CSPS Strategy and Policy Journal

Volume 3 • Dec 2011

The Editor
CSPS Strategy and Policy Journal
Simpang 347, Gadong BE1318
Brunei Darussalam
E-mail: journals@csps.org.bn
Website: www.csps.org.bn/journal.html

Published by the Centre for Strategic and Policy Studies, Brunei Darussalam
Printed by Nyuk Lian Printing Co.

ISSN 2079-8660

TABLE OF CONTENTS

CSPS Strategy and Policy Journal, Volume 3, December 2011, Pages 1-25

The Dutch Disease Hypothesis: Evidence from the Gulf Cooperation Council

Yazid Mahadi

Abstract

This paper aims to draw evidence of the effects of the Dutch disease hypothesis in member countries of the Gulf Cooperation Council (GCC). Originating in the Netherlands, an oil-abundant nation, the hypothesis suggests that a country's international competitiveness can be significantly influenced by its dependence on natural resources as a result of appreciation in its real exchange rate, thereby reducing the potential growth for its non-resource sectors. An autoregressive distributed lag (ARDL) bound testing approach is employed to analyse the possible long-run relationship between the real exchange rate and the real oil price. Should such a relationship exist, an inference can be made in support of the Dutch disease hypothesis. The results show that there is conclusive evidence in support of the Dutch disease in Oman, Qatar and Saudi Arabia. There are lessons to be drawn from the GCC countries' experience in terms of tackling the Dutch disease effect, including the efficient management of an oil revenue fund. These lessons may prove of interest to Brunei Darussalam, which is heavily reliant on its oil and gas sector, in properly managing its resources and realising its long-term diversification objective.

Keyword: *Dutch disease, GCC economies, oil-exporting countries, diversification, resource curse*

Yazid Mahadi is currently working at the Ministry of Finance, Brunei Darussalam. He graduated with a distinction in the Masters of Philosophy (MPhil) in Economics from the University of Cambridge. Prior to that, he obtained a first class degree with honours in the Bachelor of Science (BSc Hons) Degree in Economics from the University of Manchester, where he was also awarded the Manchester School Award. His areas of interest include macroeconomics, monetary economics and investments.

1. Introduction

One would normally perceive an abundance of natural resources to be a blessing and a contribution to the economic growth of a country. Yet this assertion remains questionable, especially when there is empirical evidence which suggests otherwise. Instead of moving forward in terms of their economic performance, some resource-abundant countries fail to escape from their undeveloped state. There has been a growing interest in the academic literature on the resource-abundant countries ever since the oil price shock in the 1970s. Empirical studies have aimed to unravel the paradox which the oil-exporting countries have experienced and to explore the implications of the oil boom on the macroeconomic variables such as international competitiveness, the real exchange rate and prospects of the other non-oil sectors.

The Cooperation of the Arab States of the Gulf, better known as the Gulf Cooperation Council (hereafter GCC), is a form of regional and economic integration among the six member states: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates (UAE). One of the contributing factors which acts as an impediment to economic development in resource-abundant countries like the GCC member states is the Dutch disease. Oil has been the dominant source of export revenue of the GCC countries for the past three decades,[1] hence the Dutch disease phenomenon is not unique to this group of oil-endowed countries. An economy is said to be affected by the Dutch disease when a resource boom slows down the growth of the other tradeable sectors as a consequence of an appreciation in the real exchange rate. The oil price shock in the 1970s inevitably brought in huge revenue to the GCC economies, and ever since that period the members have witnessed an unprecedented social and economic transformation. Just like the price of other tradeable goods, the world price of oil is susceptible to market volatility, depending on the economic conditions of the world oil supply and demand.

[1] Except for Bahrain and the UAE, which are highly aware of the depletion of their oil reserves, which prompted the government to create alternative exports.

Volatility in the world price of oil implies that the GCC countries' future flow of main revenue will be unpredictable.

All the resource-abundant countries face a common problem - how to diversify their economy away from the heavy dependence on the resource exports. However, the existence of the Dutch disease may complicate the government's effort to promote the expansion of other industries. An appreciation in the real exchange rate as a result of the resource boom effectively causes the international competitiveness of all other sectors to deteriorate. Hence the consequences of the Dutch disease would possibly exacerbate the problem confronted by the authorities. In addition, taking into account the fact that oil is a non-renewable resource, it is important to realise that revenue from oil exports only serves as a temporary source of income for the GCC countries, which further justifies the need for economic diversification.

While this paper focuses mainly on the economies of the GCC countries, there are several lessons which can be drawn from their experience and applied towards other resource-abundant countries in tackling the Dutch disease effect, such as Brunei Darussalam. Moreover, both Brunei Darussalam and the GCC countries have strikingly similar characteristics in terms of their major source of revenue, a high standard of living and also the reliance on foreign labour. Some GCC countries are more advanced than Brunei Darussalam in pursuing their diversification efforts; hence there are valuable lessons that can be leveraged on and which provide some guidance in identifying potential sectors to develop in order to reduce our dependence on the oil sector.

The main aim of this paper is to analyse the Dutch disease effect in the GCC countries by examining the possibility of a long-run relationship between the real oil price and the real exchange rate of each of the member states. If there is a long-run relationship between both variables, it provides evidence in support of the Dutch disease hypothesis. Furthermore, this paper performs a

formal test of the Dutch disease hypothesis by means of the autoregressive distributed lag (ARDL) bounds testing approach.

The rest of the paper is organised as follows: Section 2 explains the economic theory behind the Dutch disease and summarises the relevant theoretical literature and empirical evidence. Section 3 provides a description of the GCC economies and highlights the characteristics that the members share in common. Section 4 outlines the econometric framework employed to test the Dutch disease hypothesis and reports the main findings. Section 5 discusses the policy implications and highlights the strategies that need to be taken into account in preparation for the post-oil era and lastly, Section 6 concludes. At the end of the paper, I hope it will provide a substantial lesson on the negative impact of the Dutch disease and the plausible threat it may pose to the future development of a resource-abundant economy.

2. Theoretical Background and Literature Review

(i) Theoretical Background

Corden and Neary (1982, p. 825) presented a paper to formally analyse a growing phenomenon referred to as the 'Dutch disease' – "the coexistence within the traded goods sector of progressing and declining, or booming and lagging sub-sectors". The term originated from the experience of the Netherlands in the 1960s, since the natural gas discoveries brought about a huge influx of revenues, which subsequently led to an appreciation in the real exchange rate[2]. The appreciation may come from an increase in domestic prices or an appreciation in the nominal exchange rate or both. Then standard international trade theory ensues; a real appreciation leads to a lower international competitiveness because of the relatively expensive exports and cheaper imports. Fewer goods are exported from the country and also

[2] The monetary arrangement under the Bretton Woods system was still in effect during the time in which the Dutch gulden was pegged to the US dollar. Hence, the movement in the Dutch real exchange rate was primarily due to the movement between the domestic and foreign prices.

domestic consumers can afford more of the imported goods in consequence of the relatively cheaper imports. Appreciation in the real exchange rate creates a crowding-out effect on the other existing tradeable sectors such as manufacturing and agricultural industries, and thus undermines their potential comparative advantage that would have been exploited has there been no discovery in the first place. As a result, the economy falls into a vicious trap of greater reliance on the non-renewable resources sector and at the same time the other tradeable sectors (non-oil) weaken. The Netherlands was not the only economy to encounter such a phenomenon; some notable cases are Australia with their abundance of minerals and Japan with their technological boom[3], which challenged the existing agricultural sector. Given the evidence, the Dutch disease is likely to have occurred in the oil-endowed GCC countries. Such an issue is common among the developing resource-abundant countries, in which most studies recognise that a resource boom can be a "mixed blessing" (Looney, 1991) or even a "curse" (Sachs & Warner, 2001).

(ii) Literature Review

There are many empirical studies that have tested the existence of the Dutch disease; however, the results based on this evidence appear to be mixed. Spatafora and Warner (1995) performed a panel fixed effects estimation on a sample of 18 oil-exporting countries over the period from 1965 to 1989. The main aim of their paper was to investigate the impact on economic growth and development of the long-run movements in the external terms of trade[4]. Since oil exports account for the main proportion of the total exports, a change in the world price of oil triggers a shock in the terms of trade. The estimation results reported that there is a positive impact on investment, a negative impact on the current account and insignificant impact on savings in

[3] This also gives rise to a phenomenon called the Balassa-Samuelson effect. The technological boom that occurred in Japan raised productivity in the tradable goods sector. However, the impact of the technological boom did not only stay within the tradable goods sector. Since labour is mobile between sectors, the general level of wages increased, which subsequently led to a higher aggregate price level (see Balassa, 1964 and Samuelson, 1964).

[4] Terms of trade calculated from merchandise exports deflator (US$) / merchandise imports deflator (US$).

response to a permanent terms of trade shock. They argued agriculture and manufacturing are the closest approximation to the Dutch disease (lagging) sector, yet they failed to detect any contractions in both industries in response to an increase in the oil price in the 1970s.

Hutchison (1994) investigated the existence of the Dutch disease in three developed countries that also experienced an energy boom: the Netherlands (1967-1989), Norway (1976-1989) and the United Kingdom (1976-1989). During the period when there was a growth in energy production, there was a decline in the share of manufacturing value-added. At the same time, there was a steady rise in the services sector. Despite the presence of the Dutch disease in all the countries, the author showed that there is no long-term trade-off between the development of the energy sector and the manufacturing sector.

Sachs and Warner (2001) focused on the relationship between cross-country economic growth and natural resource endowment and used this observation to determine whether natural resources are a "curse". There is a negative association between growth and natural resource abundance as a proportion of their economy; however, they were aware of the possibility of an omitted variable bias that was driven by the unobserved geographic variables. In the paper, "… our purpose is simply to establish that the geography variables generally do not eliminate the evidence for the curse of natural resources" (Sachs & Warner, 2001, p. 830). After these variables were controlled for in their regression, the results remained robust. Sachs and Warner (2001) also ruled out the traditional stereotype that suggests most rich countries were once developed due to their abundance of natural resources, as highlighted by Habbakuk (1962). They attempted to identify what actually explained the "curse", and analogous to most other studies, it is mainly in line with the crowding-out rationale. Based on their paper, it concluded that natural resource-intensive economies tend to have higher general price levels and a strong inverse relationship between resource abundance and growth derived from exports. Therefore, this provides conclusive evidence to support the fact

that natural resource abundance hinders the export sectors as a whole, partly due to the increase in domestic prices.

