, however, require a monitoring mechanism that can control the dynamics of the fertility rate whenever it exceeds a desired level in the future.

To link longevity positively with economic growth, a strategy that links life expectancy with the retirement age could be helpful to reduce the ageing effects on the local labour supply, social security expenses and saving. However, this strategy should be supplemented by strategies that are designed to increase human capital and financial education to augment longevity effects among young and economically active generations. The intuition is that education, income and health consciousness are interlinked and promote longevity and savings. Thus, the outcomes of accumulating human capital would reduce the adverse impact of the declining support ratio in the ageing economy. Savings would also be augmented by strategies that cause capital market diversification and help people to access different financial products so that they can invest efficiently in high return assets.

It is generally emphasized that the ageing issue could be resolved when an economy enhances its productivity, accordingly. However, as discussed in this analysis, productivity growth with population ageing becomes more complex and deserves a thorough age-specific country level research on this topic.

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The Establishment of a Stock Exchange in Brunei: Overview and Recommendations for Implementation

Chong Ming Rui

Abstract

This paper provides a brief summary of Brunei's financial landscape, and suggests that recent developments provide a conducive environment for the creation of a stock exchange. It also touches on the benefits as well as challenges of having a stock exchange, and uses existing literature to show that empirical evidence supports the establishment of a stock exchange in Brunei. This paper also provides some recommendations in order to address the challenges mentioned and aid in the implementation of a stock exchange.

Keywords: Stock exchange, stock market, economic growth, Wawasan, productivity, financial development, capital market

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1.0   Introduction

A stock exchange refers to an entity permitting the buying and selling of securities, enhancing capital market activities and thus adding to a country's financial development.[1] Whereas many other countries have integrated stock exchanges into their capital markets, and with Myanmar announcing the opening of their stock exchange (Tun, 2014) in October 2015, Brunei will soon be the only ASEAN country without one. In addition to this, in the past 10 years stock exchanges have opened in the most surprising places, such as Ghana and Malawi (Minier, 2009).

This phenomenon raises a number of interesting questions for Brunei. Is stock market development relevant to Brunei? If so, what are the benefits and challenges we face? Is there empirical evidence that suggests a significant positive relationship between financial development and economic growth? Finally, what policies can Brunei pursue to ensure successful implementation of a stock exchange?

This paper seeks to address those questions and therefore discusses the relevance of setting up a stock exchange in Brunei. Section two gives a summary of Brunei's financial landscape and provides reasons that support the establishment of a stock exchange. Section three presents advantages, as well as critical issues facing Brunei's stock exchange creation, while section four provides empirical evidence that shows a stock exchange's contribution towards a country's economic growth potential. Section five includes a set of recommendations to aid in the implementation of a stock exchange and section six concludes.

2.0   Current financial landscape

Incomplete capital markets

Though Brunei issues Sukuk (Islamic bonds), they are only available to primary dealers and issuance are 12 months or less. And although financial institutions such as BIBD and HSBC do provide various forms of brokerage services, we lack the infrastructure that allows companies to issue stocks and bonds locally. This hinders economic development, as the Growth Diamond Model[2] clearly underscores the importance of a developed capital market as an important enabler for growth. The Growth Diamond Model, developed based on historical accounts of

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1 I would like to acknowledge the support and feedback given to me by my CSPS colleagues, Dr Diana Cheong, Guiseppe Rizzo and Yuzilawati Abdullah, as well as Jason Kok from Autoriti Monetari Brunei Darussalam and Billy Lim from the Ministry Of Finance.

2 The growth diamond is a model developed by three economic historians teaching Economics at New York University's Stern School of Business.

economic growth, observes that successful economies enjoy four important factors: 1. Enabling political systems, 2. Effective financial systems, 3. Vibrant entrepreneurship and 4. Sophisticated managerial capabilities (Smith, Sylla & Wright, 2007). Each facet depends on the rigor of the preceding factor; thus with an already stable political system (Rosli, 2007), the next step towards sustainable growth is to achieve a complete financial system, one capable of transferring funds to where they can be used best.