3. Economies of the GCC Countries

This section provides a brief overview of the GCC economies and draws attention to the underlying problems the members face as oil-dependent countries. It is worth gaining a comprehensive outlook of the economic structure of the GCC countries and then attempt to relate it to the main theme of this paper - the Dutch disease. Being fully aware of the special ties and common characteristics among the six member states, the GCC was set up in May 1981 with the main objective to "effect coordination, integration and inter-connection between member states in all fields, strengthening ties between their people, formulating similar regulations in various fields" (GCC: Foundations and Objectives, 2009). The Gulf countries provide an interesting area of research not only due to their heavy reliance on oil revenue, but also the strikingly similar characteristics that they share in common – which means the issues that confront the members are potentially very similar. Neither is their case identical to that of the oil boom in the Scandinavian countries and the Netherlands, because the discovery of oil in the GCC occurred at the beginning of their nation-building era, whereas oil was discovered subsequently after the Scandinavian countries and the Netherlands had already passed the industrialisation phase. Previously, the GCC's main economic activities before the discovery of oil were agriculture, fishing and pearl diving. Faced with unprecedented growth in oil export revenue since the 1970s, it was inevitable for the GCC countries to spend most of their earnings on developing better infrastructure, improving social indicators and on the other hand, placing a low priority on saving for future generations. Some studies criticised the way the GCC countries handle their oil proceeds. Kubursi (1984) argued that the consequences of the oil price rise should be regarded as a wealth effect, as opposed to an increase in income level. The failure to distinguish the notion between capital and income effects was also highlighted by Beblawi (2008). Oil should be treated just like any ordinary

asset of a country, albeit non-renewable, thus should be regarded no differently to other capital assets. A straightforward illustration of this concept is as follows;

"Pumping oil and selling it on the market is no more than transforming a real underground asset into financial assets. Oil production is no more than the monetization of oil into monetary capital" (Beblawi, 2008, p. 4).

Table 1.
Selected Economic Indicators for GCC Countries in 2008

Country	Real GDP per Capita (in thousands of US $)	GDP Growth Rate 2004-2008 (%)	Population (millions)	Proven Oil Reserves[5] (years)	Life Expectancy at Birth (years)
Bahrain	34.7	6.9	0.9	15	74.8
Kuwait	39.9	5.1	3.4	134	74.4
Oman	24.7	6.9	2.8	16	73.0
Qatar	86.0	14.3	1.1	15	77.8
Saudi Arabia	23.8	4.3	24.9	85	73.4
UAE	38.8	7.6	4.8	124	76.2

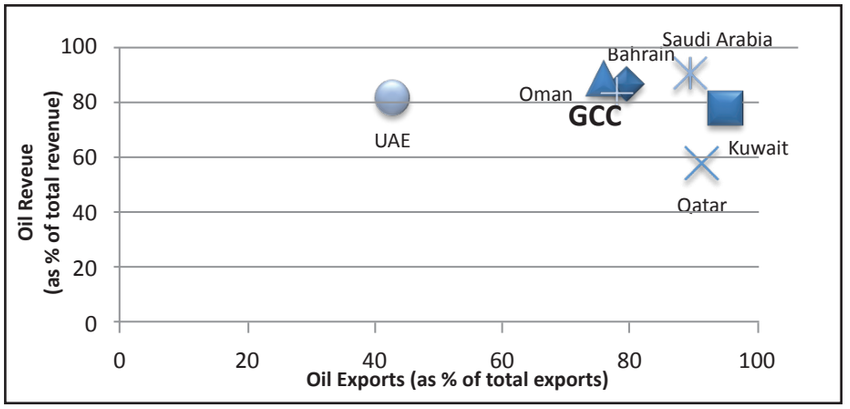
Source: Khamis, M. and Senhadji, A. (2010) and HNPStats, World Bank.

Table 1 provides a cross-sectional overview of the economic position of the GCC countries in 2008. The prosperity of some of the members is reflected in the high real GDP per capita. Countries like Qatar, Kuwait and UAE currently have one of the highest real GDP per capita in the world (compared to that of the US with US$ 47,025 per capita), whereas in 1970 it was merely US$ 8,961, US$ 3,816 and US$ 2,871[6] respectively. The standard of living has also improved remarkably since the discovery of oil with each of the members of the GCC having a life expectancy at birth greater than 70 years.

[5] Data taken from Fasano and Iqbal (2003, table 1) and it is based on production in 2002.
[6] Penn World Table version 7.0

The GCC as a whole accounts for over 40% of the world's proven oil reserves and 40% of the world oil exports (BP, 2007). According to the proven oil reserves above (production to reserves ratio), countries like Bahrain, Oman and Qatar will see their oil reserves depleted in less than 20 years if their utilisation of oil remains constant at current production levels. This further increases the urgency for such countries to eradicate their heavy dependency on oil revenues and to diversify their economies into non-oil industries. Hence, the main problem on every member's agenda is a diversification reform in preparation for the post-oil era. Figure 1 is a graph which illustrates to what extent the GCC countries are dependent on oil.

Figure 1.
GCC Countries: Oil Dependency (in 2008)



Source: Data from Khamis, M. and Senhadji, A. (2010)

There are existing and new industries that the authorities trying to expand as part of their diversification programme. Existing industries that are fighting for survival include agriculture and fishing, and new industries such as aluminium smelting, tourism, insurance services and financial services have been the main driving force in the diversification process. During the 1980s and 1990s, most of the GCC countries' approaches to diversification have been confined within the oil sector itself; both upstream (searching for and recovering hydrocarbons) and downstream (refining, selling and distributing) (Shochat, 2008). The governments aim not only to export in the form of crude oil, but also in a higher value-added form of hydrocarbons which brings in

higher revenue. The problem of integrating vertically within the oil sector also lies within the sector itself. These industries still rely heavily on the non-renewable supply of oil and the revenue that comes from the exports is still susceptible to the volatile movement of the world oil price.

Each of the GCC members approaches the diversification reform with varying pace and degree of priority. It may even be affected by the volatility of the world oil price, since revenue from oil exports is considered as the main source to fund government expenditure. During the periods of weak oil prices, diversification projects tend to slow down due to lower export revenue, although the lower revenue intensifies the urgency of diversification. In contrast, during the periods of oil boom, the government is distracted by the high revenue, thus unable to allocate its spending efficiently (Shochat, 2008). Fasano and Wang (2001) also reported that GCC countries tend to spend on current expenditure rather than capital expenditure during the oil boom period, which only has a significant impact in the short-term rather the long-term.

So how can we relate this to the issue of the Dutch disease? Given a government's continuous efforts to diversify the economy, the process may well be impeded due to the existence of the Dutch disease. As long as the oil revenue remains as a significant proportion of the total exports, the real exchange rate varies according to volatility in the oil price, which affects the international competitiveness of the non-oil sector. It is also important to note that the currency of each member of the GCC is pegged to the US dollar at their respective fixed rates (*de facto* for several decades and now officially since 2003) (Fasano & Iqbal, 2003). However, the exchange rates in real terms still vary depending on both domestic and US prices. The development of both existing and new non-oil industries hinges on the speed of the government in pursuing the diversification process, thus enabling these industries to escape from the trap of the Dutch disease and eventually account for a significant proportion of total exports.

4. Empirical Analysis

This section is subdivided into three sections. The first subsection outlines the econometric framework and justifies the method used in comparison to the other alternatives. The second describes the data used for the empirical analysis and discusses some of the reservations made in choosing the variables, and finally the third reports the empirical findings.

(i) Econometric Methodology

The econometric procedure used in this paper exploits the possibility of a long-run level relationship between the real exchange rate and the real oil price. Should a positive relationship exist, we can infer that there is evidence in support of the Dutch disease hypothesis. This paper adopts the autoregressive distributed lag (ARDL) bounds testing approach developed by Pesaran, Shin and Smith (2001). Javan-Pahar and Mohammadi (2008), the main reference for this paper, employed the ARDL approach to test for the validity of the Dutch disease hypothesis on 14 oil-exporting countries. Following the framework of the Dutch disease hypothesis testing set up by Javan-Pahar and Mohammadi (2008), a different set of annual data for the six GCC countries between the period 1970 and 2000 is used. The direction of the long-run causal relationship between both variables is also analysed carefully in this paper.

If the real exchange rate (RER_t) and the real oil price (O_t) are suspected to be cointegrated, a log-linear specification of the two variables can be estimated as follows:

$$\log RER_t = \alpha_0 + \alpha_1 \log O_t + u_t \qquad (1)$$

The ARDL approach requires some re-specification of the standard Error-Correction Model framework. u_{t-1} is substituted with a linear combination of

$\log RER_{t-1}$ and $\log O_{t-1}$, hence forming the conditional error-correction version of the ARDL approach:

$$\Delta \log RER_t = \beta_0 + \sum_{i=1}^{m} \beta_i \Delta \log RER_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta \log O_{t-i} + \lambda_1 \log RER_{t-1} + \lambda_2 \log O_{t-1} + v_t \quad (2)$$

where β_i and γ_i capture the short-run error-correction dynamics whereas λ_1 and λ_2 correspond to the long-run dynamics of the model. The computed values of λ_1 and λ_2 are essential to provide inferences regarding the Dutch disease hypothesis.

Inference regarding the computed F statistic is based on the asymptotic critical value bounds generated by Pesaran et al. (2001). Two polar sets of critical value bounds are reported; one set is generated by the I(1) series while the other is from the I(0) series, and are referred as the upper and lower bound critical values respectively.

The appropriate lag length of the $\sum_{i=1}^{m} \beta_i \Delta \log RER_{t-i}$ and $\sum_{i=1}^{n} \gamma_i \Delta \log O_{t-i}$ in equation (2) is selected optimally according to standard techniques such as the Akaike Information Criterion (AIC) and the Schwartz Bayesian Criterion (SBC). Pesaran and Shin (1999) recommended a maximum lag length of 2 for annual data. Then equation (2) with the appropriate lags *m* and *n* is estimated by Ordinary Least Squares (OLS). Equation (1) is also estimated to determine the sign and significance of the normalised long-run coefficient on the real oil price, α_1.