Furthermore, this point has become exceptionally relevant due to the increased investment opportunities in Brunei. The government has called for a cumulative international investment target of $70-80 billion (Shahminan, 2014) from 2011 to 2035 to support oil and gas production. In addition, the ASEAN economic community is to be established by the end of 2015. This regional integration of the South East Asian countries promotes a freer flow of capital, amongst others. Hence as Brunei anticipates an increased level of investment, it is important that we have the necessary mechanims to direct these funds efficiently, preventing wastage in financial resources that will inhibit economic growth.

Calls for alternative financing

In addition, in an attempt to diversify the economy, the government has been active in promoting entrepreneurial activities, encouraging the development of small medium enterprises (SME's) by providing training and financing (Anwar 2007, Bakar 2010, Bakar 2012). However, over-reliance on government loans can reduce competitiveness; hence there have been calls for alternative financing (Bakar, 2012). Nonetheless, these urges to decrease reliance on government financing can only go so far without the development of local capital markets. By providing a stock exchange with a SME platform, those with high growth potential are able to raise capital and expand their business. In addition, although some SME's may not meet listing requirements, venture capitalists are able to list on the mainboard and use funds raised to invest in those SMEs.

Excess liquidity

In addition to this, regulatory developments have resulted in excess liquidity in the financial system. In 2005, the Ministry of Finance (MoF) issued a directive capping personal loans at 30% or less of banks' total portfolios by 2010. There has therefore been a steady decline in the volume of personal loans (Figure 1). Following this, credit card reforms were also introduced – credit limits for individual borrowers were capped at 12 times their gross monthly salary, repayment periods had a maximum of 6 years and tighter limits on cards were imposed based on the respective individual's salary scale. Moreover, credit card interest rates were reduced from

24% to 18% in 2010. This has increased liquidity because banks are now more reluctant to rely on retail borrowing to make profits.

Figure 1.

Total personal loans
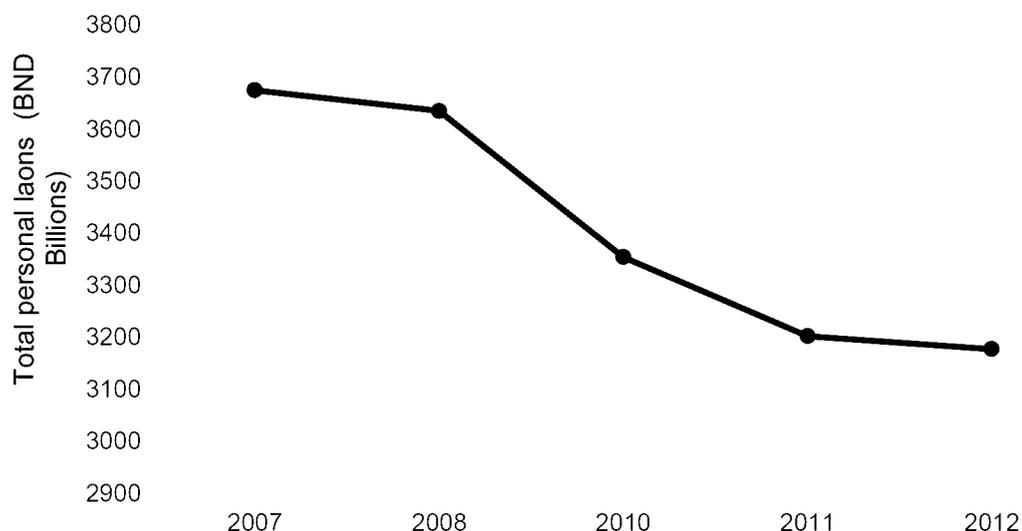
Source: Graph drawn by author, data from IMF Country Report No. 13/174 (2013)

Banks are now unable to earn as much from retail lending compared to before; hence they have been identifying various other means to earn revenue. Baiduri Bank has announced that it will be launching a new subsidiary, Baiduri Capital, focused on investment products (Koo, 2014). As financial institutions continue to find ways to park their excess cash, there is a concern that these funds will flow overseas if Brunei does not provide profit-generating investment products.

Due change in consumer behaviour

Stringent initiatives aimed at preventing borrowers from excessive use of credit facilities continued with the establishment of a Credit Bureau. The Credit Bureau set up under the Authority Monetary Brunei Darussalam (AMBD) allows financial institutions to access a borrower's credit report, thus promoting good financial management. This has been predicted to cause a change in consumer behaviour (Goh, 2012), as they become more careful with their spending and choose to save instead in an attempt to gain a good credit rating.

The anticipation of increased investment, pursuit of alternative financing, presence of excess liquidity and a coming change in consumer spending patterns provide a conducive environment for the establishment of a stock exchange. This will provide a productive way for funds to be used in the economy, and enhancing capital markets will allow Brunei to gain traction towards the Wawasan 2035 goal of an 8% financial sector contribution to GDP, which currently stands at 2.8% (Kasim, 2014).

3.0 Opportunities and challenges of a stock exchange

Capital markets provide a transparent mean of accessing firms' financial prospects; hence capital can be directed to investments with higher returns (King and Levine, 1993). This is the efficiency effect: the creation of a stock exchange increases mobility of liquid cash which can be easily moved across projects with different yields. It allows for better use of scarce resources, as capital flows to projects with higher growth potential. As market participants have access to a firm's financial standing and other important information, they are able to make an informed decisions when making investment choices, allowing for better allocation of funds than relying on personal judgments.

Besides the mobility of resources, the takeover mechanism that the stock market encourages also ensures efficient mobilization of resources. The argument for this is that if the current management does not allow a firm to reach its fullest potential, it risks being taken over. Hence this ensures that managerial resources are also efficiently allocated (Kumar, 1984).

A stock market can also increase GDP growth rates through the accumulation of capital. Though this way of achieving growth is not sustainable (Young, 1995), at least allows Brunei to catch up with other emerging economies, particularly the Asian Tigers. Investment increases because investors are more likely to invest when they can withdraw their investments any time, compared to having their savings choked up in a long-term project where they are unable to withdraw their cash as they wish (Levin, 1996). This reduces downside risk and thus increases the level of investments.

In addition, a stock exchange will be able to create more high-income jobs in the economy. This is because stock exchanges rely heavily on various professional services such as audit, accountancy, rating agencies and so forth. In addition, financial intermediaries such as central securities depositories and clearing agencies are required to support the working of a stock exchange (Shen, 2014). This will create additional high value added service jobs for the economy, and maintain high incomes. Because the government sector in Brunei is highly saturated (Han, 2013), allowing

the private sector to create more jobs can reduce unemployment in the country.

Moreover, firms benefit from a wider range of financial services. The stock market will complement the banking industry and provide increased choices for firms to raise capital (Garcia & Liu, 1999). Raising funds through public equity has its advantages: banks are more restrictive with their lending and place more rules regarding what firms can do with borrowed money compared to bondholders. In addition, if demands for securities are high, public equity can be cheaper than bank loans. Hence, depending on firm's financing needs, they can choose to raise capital via loans or stocks and bonds.

As mentioned previously, SME's also gain from the establishment of a stock exchange. SME's with high future discounted profits can list on a smaller platform, and those that are unable to list can instead benefit from increased venture capitalist funding. Further, this kind of financing not only decreases reliance on government loans, but encourages SME's to develop valuable principles such as good corporate governance and financial management skills, amongst many others (Apong, 2013).

In addition to this, Bruneians have been plagued by "get rich quick" schemes (Bakar, 2012 and Han 2013). A stock exchange allows small investors to invest as little or as much cash as they wish, and for as long as they desire. This provides a legitimate avenue for Bruneians to invest and encourages greater financial understanding, decreasing the possibility of succumbing to dubious investment schemes promising high yields with low risk.

However, there also exist challenges as well as disadvantages to having a stock exchange in Brunei. First, local companies may be unused to the idea of raising capital via stocks and bonds, and may prefer to stick to more traditional methods of borrowing. This may result in very little supply of securities, proving a stock exchange unnecessary. Conversely, Bruneians may not be used to investing in public equities, and this can hurt liquidity, which can have detrimental effects on the legitimacy of the stock exchange.

Currently, Brunei lacks financial intermediaries and investment banks needed to support the workings of a stock exchange. Thus before a stock exchange can be created, these supporting structures need to be in place and hence the the Authority Monetary of Brunei Darussalam needs to provide a conducive environment for the setting up of these financial institutions.