Javan-Pahar and Mohammadi (2008) transformed equation (2) by setting $\lambda_1 \log RER_{t-1} + \lambda_2 \log O_{t-1}$ equal to zero and adding the error-correction term EC_{t-1};

$$\Delta \log RER_t = \beta_0 + \sum_{i=1}^{m} \beta_i \Delta \log RER_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta \log O_{t-i} + \delta EC_{t-1} + v_t \quad (3)$$

Computed δ from the estimation of equation (3) provides useful information related to the relationship between both variables. The magnitude of δ represents the speed of adjustment of the dynamic system as it reverts back to its long-run equilibrium; hence it is expected to have a negative sign and also to be significant, thus ensuring the long-run equilibrium can be attained.

Estimation of equation (3) is also used to examine the possibility of a short-run causality between both variables. $\Delta log\ RER_t$ and $\Delta log\ O_t$ are interchanged as the dependent variable depending on the direction of causality to be tested for.

(ii) Data

The sample of 6 GCC countries is obtained for the period from 1970 to 2000. The annual data for the nominal exchange rate and consumer price index (CPI) of the relevant countries are extracted from the Penn World Table version 6.2 (Heston, Summers & Aten 2006). The real exchange rate (RER) is calculated using the purchasing power parity (PPP) rationale; $RER_t = E_t P_t / P_t^*$, where E_t is the nominal exchange rate in the form of US $ per unit of domestic currency, P_t and P_t^* are the domestic and the US price indices respectively. The real exchange rate in the long-run is the nominal exchange rate adjusted by the ratio of both price indices.

The real world price of oil (O_t) from 1970 to 2000 is obtained from the Annual Statistical Bulletin 2007 (T73), OPEC. The real price is adjusted for both movements in exchange rate and inflation.

(iii) Estimation and Results

The results in Table 2 show the F statistic ($logRER_t \mid logO_t$) computed when restricting λ_1 and λ_2 in equation (2) to zero. When compared against the critical value bounds reported in Pesaran et al. (2001), there is rejection of the null hypothesis of no cointegration for the case of Oman, Qatar and Saudi Arabia, therefore providing evidence for the Dutch disease effect. However, the critical value bounds simulated by Pesaran et al. (2001) are generated for sample sizes of 500 and 1,000 observations and 20,000 and 40,000 replications respectively. Narayan (2005) follows the same methodology and develops the critical value bounds for sample sizes between 30 and 80. The lower and upper bounds are 4.267 (3.437) and 5.473 (4.470) with 5% (10%) significance levels respectively. Based on the modified critical value bounds, only Oman and Qatar are found to have the Dutch disease.

Table 2.

ARDL Cointegration Test

Dependent Variable: Δ *log* RER_t

Country	ARDL(*m*,*n*)	F statistic ($logRER_t \mid logO_t$)	Critical value bounds			
			5% significance		10% significance	
			I(0)	I(1)	I(0)	I(1)
Bahrain	(1,1)	0.207843	3.79	4.85	3.17	4.14
Kuwait	(1,1)	0.243172	3.79	4.85	3.17	4.14
Oman	(2,1)	10.22194*	3.79	4.85	3.17	4.14
Qatar	(1,1)	7.336157*	3.79	4.85	3.17	4.14
Saudi Arabia	(1,1)	4.205258**	3.79	4.85	3.17	4.14
UAE	(1,1)	1.383792	3.79	4.85	3.17	4.14

Note: * and ** denote significance at 5% and 10% respectively.

To determine the direction of the long-run causal relationship between both variables, equation (2) is estimated again, but with Δ *log* O_t taken as the dependent variable. The computed F statistics ($logO_t \mid logRER_t$) of each of the countries are insignificant except for the UAE, since the null hypothesis of no cointegration cannot be rejected (see Appendix Table 1)[7]. Hence, there is no long-run causal relation which runs from the real exchange rate to the real oil price. This implies the underlying long-run relationship that explains the existence of the Dutch disease in Oman, Qatar and Saudi Arabia reported in Table 2 earlier runs from the real oil price to the real exchange rate. The direction of long-run causality is expected since the exogenous world price of oil is taken as given[8] and most of the shifts in the real exchange rates can be explained by the volatility in the real oil price.

Table 3.

Adjustment Rate and Long-Run Parameter Estimates

Country	δ	$log\ RER_t = \alpha_0 + \alpha_1 log\ O_t + u_t$	
		α_0	α_1
Bahrain	-0.005348	-1.700515*	0.321460*
	[0.008127]	[0.100348]	[0.051986]
Kuwait	-0.492783**	-1.734222*	0.067517
	[0.218937]	[0.090068]	[0.046661]
Oman	-0.531840*	-2.513037*	0.337137*
	[0.115040]	[0.194088]	[0.100549]
Qatar	-0.172429*	0.085106	0.217880*
	[0.044440]	[0.103557]	[0.053649]
Saudi Arabia	-0.221051*	-0.163580	0.412535*
	[0.075595]	[0.106915]	[0.055389]
UAE	-0.013777	1.177363*	0.076844
	[0.008114]	[0.098832]	[0.051201]

Note: * and ** denote significance at 5% and 10% respectively.

Numbers in parentheses are the corresponding standard errors.

[7] A conclusive inference cannot be made for the UAE since the earlier results in Table 2 show that there is no long-run relationship which runs from the real oil price to the real exchange rate.

[8] Even though Saudi Arabia, the second largest oil producer, may influence the world price of oil by controlling their supply. However, the rest of the members of the GCC account for a lower share of the world oil market, therefore the world price of oil is taken as given.

The computed coefficients of the lagged error-correction term, δ in equation (4), reported in Table 3 are all negative and significant (except for Bahrain and the UAE). The absolute values of δ suggest there are relatively high rates of adjustment to the long-run equilibrium in Kuwait and Oman. For example, δ of -0.492783 for Kuwait, means that the deviation from the long - run equilibrium is corrected by 0.492783% every year. Furthermore, we can deduce an alternative inference on cointegration only for Bahrain, Oman, Qatar and Saudi Arabia.[9] The negative and significant values of δ for Oman, Qatar and Saudi Arabia reinforce the previous findings of the Dutch disease effects found using the ARDL approach.

The last 2 columns of Table 3 report the long-run parameter estimates between the real oil price and the real exchange rate. The estimates on the coefficient α_1 are positive and significant for Bahrain, Oman, Qatar and Saudi Arabia. Again, this provides consistency with the previous results for those 3 countries that are affected by the Dutch disease. An increase in the real oil price leads to an increase in the real exchange rate of the respective country

The computed χ^2 test statistics indicate all the lagged difference variables are insignificant except for Saudi Arabia, in which there is a short-run causality that runs from the real exchange rate to the real oil price. The lack of short-run causality between both variables is rather unsurprising given the real oil price is expected to interact with the real exchange rate in the long-run rather than in the short-run. This information provided to us is crucial to macroeconomic policy decision making. Any policy to overcome the Dutch disease implemented today may not have a strong impact in the short run, but may help to achieve the long-term economic objective which is of much greater concern.

[9] Refer 2nd column and 3rd column of Table 2. The properties of *log RER* and *logO* meet the conditions for Engle-Granger co-integration testing.

5. Policy Implications

This section aims to demonstrate how an economic theory based on intertemporal decision making on consumption can be applicable to the situation faced by oil-exporting countries. Norway's approach to managing the oil revenue is used as a model, as suggested by the IMF in its recent survey (Velculescu, 2008).

Based on economic theory, an agent needs to consider both his present and future streams of income and make intertemporal decisions on consumption over the given time horizon. There is not a case where future income always looks promising; therefore he needs to allocate a proportion of his income as savings to prepare for the unpredictable future, or to quote a famous phrase by Campbell (1987), "saving for a rainy day". The Permanent Income Hypothesis, accredited to the work of Milton Friedman, argues that the intertemporal consumption pattern optimised by a rational agent should not be determined by the current income, but by a long-term series of future income expectations, also known as the permanent income (Friedman, 1957). Indeed, saving creates a trade-off between current and future consumptions; however, it also guarantees the agent's spending pattern is less distorted should there be a sharp reduction in income in the future.

The scenario experienced by the GCC countries, where the main source of income is susceptible to the volatile movement of the world oil price, follows the same mechanism to the one faced by an intertemporal agent mentioned above. Being aware of the dwindling oil reserves, Kuwait was the first member to set up an oil revenue fund in 1976 called the Reserve Fund for Future Generations (RFFG), aimed at preparing for a sustainable income for future generations[10]. Even though each country may differ slightly in their operational rules and objectives, the oil revenue fund is now a popular tool in managing oil wealth and is ubiquitous among the oil-exporting countries.

[10] www.kia.gov.kw/En/Pages/default

Norway's oil revenue fund[11], recently renamed the Government Pension Fund – Global[12] (hereafter, the Fund) should serve as an exemplary model for the other oil-exporting countries. It functions as both a savings and stabilisation fund by channelling the oil revenues into the Fund and accumulating reserves during the periods of high or stable oil prices. These reserves can be utilised either in the short-run when the economy sees a shortfall in revenue or in the long-run as the depletion of oil comes nearer, as well as to meet the growing social expenditure due to the ageing population in Norway, thus promoting "intergenerational equity" (Fasano, 2000). The Fund becomes one of the fiscal-management tools at the government's disposal to mitigate the impact of the volatility of oil exports. During an oil boom period, the government undertakes a tight fiscal position to neutralise the shock on the domestic demand. This prevents the economy from overheating and also dampens the pressure for the real exchange rate to appreciate. During a weak oil price period, the government still manages to inject money into the economy by using the reserves accumulated in the Fund to prevent contraction in the economy. Norway's effectiveness and strong discipline in managing the Fund is evident in the negative correlation between its budget expenditure and revenue availability in the 1990s (Fasano 2000, Figure 1). As a strategy to offset the shifts in the real exchange rate in response to the oil price volatility, it is imperative for the investments, in particular the excess reserves, to be made in the foreign market, as opposed to the domestic market. We have shown earlier that an oil boom corresponds to an appreciation in the real exchange rate, and this is the essence of the Dutch disease. Therefore, solely allocating the investments of the oil revenue fund abroad could possibly be one of the solutions since it directly tackles the inherent problem which brought about the Dutch disease.