Furthermore, the dangers of a stock market include the fact that it encourages investors to be short-sighted – selling when dissatisfied rather than being committed to the firm's progress

(Bhide, 1994). Because liquid stock markets make it so easy for investors to buy and sell, most investors will have the tendency to treat the stock exchange as a 'casino', instead of focusing on long-term productive investments.

Short-termism can also happen to managers. The stock market encourages managers to have tunnel vision as their bonuses are tied to short-term results. This myopic view held by managers can therefore hurt long-term growth as they make decisions without consideration for future earnings. For example, companies in America invested 15 times or more of the revenue they distributed to shareholders in 1970s; however, these days this ratio stands at 2 or less (Smithers, 2013).

In addition to this, market abuse can also occur and cause significant harm to the economy. Market abuse refers to any form of behaviour that results in financial investors being unfairly disadvantaged. Examples include the spreading of false information about a firm, which can artificially raise or reduce stock prices. Market abuse has significant consequences because it can result in huge loses for investors, and subsequently reduce confidence in the legitimacy of the stock exchange.[3] This point is particularly relevant for Brunei, as Bruneians are still naïve in terms of the sophistication of a stock exchange.

Certain forms of market abuse guided by irrational behaviour can cause speculative bubbles to emerge (Adjasi & Yartey, 2007). When this happens, the prices on the stock market no longer reflect a firm's future earning potentials (Binswanger, 1999). This distorts an individual's judgment and thus does not allow for efficient allocation of investments. Thus in order for Brunei to fully capture the benefits of a stock exchange, it is important to have a strict regulatory framework in place, one that covers all financial instruments and persons involved in the dealings on the stock exchange, and allows for the imposition of criminal sanctions. This will be able to hinder the presence of market abuse.

4.0   Stock exchange contribution towards economic growth

The economic literature is saturated with papers that show a high correlation between financial sector development and economic growth. Levine and Zervos (1998) show that stock markets that are more liquid encourage economic growth, whilst Levine (2002) echoes these findings and observes that financial deepening increases economic growth.

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3 The Financial Services Authority in the UK identified eight types of behavior that count as market abuse. They can be found here: https://www.fca.org.uk/static/documents/fsa-market-abuse-factsheet.pdf

However, it is difficult to extrapolate these findings to Brunei's economy because of her underdeveloped capital market infrastructure, a contrast to the more developed capital markets of the countries used in the those studies. Therefore, our analysis makes use of the results found in Minier (2009), as its data set comprises 54 countries that between the years of 1960 and 1998, opened their first stock exchange – a similar kind of financial development as proposed in this paper.

Minier (2009) shows two results particularly useful to us. First, she shows that opening a stock exchange increases economic growth in the first five years after its opening.[4] She does this by comparing countries that opened their first stock exchange with a group of control - countries with similar development levels, predicted growth rates and economic freedom, the only difference being that they did not open a stock exchange.

From Table 1, we see that countries that opened a stock exchange were predicted to grow more slowly than their controls (-0.108 vs -0.007). However, in reality, after opening a stock exchange their economic growth was higher than their control group (0.095 vs -0.007). These results are significant to the 90% level. This confirms our hypothesis that the establishment of a stock exchange will help Brunei achieve increases in economic growth.

Table 1.

GDP growth rates between countries and respective control groups

	Countries that open stock exchange	Control groups
5-year growth	0.095 (0.219)*	-0.007 (0.184)
Predicted	-0.108 (0.332)	-0.007 (0.148)
Observation	14	106
10-year growth	0.212 (0.226)	0.057 (0.323)
Predicted	022.139 (0.176)	0.057 (0.253)
Observation	3	22
15-year growth	0.844	-0.176 (0.292)
Predicted	-0.186	-0.197 (0.066)
Observation	1	8

Growth rates are in log difference in GDP per capita. To compute control group means, each observation is weighted by the inverse of the number of observations in that control group; the sample size is rescaled to the original sample size. Standard deviations of the means appear in parentheses. * indicates that the mean of the countries opening an exchange is statistically different from the control group mean at the 90% level using Welch's approximate degrees of freedom.