Not all oil revenue funds have been as successful as Norway, mainly due to the major flaws in their operations and management. Some of the main factors

[11] Norway is a developed oil-exporting country with high real income per capita and standard of living. It is one of the few oil-exporting countries which does not place great reliance on oil exports as the main source of income due to the significance of other exports such as shipbuilding, machinery and services.
[12] Formerly known as the Government Petroleum Fund.

will be discussed as follows. Establishing a clear governance framework, objectives and forecasts are crucial to ensure the private sector's (including private firms and the public) expectations are aligned with the government's. It also instils accountability and enhances the fund's reputation as a trustee in managing the country's oil wealth. Lastly, an oil revenue fund needs to acquire a high level of discipline in adhering to the operational rules. Frequently changing the operational rules could potentially undermine the main objective for the fund being set up in the first place. Overall, an oil revenue fund is an important instrument for oil exporting countries to promote "intergenerational equity" and dampen the Dutch disease effect by preserving international competitiveness. However, it is not to be regarded as a perfect substitute for sound fiscal and macroeconomic management (Stevens, 2003).

The recent global financial crisis in 2008 posed new challenges not only for the sovereign wealth funds (hereafter, SWFs) within the GCC economies, but also worldwide. Most of the SWFs were not immune to the crisis due to their exposure to the international markets. The crisis has tested the robustness of the SWFs with regard to whether they can meet their respective obligations during difficult times. Consequently after the crisis, it enables them to draw some lessons from their experiences during extreme market stress. The contagion effect of the financial crisis has led them to re-assess their exposure in different markets, especially in the US and European markets, where the crisis originated. It has also prompted some SWFs to introduce a more diversified range of asset classes and a more dynamic approach to investing to enable them to adapt to a volatile market environment. The recent crisis justifies further the importance for the SWFs in GCC economies to address the shortcomings mentioned in the previous paragraph. In overall, the event has given an opportunity to the SWFs to identify their weaknesses and implement extra defences in their framework to prepare for future challenges.

In resource rich countries, an abundance of natural resources may reduce the pressure to innovate and foster new niche sectors (a matter of mindset). In contrast, in Singapore, which is not endowed with natural resources, there is a

strong mindset (almost a survival instinct) committed to innovation and fostering new niche sectors that can take advantage of the high calibre of its human capital. Without this commitment, as the government of Singapore constantly reminds its people, the economy would decline. The absence of a strong entrepreneurial culture and innovative mindset, which is sometimes the case in resource rich states, exacerbates the resource curse.

6. Conclusion

Similar to most of the findings by previous studies on oil-exporting countries, an application of the ARDL bounds testing approach helps us to provide evidence in support of the Dutch disease in Oman, Qatar and Saudi Arabia. The direction of the long-run causal relationship is also analysed, with the underlying effect of the Dutch disease running from the real oil price to the real exchange rate. The insignificance of the short-run dynamics also sheds some light on the optimal type of policies that the governments should undertake. Since the Dutch disease, identified by the long-run relationship between the real oil price and the real exchange rate, is more of a long-term phenomenon; authorities should opt for policies that contribute towards a significant impact in the long-run.

We identify one of the main problems that has confronted the GCC countries since the 1970s as their heavy dependence on oil. A strong commitment to discipline as well as prudential management of the oil revenue fund could assist the GCC countries to alleviate the Dutch disease. The presence of the oil revenue fund in the respective countries prevents the government from spending excessively and helps to neutralise the impact of oil price volatility on the domestic economy. The countries' imagination in diversifying into the non-oil sector and services would be undermined if there is still a lack in domestic human capital to support capital-intensive industries. Hence, access to a high level of education is regarded as a major determinant in preparing the GCC countries for the post-oil era.

Brunei Darussalam can learn from the experience of the GCC economies in tackling the Dutch disease effect due to the similarity in a number of economic aspects. The prospects for Brunei Darussalam's economy rely upon the efficiency and competency of the government in pursuing its diversification programme. Faced with the fact that oil reserves are on course to depletion, and an increasing global awareness of the environment, the authorities should employ relevant policies as soon as possible in order to attain a sustainable revenue base in the future. The present authorities therefore need to take proactive measures in focusing more attention on diversifying the economy in order to achieve a sustainable development for its future generations.

REFERENCES

Asteriou, D. & Hall, S. G. 2007, *Applied Econometrics: A Modern Approach using Eviews and Microfit*. Palgrave Macmillan, New York.

Bablewi, H. 2008, *Gulf Industrialization in Perspective*, viewed 7 June 2009, <www.hazembeblawi.com/eng>.

Balassa, B. 1964, 'The Purchasing Power Parity Doctrine: A Reappraisal', *Journal of Political Economy*, vol. 72, pp. 584–596.

BP Statistical Review of World Energy 2007, viewed 15 June 2009, <www.bp.com>.

Campbell, J. Y. 1987, 'Does Saving Anticipate Declining Labour Income? An Alternative Test of the Permanent Income Hypothesis', *Econometrica*, vol. 55, no. 6, pp. 1249-1273.

Corden, W. M. & Neary, J. P. 1982, 'Booming Sector and De-Industrialization in a Small Open Economy', *Economic Journal*, vol. 92, pp. 825-848.

Engle, R. F. & Granger, C. W. J. 1987, 'Cointegration and Error-Correction Representation, Estimation, and Testing', *Econometrica*, vol. 55, pp. 251-276.

Fardmanesh, M. 1991, 'Dutch Disease Economics and the Oil Syndrome: An Empirical Study', *World Development*, vol. 19, no. 6, pp. 711-717.

Fasano, U. 2000, *Review of the Experience with Oil Stabilization and Savings Funds in Selected Countries*. IMF Working Paper WP/00/112, International Monetary Fund, Washington D.C.

Fasano, U. & Iqbal, Z. 2003, *GCC Countries: From Oil Dependence to Diversification*. International Monetary Fund, Washington D.C., viewed 7 June 2009, <www.imf.org>.

Fasano, U. & Wang, Q. 2001, *Fiscal Expenditure Policy and Non-Oil Economic Growth: Evidence from the GCC Countries*. IMF Working Paper WP/01/195, International Monetary Fund, Washington D.C.

Friedman, M. 1957, *A Theory of the Consumption Function*. Princeton University Press, Princeton.

GCC 2009, *Foundations and Objectives*, viewed on 20 June 2009, <www.gccsg.org/eng/index.php>.

Habbakuk, H. J. 1962, *American and British Technology in the Nineteenth Century*. Cambridge University Press, Cambridge.

Heston, A., R. Summers & Aten, B. 2006, *Penn World Table Version 6.2*. Center for International Comparisons of Production, Income and Prices, University of Pennsylvania, Pennsylvania.

Hutchison, M. M. 1994, 'Manufacturing Sector Resiliency to Energy Booms: Empirical Evidence from Norway, the Netherlands, and the United Kingdom', *Oxford Economic Papers*, New Series, vol. 46, no. 2, pp. 311-329.

Khamis, M. & Senhadji, A. 2010, *Impact of the Global Financial Crisis on the Gulf Cooperation Council Countries and Challenges Ahead.* International Monetary Fund, Washington D. C.

Kubursi, A. A. 1984, *Oil Industrialization and Development in the Arab Gulf States.* Croom Helm, London.

Kuwait Investment Agency 2009, *Overview of Funds*, viewed 5 July 2009, <www.kia.gov.kw/En/Pages/default>.

Kuwait Programme on Development 2009, *Governance and Globalisation in the Gulf States*, LSE Kuwait Programme Research Paper, viewed 20 June 2009, <www.lse.ac.uk/collections/LSEKP/index.htm>.

Looney, R. E. 1991, 'Diversification in a Small Oil Exporting Economy: The Impact of the Dutch Disease on Kuwait's Industrialization', *Resources Policy*, vol. 17, no. 1, pp. 31-41.

Narayan, P.K. 2005, 'The Saving and Investment Nexus for China: Evidence from Cointegration Tests', *Applied Economics*, vol. 37, pp. 1979-1990.

OPEC Annual Statistical Bulletin 2007, viewed 15 June 2009, <www.opec.org>.

Pesaran, M. H. & Pesaran, B. 1997, *Working with Microfit 4.0: Interactive Econometric Analysis.* Oxford University Press, Oxford.

Pesaran, M. H., & Shin, Y. 1999, 'An Autoregressive Distributed Lag Modelling Approach to Cointegration Analysis' in Strom, S. (ed.), *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium*, chapter 11, Cambridge University Press, Cambridge.

Pesaran, M.H., Shin, Y. & Smith, R. J. 2001, 'Bounds Testing Approaches to the Analysis of Level Relationships', *Journal of Applied Econometrics*, vol. 16, pp. 289-326.

Sachs, J. D. & Warner, A. M. 2001, 'The Curse of Natural Resources', *European Economic Review*, vol. 45, no. 4-6, pp. 827-838.

Samuelson, P. 1964, 'Theoretical Notes on Trade Problems', *Review of Economics and Statistics*, vol. 23, pp. 145-154.

Shochat, S. 2008, *The Gulf Cooperation Economies: Diversification and Reform*. London School of Economics, London.

Spatafora, N. & Warner 1995, *Macroeconomic Effects of Terms-of-Trade Shocks: The Case of Oil-Exporting Countries*. World Bank Policy Research Working Paper 1410, Washington D.C.

Stevens, P. 2003, 'Resource Impact: Curse or Blessing? A Literature Survey', *Journal of Energy Resources*, vol. 9, pp. 3-42.

Velculescu, D. 2008, *Norway's Oil Fund Shows the Way for Wealth Funds*. IMFSurvey Magazine Policy, International Monetary Fund, Washington D.C., viewed 14 July 2009, <www.imf.org>.

World Bank 2009, *HNPStats, Development Database*, The World Bank Group, Washington D.C.

Appendix

Appendix Table 1.

ARDL Cointegration Test

Dependent Variable: Δ log Ot

Country	ARDL(m,n)	F statistic (logOt | logRERt)	Critical value bounds			
			5% significance		10% significance	
			I(0)	I(1)	I(0)	I(1)
Bahrain	(1,1)	3.311733	3.79	4.85	3.17	4.14
Kuwait	(1,1)	3.403394	3.79	4.85	3.17	4.14
Oman	(1,1)	2.095358	3.79	4.85	3.17	4.14
Qatar	(1,1)	1.979360	3.79	4.85	3.17	4.14
Saudi Arabia	(1,1)	3.931102	3.79	4.85	3.17	4.14
UAE	(1,1)	5.037592*	3.79	4.85	3.17	4.14

Note: * and ** denote significance at 5% and 10% respectively.

Assessment of Forest Resources in Brunei Darussalam: A Remote Sensing Solution

Kazimierz Becek

Abstract

This report assesses statistical data on the forest resources of Brunei Darussalam. The author conducted a careful audit of several publications on forest resources of Brunei Darussalam, and found that in some instances there are huge discrepancies in the reported forest cover in Brunei. The lack of regular comprehensive inventories and an erroneous linear extrapolation model parameter, i.e. the country's annual deforestation rate, used to estimate the net loss of forest cover are the major contributory factors. As a rapid way to rectify these disparities in the forest cover, a novel Remote Sensing method is suggested. Also outlined is a preliminary feasibility analysis to carry out an immediate forest inventory using the proposed Remote Sensing method and recent datasets in the custody of the Survey Department. It is suggested that this very necessary update of the forest resources assessment of Brunei Darussalam may be carried out by local experts for a fraction of the cost of a comprehensive forest resources assessment.

Keywords: *Brunei Darussalam, Forest Resources Assessment, FAO, Forestry Department, Survey Department, Remote Sensing, LiDAR*

Kazimierz Becek obtained his MSc in Geodesy from the Agriculture University, Wroclaw, Poland, and PhD and ScD from the Technical University, Dresden, Germany. He worked at the University of New South Wales, Sydney, Australia. Since 2003 he has been with the University of Brunei Darussalam, teaching geomatics, GIS, cartography and remote sensing. His interests include applications of remote sensing and GIS for environmental studies.

1.0 Introduction

Reliable data on the forest resources of a country are needed not only for well-informed management of forests, but also to fulfil international obligations regarding the supply of accurate data on forest resources in the country concerned. The latter is one of the most important single pieces of data for studies on, and mitigation of, global warming. To assess the available CO_2 sink capacity of global forests, an accurate and global view of forest resources is required. This knowledge is also necessary to serve many other purposes, including policy planning on a local to global scale, and to ensure sustainable forest resource management from the regional and global vantage points.

Reliable data on forest resources requires an effective system for data acquisition, processing, storing, reporting and dissemination that is efficiently operated by the authority in charge of forestry in the country. Nowadays, such systems are in place and operational almost everywhere in the world. Local and international research organisations such as the International Union of Forest Research Organisations (IUFRO) (http://www.iufro.org/), the World Wildlife Fund (WWFII) (http://www.wwf.org/) and others strive to improve the quality, accuracy and reliability of the methods and results of forest resource assessments. The progress in this area, especially in recent years, has been substantial, thanks to the development of Remote Sensing (RS) technologies and techniques that allow for the rapid and accurate data capture required for a forest inventory (Becek 2011). Also, improvements in terrestrial data capture and management, including the Global Navigation Satellite System (GNSS) and Geographic Information Systems (GIS), help to gather data on local forest matters such as wildfires, infestation of insects and diseases, logging concession areas, illegal logging events, forest rehabilitation and conservation areas and plantations.

A careful study of the Bruneian data on the percentage of forest cover submitted to the FAO (Food and Agriculture Organisation), published by the UN (United Nations), as well as newspaper publications and the results of research on the forest cover conducted by (Becek 2008) lead to the conclusion that there are some significant discrepancies between these sources of data regarding the forest resources of Brunei Darussalam. A null hypothesis is that the lack of decadal forest inventories in Brunei (FAO 2010b), and also the very limited GIS and Remote Sensing capabilities of the Forestry Department of Brunei (FAO 2010b), a lack of data exchange between other agencies in the country (FAO 2005) and the 'too optimistic' deforestation rate used by the Forestry Department are to blame for these discrepancies.

To this end, the Heart of Borneo (HoB) (http://heartofborneo.org/) initiative, one of the most important cross-boundary ecological projects in the world, involving the ecological systems of Brunei, Indonesia and Malaysia, may not be adequately serviced because of a lack of proper monitoring and assessment instruments. As a leading and prestigious project, HoB requires a current set of data, not only for the size of the area declared for it, but also for any changes in the permanent and the phenomenological vegetation cover, the land use and the anthropogenic infrastructure, including transportation and dwellings. This type of detailed and current data on HoB will only be available if functional data acquisition systems are in place, mainly remote sensing systems, but also regular reports from stakeholders such as the Ministry of Development, the Ministry of Industry and Primary Resources and the Ministry of Defence. In addition, a dedicated geographic information system (GIS) would facilitate data processing, analysis, data collection and information development.

Taking into account the availability of the Light Detection and Ranging (LiDAR) survey of the country and high-resolution aerial photography, it would be possible to carry out a high-precision forest resource assessment in Brunei in a few months. Assuming also a cost-free data exchange between the Forestry Department and the Survey Department – agencies of the Government of Brunei Darussalam – such a project could be completed for a fraction of the cost of a forest inventory conducted using traditional methods.

The technical, organisational and other aspects of such a project are examined in this paper with the hope that highlighting the lack of current data on forest resources in the country will assist the relevant authorities in the country in their decision making in order to embark on this well overdue forest inventory.

2.0 What is a Forest?

According to the FAO (FAO 2004), there are at least 250 definitions of a forest. This large number of attempts to define a forest may be justified by virtue of the seemingly countless types of forests found on our planet. Putting aside quite common and natural disagreements among scientists, there is also much cynical disregard for the universal forest protection so as to propose definitions of forest to satisfy certain economic interests of some countries (oil palm plantations). Nevertheless, after many years of searching for the most universal forest definition, the following is currently recognised by the FAO as the definition of a forest:

'*Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 per cent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use*' (FAO 2004).

It is important to notice that this definition requires that at least 10% of the area must be under tree canopy to be recognised as a forest. This implies that a logged out (clear-cut) forest cannot be called a forest anymore. This 10% threshold warrants that a minimum ecological value of a forest is preserved after a logging operation. In fact, the whole sense of this definition is embedded in the recognition (for the first time by many people) of the value of a forest as a unique ecological system, which is extremely important for ensuring climate stability and maintaining the biodiversity of our planet.

It appears that the Forestry Department of Brunei Darussalam accepts the above definition of forest. However, some doubts may arise because of the following statement made by the Deputy Director of the Forestry Department (Thien 2010):

'*Brunei's definition of forest cover includes the total amount of virgin forests and logged-over forests'*.

This statement clearly indicates that a 'logged-over' forest is also considered as a forest, which is contrary to the FAO's definition of forest and against any ecological sense. Also, common sense is violated if one attempts to count an area as a forest after all the trees have been cut down.

Certainly, both examples are definitions of a forest, but the latter, in particular, seems to ignore the fact that a forest is much more than just a collection of trees. For example, a 'forest' without trees does not provide shelter for animals.

3.0 Forest Resource Assessment as a Tool of Trade of Forest Departments

Forest resources assessments or forest inventories are performed on a regular basis by most of the countries around the world. The main goal of a forest inventory is to determine a number of parameters that characterise forest resources in a qualitative and quantitative manner. These parameters allow for assessing the magnitude of the impact of the natural and anthropogenic factors on forest resources. For example, the extent of forest cover depends on the intensity of logging activities, conversion of forest into agricultural and urban and industrial areas, depletion of forest due to diseases, fires and other factors. A forest inventory aims also at capturing many different characteristics of a forest. To explain this, one must understand that a forest is an extremely complicated ecological system, which provides livelihood not only to found species, but also it has always been a place where people have

obtained food, medicines, building materials and safety. Commercial benefits can also be derived from a forest. Accordingly, the timber productivity of a forest must be assessed from this perspective. The knowledge of how much timber is in a specific forest and its annual rate of growth of timber is necessary to estimate the maximum allowable level of timber extraction to maintain a sustainable balance between timber extraction and production.

Major inventories are usually conducted every 10 years. However, reports on forest resources are compiled annually by updating the results of the major inventory with data taken from various sources, including internal forestry department statistics, reports of logging companies, the emergency services department and a few other departments dealing with land matters. Depending on the country concerned, these departments may include the Town and Country Planning Department, Land Department, Department of Public Works, Department of Agriculture, Department of Natural Resources (minerals), Department of Communications and Transportation, Fire and Rescue Department, Survey Department and others. A level of development and functionality of the National Spatial Data Infrastructure (NSDI) (Ali 2009) in the country of concern is a single predictor allowing for assessing how successful the spatial data sharing between the government agencies is. In the case of Brunei, the Brunei Darussalam Spatial Data Infrastructure (BDSDI) was formally started in 2008.

The most comprehensive, global data source on forests is the Global Forest Resource Assessment report (GFRA) (http://www.fao.org/forestry/fra/en/). The GFRA has been published every five to ten years since 1946 by the Food and Agriculture Organisation (FAO) of the United Nations (UN), and is compiled from the reports of members' countries. A great deal of work has been done to adopt common standards of reporting of the national data for the compilation of the GFRA. The latest GFRA report was published in 2010. The following subjects are presented in GFRA reports (FAO 2010):

1. extent of forest resources and their contribution to the global carbon cycle;
2. forest health and vitality;
3. forest biological diversity;
4. productive functions of forests;
5. protective functions of forests;
6. socio-economic functions of forests, and
7. the legal, policy and institutional framework related to forests.

Besides global tables, the GFRA report includes also country reports that were used to compile the GFRA. Brunei Darussalam has submitted its reports to the FAO since the country became a member of the UN, that is, since 21 September 1984.