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4 It is difficult to say anything concrete about longer-term analysis because of the small sample size. Hence we focus on 5-year growth rates for the rest of the analysis. According to Minier (2009), GDP data for control groups were not readily available for periods longer than 10 years, vastly reducing sample size.

Second, she presents results that suggest that low number of listings may not be a hindrance for growth. This is an important result because one of the challenges facing Brunei in the creation of a stock market is the possible small number of listings as companies are unused to public equity. This may invalidate the need for a stock exchange if it prevents Brunei from realising the benefits a stock exchange can provide.

Minier (2009) analyses this by dividing the data set into countries that had 12 companies or less listed at the time of opening and countries with more than 12 companies listed at the time of opening. Twelve were used as the threshold as it was the median number. From Table 2, we see that countries with less than 12 companies listed on the stock exchange at the time of opening had higher 5-year growth rates (0.078 vs 0.008) than countries with more than 12 companies listed.

Table 2

GDP growth rates between countries and respective control groups by number of listed companies at time of opening of stock exchange

	Countries that open stock exchange	Control groups
Fewer than 12 companies listed at opening:		
5-year growth	0.078 (0.162)	-0.086 (0.281)
Predicted	-0.179 (0.280)	-0.086 (0.217)
Observations	16	211
More than 12 companies listed at opening:		
5-year growth	0.008 (0.317)	0.009 (0.278)
Predicted	-0.025 (0.197)	0.009 (0.223)
Observations	15	207

Notes to table: Control groups observations are weighted by the inverse of the number of countries in the control group. Standard deviations of the means appear in parentheses.

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However, possibly even more important for Brunei is the empirical results highlighting that the channel for increases in growth rates mainly comes from increases in total factor productivity rather than increases in the level of investment. Table 3 shows that increases in growth rates are mainly due to increases in productivity, due to only marginal differences in investment levels between those countries that open stock exchanges and their control groups compared to the bigger difference for productivity levels. Hence based on growth rates from Table 1, this shows

that productivity levels must have played a more important role. Minier (2009) is not alone in showing this, as Baier et al (2004) also shows that increases in economic growth mainly come from increases in productivity.

Table 3

Average levels of investment and productivity

	Countries that open stock exchange	Control groups
Investment		
5 years	1.06 (0.05)	1.03 (0.07)
Observations	18	185
Productivity		
5 years	1.04 (0.16)*	0.98 (0.17)
Observations	18	185

To compute control group means, each observation is weighted by the inverse of the number of observations in that control group; the sample size is rescaled to the original sample size. Standard deviations of the means appear in parentheses. *indicates that the means are statistically different at the 90% level, based on Welsh's approximate degrees of freedom. Data source: Collins and Bonsworth.

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Why is this result significant for Brunei? It is because low levels of productivity have been identified as a major hindrance for economic growth (Too, 2012). In fact, the Tenth National Development Plan emphasizes achieving economic growth through increases in productivity in order to achieve the targeted 6% average annual GDP growth (OECD, 2013). In addition, Cheong (2013) as well as Apong (2013) have also argued for a similar growth path. Hence the stock exchange being able to drive increases in productivity is a welcome prospect for Brunei.

Thus, the existing literature shows that there exists a positive correlation between stock market development and economic growth. In addition, having a small number of companies on the stock exchange in the first year of establishment does not hinder growth. However, this result should not be taken for granted and the relevant government authorities with the mandate to promote capital market activities should remain vigilant in developing the necessary infrastructure required for financial sector development.

5.0   Recommendations for implementation

In our recommendation for the establishment of a stock exchange, we propose that the Authority Monetary of Brunei Darussalam (AMBD) set up an entity that deals with the governing of the stock exchange. A Securities and Exchange Commission (SEC) should be created, as practiced by many countries overseas. It should be endowed with a mandate to promote conditions that would facilitate capital formation and to regulate the markets to ensure lawful and efficient transactions. Furthermore, understanding that Brunei may not have the capabilities and expertise of managing such a regulatory body, we suggest looking into the possibility of seeking technical support from a well-established stock exchange overseas, conceivably through a Memorandum of Understanding. For example, both Laos and Cambodia enlisted South Korea's expertise when establishing their stock exchange.