4.0 New Technologies in Assessing Forest Resources

The simplest, very effective, but time-consuming method of forest inventory is photo interpretation of aerial or satellite imagery. This method requires an experienced photo interpreter who is able to delineate boundaries between different forest types. Once this step is completed, the area of the forest-type regions are calculated and summarised. The quality of this method depends on the scale of the imagery and the level of experience of the interpreter.

Modern data acquisition methods for the purpose of forest inventories are entirely based on the technology known as Remote Sensing (RS). RS relies on multispectral images that are captured from space from orbiting satellites. The multispectral images from these satellites are freely available from vendors around the world. The price of the images depends on the sharpness (smaller pixel more expensive image) of the image and on the number of spectral bands in the image. A good-quality image may be purchased for a few thousand Brunei dollars. The multispectral image is processed by a sophisticated computer program for the purpose of highlighting similar pixels. These groups of pixels are referred to as classes. It is assumed that a class represents a certain type of feature on the surface of the earth, for instance,

soil, water or a particular forest type. The whole process is to the highest degree automated and requires minimal human assistance. One of the important obstacles in deploying this forest inventory method is the persistent cloud cover over Brunei. The clouds make capturing an image that would be suitable for analysis difficult.

Another, recently developed method (Becek, 2011) is based on radar satellite data. The tremendous advantage of this method relies on the fact that the radar waves are able to penetrate cloud cover. Thus, the data acquisition may be carried out independently of the weather. This method allows for automatic identification of all areas covered by vegetation. A very important advantage of this method is its ability to estimate forest density, which may be correlated with the health status of the forest.

A version of this method is the LiDAR survey, which is performed from an aircraft. The LiDAR produces a dense 'cloud' of points covering the surface of the earth. These 3D points are used to calculate the height of vegetation. In other words, the LiDAR survey can be used to identify points (and areas) at which vegetation is present. Therefore, the areas under vegetation can be easily identified.

The above methods deliver a significant part of the data for a comprehensive forest inventory without assistance from any additional information from any other agency. This is important in cases where the data sharing culture among government agencies is still underdeveloped.

5.0 Forest Resource Assessments in Brunei

The Forestry Department of Brunei Darussalam has conducted only one national forest resources assessment so far. As a result of this study, forest type maps at 1:50,000 and 1:200,000 were produced (FAO 2005). The Anderson & Marsden (Forestry Consultants) Company from Singapore conducted this inventory using the photo interpretation method (outlined

above). Two sets of aerial photographs were used, consisting of colour photos taken during the 1975/76 period, and black and white photos taken in the 1981/82 period. The approximate scale of both photos was 1:25,000. Extensive ground truthing was also conducted to support the photo interpretation. The final report from this inventory was published in 1984 (Anderson & Marsden 1984).

Since this comprehensive inventory, no further follow-up inventory has been carried out. Thus, all statistics of Brunei forestry have been based on this sole data source. To provide for annual loss of forest cover, probably due exclusively to permitted logging activities (about 100,000 m^3 per annum), a figure of 2,000 ha has been assumed.

The Forestry Department of Brunei Darussalam observes the 'Cut one, plant four' policy, which means that one lost tree must be replaced by four planted trees. Unfortunately, the author was not able to source any statistics on how many trees are successfully planted by the Forestry Department annually. However, assuming that just one tree out of four was successfully established, this would mean that the net loss of forest is null. However, this policy can only be successfully implemented where the forest land is not permanently converted into some non-forest usage.

Forest is lost not only due to logging, but also due to land conversion processes. The magnitude of loss of forest cover in Brunei Darussalam due to land conversion from forest to agricultural or urban land use is unknown. This fact and a justification of it were expressed by the Forestry Department in an official submission to FAO in the following way:

'*Due to lack of study on specific fields and some of data under the jurisdiction of other government agencies in Brunei Darussalam, the [Forestry] Department is not able to give some detailed information as requested. Some steps for reporting tables [in GFRA] as stated in the guidelines are not relevant due to the limited source of data'.* (FAO 2005)

This admission is quite staggering and bold at the same time. It should trigger an immediate reaction from the relevant authorities. Some other disturbing facts regarding the basic statistics on forest cover in Brunei Darussalam are collected in Table 1.

Table 1.
Percentage of land covered by forest and pristine forest in Brunei Darussalam according to selected data sources

Indicator	Data sources (*see reference list for full details*)					
	FAO 2000	**FAO 2005**	**FAO 2010b**	**UN 2007**	**Thien 2010**	**Becek 2008**
Year	2000	2005	2010	2007	2010	2000
Forest cover	83.9 (75%) [a]	52.8 (73.7%) [a]	72.0%	52%	78%	48%
Pristine forest	100%	100%	69%	No data	No data	No data

[a] The figures without brackets were taken from FAO 2000 and FAO 2005. The figures in the brackets were taken from FAO 2010b as corrected figures for the years 2000 and 2005.

The data shown in Table 1 indicate that the forest cover in 2000 varied between 48% and 83.9%. In 2005 the same indicator ranged from 52.8% and 73.7% and in 2010 it was listed as 72% and 78%. Note that the forest cover increased over 5 years by approximately 5%. Even larger discrepancies were identified for the percentage of the pristine forest in the total forest cover. Note that in 2000 and 2005 this indicator was listed as 100%. But in 2010 the percentage of pristine forest was only 69%.

Some more light on these discrepancies may be provided from the already referenced interview with the Deputy Director of Forestry Department (Thien 2010), in which he stated that:

'In 2005, we calculated that we still have 76 per cent of Brunei's forest cover'.

Besides the fact that the title of the article reports that about 78% of the land mass of the country is under forest versus the 76% stated in the above statement, it is important to note that this figure in FAO 2005a was quoted as

52.8% (Table 3, p. 191). Also, Brunei Darussalam has been listed as the number one country in the world with the highest percentage of primary forest (100%) (ibid. p. 42). Both figures seem to have been subsequently modified by the Forestry Department. Hence, in the FAO 2010a report the forest cover and the primary forest areas are given as 72% and 69%, respectively (Table 1, figures in brackets).

Realising that there are problems with the reported figures on the forest cover of Brunei, the Government of Japan in 2008 offered to fund a project to reconcile these discrepancies. For unknown reasons, this offer has not been accepted by the Forestry Department of Brunei Darussalam.

A proper monitoring of forest resources of the country should not be done merely for statistical purposes. Forest monitoring may be carried out through forest inventories or simply by inspecting free satellite data available on the Internet (Google Earth). Forest monitoring may be used, for example, to assess the implementation of the Brunei Selective Felling System (FAO 2010). The system should ensure the integrity of the residual forest stands and that sufficient forest canopy cover remains after trees have been extracted. Figure 1 demonstrates that in at least one concession forest area, the selective logging system is violated.

Figure 1.

Source: Google Earth®.

Figure 1 shows a fragment of a logging concession in the western part of Brunei. The clear-cut logging is evident (reddish areas). On the left is clearly visible pristine forest. On the right are the remains of a forest logged out some time ago. Only a few trees were saved. The low vegetation is probably some kind of shrubs – no trees. The geographic centre of the image is: $\varphi = 4^{o}$ 24' 03" N, $\lambda = 114^{o}$ 21' 33" E. The image shows an area 1 km by 1.2 km.

6.0 Feasibility of an Update of Forest Resource Assessment in Brunei

The Survey Department, Ministry of Development of Brunei Darussalam, is in charge of providing basic spatial information, which includes the production and updating of a range of maps (http://www.survey.gov.bn/index.htm). The Survey Department is not in charge of developing thematic maps or inventories, including geological, historical and forest maps. Thus, the Forestry Department is responsible for preparation of forest maps and forest inventories. However, the Survey Department may assist in providing the most recent data that can be used to prepare an update of the forest maps of Brunei Darussalam.

Towards the end of 2010, a Canadian subcontractor delivered to the Survey Department two data sets of superior quality covering the whole country. There is no doubt that this fact is a remarkable moment in the history of the Survey Department and also this country. Never before has such high quality data been captured for the whole of Brunei. These data sets are a seamless mosaic of colour aerial photographs (http://www.rtbnews.rtb.gov.bn/?c=newsDetail&news_id=16115). The photographs were geometrically corrected, which is necessary for them to be used for mapping purposes. The smallest image element (pixel) represents a 19 cm by 19 cm square on the ground, which may be compared to the 61 cm by 61 cm of the sharpest images available on Google Earth®. Such high-resolution images allow for precise identification of tree species and even the trees' health condition. The second data set delivered is a set of elevation data of the earth's surface and

also the elevation of objects above it. With an astonishing density of one point per square metre, this elevation data set allows for precise modelling of the country's topography. It also provides data on the elevation of trees; tree density may also be derived from this data set.

Both data sets are extremely useful in preparing an update of the forest inventory in Brunei Darussalam, which is already 30 years old. The resulting inventory would provide not only an update in terms of the actual forest cover, but it would also deliver several other characteristics, including forest density, which is a proxy for forest health.

A few additional benefits a forest inventory carried out based on the above-mentioned data sets would include the following:

- the inventory would be extremely inexpensive (probably up to B$100,000);
- the duration of the inventory including the map production should not be longer than six months;
- the inventory would not require any field work to be performed;
- the inventory can be made by the experts who are already in this country; and
- the societal benefits of such a project being carried out in Brunei would be enormous in terms of training provided to the staff of the Forestry Department and also any individuals involved.

7.0 Conclusions

The need for an update of the forest resources assessment has been justified by pointing out several dramatic discrepancies in the forest cover of Brunei Darussalam as reported by the Forestry Department of Brunei Darussalam. A few reasons for these discrepancies are:

- a lack of regular forest inventories;
- a lack of data sharing agreements between the departments (non-existence of NSDI); and
- a lack of a functional Geographic Information System for handling and reporting data on forest resources.

Brunei Darussalam has joined Indonesia and Malaysia in their efforts to protect the precious and unique forest and biodiversity of Borneo. The Heart of Borneo (HoB) initiative has already been well recognised around the world as a brilliant example of cross-boundary collaboration to protect an endangered tropical forest. An active and sensible participation in HoB would require from all sides a full awareness of what is happening in the forests under all three jurisdictions. However, comprehensive knowledge about a forest can only be acquired through regular forest inventories and proper record-keeping practises. This demand for comprehensive knowledge of the natural environment has also been implicitly expressed in Brunei's National Vision, known as Wawasan 2035 (http://www.bedb.com.bn/why_wawasan2035.html). One of the strategies lauded by Wawasan 2035 is to develop "*an environmental strategy that ensures the proper conservation of our natural environment and cultural habitat. It will provide health and safety in line with the highest international practices*" (ibid).

Modern remote sensing methods have been suggested as a way to overcome the obstacles in conducting periodic forest inventories in Brunei Darussalam, using traditional methods. Remote sensing methods allow for accurate monitoring and assessment of the forest resources of the entire country and can also provide much more detailed information than the traditional sample-based method. In addition, costs involved in purchasing the required remote sensing data are many times lower than those for the traditional method. The cost factor has also been gradually improving as a result of the development of unmanned air vehicles (UAV), which are significantly less expensive than the manned aircraft. Deploying UAVs on missions to collect forest data is far

simpler, logistically, than using manned aircraft (no air traffic control permits required, etc).

However, a proper business model in the relevant authority must be implemented prior to adoption of modern forest resource assessment methods. Some deficiencies in the Forestry Department's business model have recently been identified (Soon, 2011). These include inadequate funding and insufficient human resources. Indeed, this article will help towards a comprehensive review of the Forestry Department's business model, to achieve the desired quality of the data available on the country's forest resources. It is also important to strengthen collaboration between the Forestry Department and other agencies in sharing data and human resources, in training and in using local expertise wherever possible to gradually achieve self-sufficiency in performing the tasks assigned to the Forestry Department.

REFERENCES

Ali, J. 2009, 'The Challenges in the Implementation of Brunei Darussalam Spatial Data Infrastructure (BSDI)', Kertas Kerja, Symposium Sempena 100 Tahun Pentadbiran Tanah Moden Negara Brunei Darussalam, pp. 17, viewed 11-12 Nov. 2009, viewed 15 July 2011, <www.tanah.gov.bn/Symposium/Hj Jamil Hj Ali. Challemges in BSDI.i.pdf>.

Anderson & Marsden 1984, *Brunei Forest Resources and Strategic Planning Study. Final Report*, the Government of Brunei Darussalam, vol. 1.

Becek, K. 2008, 'Development of a Vegetation Density Map of Brunei Darussalam'. *Proceedings of the MapAsia 2008 Conference*, Kuala Lumpur, Malaysia.

Becek, K. 2011, *Biomass Representation in Synthetic Aperture Radar Dataset*', LAP Lambert Academic Publishing, Saarbrücken, Germany.

FAO 2004, *Global Forest Resources Assessment Update 2005; Terms and Definitions (Final Version)*, FAO, United Nations, Rome, Paper - 83/E.

FAO 2005, *Global Forest Resources Assessment 200*', Forestry Department, FAO of the UN, viewed 15 July 2011, <http://www.fao.org/forestry/fra /fra2005/en/>.

FAO 2010a, *Global Forest Resources Assessment 2010*, Forestry Department, FAO of the UN, viewed 15 July 2011, <http://www.fao.org/ forestry/fra/fra 2010/en/>.

FAO 2010b, *Global Forest Resources Assessment 2010, Country Report, Brunei Darussalam*, Forestry Department, FAO of the UN, viewed 15 July 2011, <http://www.fao.org/docrep/013/al466E/al466E.pdf>.

Soon, J. Y. K. 2011. *Forest Management in Brunei Darussalam: Assessment of Principles and Policies and Feasible Forest Resources Assessment Tool*. MA Thesis, Universiti Brunei Darussalam.

Thien, R. 2010, 'Brunei still has 78% green cover. UN's deforestation claims refuted', *The Brunei Times*, January 9 2010, vol. 3, p191.

UN 2007, *Brunei Darussalam*, UN Data, World Statistics Pocketbook, UN Statistics Division, viewed 15 July 2011, <http://data.un.org/CountryProfile. aspx?crName=Brunei Darussalam>.

CSPS Strategy and Policy Journal, Volume 3, December 2011, Pages 43-63

An Evaluation of Labour Market Policy Measures for Brunei Darussalam

Koh Wee Chian

Abstract

This paper considers various policy measures and their effects on reducing future labour shortages based on a benchmark GDP growth rate. A model for labour force participation rate by gender and age group is constructed in order to make projections for the labour force in Brunei Darussalam from 2010-2035. A model for labour demand is also estimated to give a macro view of the future labour market. The female labour force participation rate is gradually catching up to that of the male, with females projected to make up 48 per cent of the total labour force in 2035. This increase in female labour participation is also associated with a steady decline in total fertility rate. As a consequence, labour demand growth is projected to outpace population and labour force growth, thereby increasing the dependence on foreign labour from 50 per cent in 2009 to 63 per cent in 2035. Among the policy measures considered in addressing this issue, the most promising appears to be raising labour productivity.

Keywords: *labour market, projections, policy measures, productivity, Brunei Darussalam*

Koh Wee Chian is an Associate Researcher at CSPS. His current research interests are in econometric and general equilibrium modelling applied to development economics and public policy issues. He holds a Master of Science in Finance and Economics from the London School of Economics and Political Science, a Master of Social Sciences in Applied Economics and a Bachelor of Science (Honours) in Statistics from the National University of Singapore. He also holds the Financial Risk Manager (FRM) designation awarded by the Global Association of Risk Professionals.

1.0 Introduction

After two decades of slow economic growth, averaging just 1.7 per cent, which is the lowest among ASEAN countries, and a lack of success in economic diversification, Brunei is now embarking on an ambitious Long-Term Development Plan (LTDP) to achieve the aims of Brunei Vision 2035, which are to be recognised for the accomplishments of its people and to be among the top ten nations in the world in terms of per capita income and quality of life.

While there has been some research work on development planning and economic diversification (see Cleary & Wong, 1994; Tisdell, 1997; Bhaskaran, 2007; Crosby, 2007), little has been done on labour market forecasting and manpower planning to support the nation's economic growth and development efforts. This paper attempts to make projections for Brunei's labour force over the period 2010-2035 for each gender and each age group, which will then be aggregated to produce the total labour force. Labour demand projections will also be constructed to give an overall labour market view, which will highlight the manpower shortfall or surplus depending on various economic growth scenarios.

The past three decades have seen the labour force participation rate (LFPR) of females increasing from 29 per cent in 1980 to 60 percent in 2009, while the male LFPR has decreased from 83 per cent to 75 per cent over the same period. This paper will also discuss the impact of more females entering the workforce.

Under the bold LTDP, Brunei is targeting an annual growth rate of 6 per cent (see Rosli, 2008), which has never been achieved in the past three decades. This paper will also examine, on a macro level, the implications of the 6 per cent growth target on the labour requirements of the Brunei economy – whether this growth rate can realistically be achieved with the growth trend of the labour force, and if not, the number of foreign workers required to support

the growth objective, including issues regarding the increased dependence on foreign labour.

The paper is organised as follows. Section 2 documents the data sources used as well as explaining the methodology for the labour market projections, in particular the approach to forecasting the labour force by incorporating population growth forecasts and modelling changes in the labour force participation rate. A model of demand for labour is estimated using regression analysis. The projection results are presented and elaborated in Section 3, followed by Section 4, which discusses the policy implications arising from the labour market projections. Various policy measures and their impact on labour demand are also examined. Concluding remarks are provided in Section 5.

2.0 Methodology

Labour Force Projection

Historical annual time series data on population and labour force by each gender and each age group were obtained from the International Labour Organization (ILO), which cover the period 1980-2009. The LFPR for each gender and age group is calculated by dividing the labour force by the population:

$$LFPR_{agt} = \frac{LF_{agt}}{POP_{agt}} \quad (1)$$

where $LFPR_{ag}$ is the labour force participation rate for age group a (15-24 years, 25-34 years, 35-54 years, 55-64 years or 65+ years) and gender g (female or male) in year t (1980, … , 2009). LF and POP are the labour force and population, respectively.

LFPR projections from 2010-2035 are based on the methodology proposed by Kim (2010), which utilises the shapes of the male and female LFPR time trends for a given age group. More precisely, the LFPR time series of both

gender types for each age group are first plotted to identify whether the male and female LFPR display (i) constant gaps, (ii) convergence, (iii) divergence or, (iv) a non-monotonic pattern. In the case of Brunei, the time trends display convergence for all the age groups, as shown in Figure 1.

As suggested by Kim (2010), the LFPR projections are estimated by fitting the time series to the following logistic function:

$$y_t = y_{min} + \frac{(y_{max} - y_{min})}{(1 + \exp(\mathrm{a} + \beta t))} \quad (2)$$

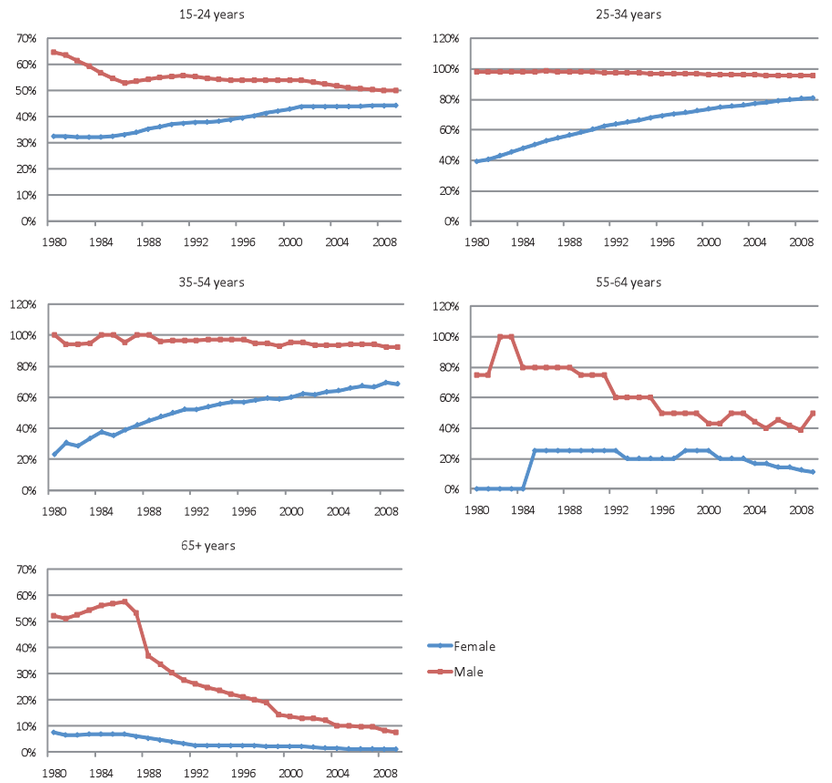
where y_t is the LFPR in year t (1980, … , 2009) for females or males, y_{max} and y_{min} are the maximum and minimum values of y in the logistic function, and α and β are the parameters to estimate.