In addition to this, we also propose that the government to begin financial literacy initiatives. It is usual for the SEC to provide educational materials on their website; however we feel that this is insufficient for Brunei. We suggest that the government provide regular financial literacy programmes to educate market participants, with the purpose of creating an informed society, one that is mindful of its legal rights and responsibilities and confident in its ability to make use of the services provided by a stock exchange. Although banks in Brunei occasionally hold financial literacy programmes, they are irregular and not open to the public, unlike programmes in other countries. For example, Singapore has a National Financial Education Program called MoneySENSE, Australia's Centrelink, a government agency, provides financial information support and the United States Treasury's Office of Financial Education offers investor education programmes amongst others.

Furthermore, there are various initiatives that Brunei can take in order to tackle the short-termism culture prevalent in the West. Most managers in the UK and US are rewarded in the form of bonuses rather than salary. These bonuses are usually tied to share prices, which fluctuate depending on whether quarterly earnings targets are met. (Smithers, 2013). It is this incentive structure that causes firms to pay too much attention to short-term earnings. Hence, Brunei should look into structuring compensation packages such that managers are incentivized to make decisions for long-term growth. For example, Judge Richard Posner proposes that managers are paid "a specified percentage of his compensation in the form of restricted stock in the corporation—stock that he could not sell for a specified number of years."

In addition, in order to prevent investor myopia, we suggest that companies are not made to publish quarterly earnings, as firms do now in the UK and US. By publishing quarterly earnings, it gives investors a temptation to focus on short-term results. Because different industries have different investment cycles, and therefore the fruits of their investment are realized at varied time intervals, we suggest that companies publish annual reports depending on the average lengths of their investment cycle. In fact, Professor John Kay, tasked to review the problem of short-termism in the UK, suggested the abolishment of quarterly results.

Besides this, in order to facilitate the listing of companies in the stock exchange, we suggest that the government encourage suitable corporations such as DST, Shell and TelBru to go public first, as a catalyst for other firms and to create an encouraging environment for the promotion of capital market activities. However, caution must be practiced here, so as to not force companies that are not ready to go public to conduct an IPO.

Moreover, there is an opportunity to further promote Islamic finance in Brunei through the stock exchange. Recent developments have shown that Islamic finance is growing in Brunei, with BIBD already conducting a structured syndicated murabaha for Turkiye Finans Katilim Bankasi (TFKB), which raised $300m, and co-leading a $1bn sukuk issuance for the government in Indonesia (Oxford Business Group, 2013). We are able to further promote Islamic finance by providing a platform in the stock exchange that is Syariah-compliant and specifically catering for companies wanting to issue Islamic products. This will provide a good stepping-stone towards making Brunei an Islamic financial hub.

Indeed, this set of recommendations and suggestions are not exhaustive, as issues that are not anticipated will arise, and it is important the SEC has the expertise to resolve any problems that come up along the way.

6.0   Concluding remarks and limitations

The anticipation for increased investments, desire to decrease reliance on government grants to increase competitiveness, presence of excess liquidity caused by new regulations and anticipated change in consumer behavior provides an apt opportunity for the creation of a stock exchange. This can increase growth potential as the existing literature shows a positive and significant relationship between capital market development and economic growth.

That being said, the challenges facing Brunei in establishing a stock exchange exist and cannot be downplayed. Being a small country unused to stock market operations and with a lack of financial

infrastructure the path to stock exchange creation will be a demanding one. Nonetheless, the benefits and opportunities that a stock exchange can bring justify laying the necessary groundwork required to prepare the country for the creation of a stock exchange, especially the increases in growth through gains in productivity.

However, there are limitations that exist in this paper. First, empirical analyses are based on 5-year growth rates, as longer-term analysis is not reliable due to the small sample size. More importantly, this paper did not look into market sentiments. They are vital as, if market participants are not confident or do not support the creation of a stock exchange, then any efforts to pursue it will prove futile. This is because a stock market relies greatly on the liquidity provided by market participants. Therefore, there is scope for more research to be done into the opinions of investors, firms and financial institutions and drawing policy options from them.

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