The values of y_{max} and y_{min} depend on whether the female LFPR catches up with the male LFPR, or vice versa. In the former case, the values of y_{max} and y_{min} for males are the observed LFPR in 1980 and 2009 respectively. The values of y_{max} and y_{min} for females are the observed male LFPR in 2009 and observed female LFPR in 1980. The age groups 15-24 years, 25-34 years and 35-54 years fall under this case.

In the other case where the male LFPR converges to the female LFPR instead, the values of y_{max} and y_{min} for males are the observed male LFPR in 1980 and observed female LFPR in 2009 respectively. The values of y_{max} and y_{min} for females are the observed LFPR in 1980 and 2009 respectively. The age groups 55-64 years and 65+ years are classified under this case.

Figure 1.

Male and female labour force participation rate from 1980-2009 by age group



Source: ILO (2010) and author's calculations

With the LFPR projections from 2010-2035 in place, the next step involves utilising population forecasts for each gender and age group constructed by the United Nations (UN). Annual population growth from the UN over the period 2010-2035 under the medium fertility variant (which is the benchmark case, and assuming normal mortality and international migration rates) is applied to the ILO population data to derive population forecasts through 2035. The LFPR and population projections for each gender and age group are then multiplied to obtain the labour force projections over the period 2010-2035.

Labour Demand Projection

The oil and gas sector is the largest contributor to Brunei's gross domestic product (GDP), making up 60 per cent of nominal GDP in 2009. However, less than 5 per cent of Brunei's total labour force works in the oil and gas sector. As noted in Koh (2011), most of Brunei's labour demand depends on the non-oil and -gas sector.

Since historical data series on labour demand is not available, labour demand is assumed to be equal to labour force net of unemployment, noting that the number of vacancies at any point in time is very small compared to the total labour force:

$$LD_t = LF_t(1 - UR_t) \qquad (3)$$

where LD_t is the labour demand in year t (1980, … , 2009), LF_t and UR_t are the labour force and unemployment rate, respectively.

The labour demand function is then estimated using ordinary least squares regression on real non-oil and -gas value-added, denoted by YN. The estimated equation for labour demand is:

$$LD_t = \underset{(7.590)^*}{49.165} + \underset{(0.001)^*}{0.023\ YN_t} \qquad R^2 = 0.969 \qquad (4)$$

where the figures in parentheses are the standard errors and * denotes significance at the 0.01 level.

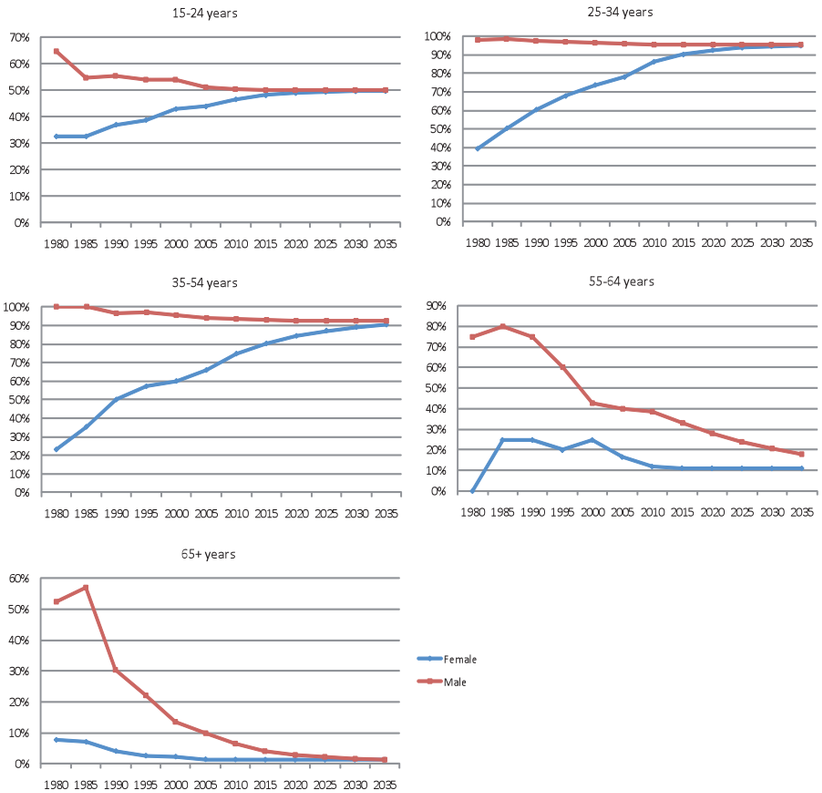
The equation is then used to produce out-of-sample labour demand forecasts for 2010-2035.

3.0 Labour Market Analysis

The LFPR and labour force projections for each gender and age group are shown in Figures 2 and 3 respectively.

Figure 2.

Male and female labour force participation rate from 1980-2035 by age group

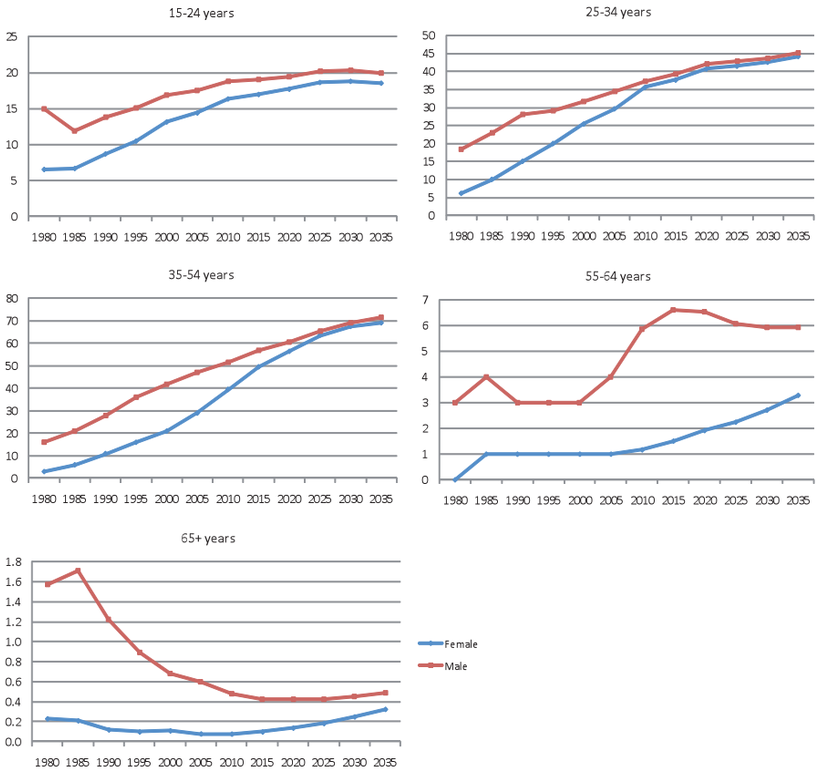


Source: Author's calculations

Based on the convergence trends in the LFPR, the female labour force is projected to catch up to the male labour force, growing twice as fast, from a 57:43 male to female ratio in 2009 to 52:48 by 2035. The male labour force is projected to increase from 112,980 in 2009 to 143,100 in 2035 (0.9 per cent annual growth rate), and the female labour force to increase from 84,740 to 135,590 (1.8 per cent annual growth rate) over the same period.

Figure 3.

Male and female labour force (in thousands) from 1980-2035 by age group



Source: Author's calculations

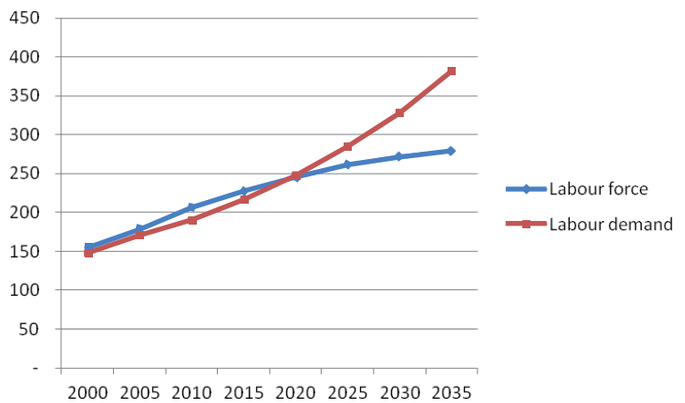
Over the past decade, the average growth rates for the oil and gas and non-oil and -gas sectors are -0.4 per cent and 3.5 per cent, respectively. In terms of setting the benchmark scenario for labour demand, we assume that the future growth rates for the oil and gas and non-oil and gas sectors to be 2.5 per cent and 3.5 per cent respectively, in view of the country's energy policy direction to double hydrocarbon production by 2030 according to the Energy White Paper by the Energy Department at the Prime Minister's Office (see Goh & Thien, 2011) and continued fiscal spending to drive the non-energy sector. Based on these growth assumptions, the economy is projected to grow at an annualised rate of 3 per cent, compared to 1.4 per cent over the past decade. Note that this benchmark scenario is more realistic than just assuming the

country's growth target of 6 per cent. For comparison purposes, recent official data showed real GDP growth of 2.6 per cent and 2.5 per cent in 2010 and 2011 H1 respectively (see JPKE, 2011a, 2011b). Hence a benchmark scenario of 3 per cent, though slightly optimistic, is a realistic baseline.

Figure 4 shows the projected total labour supply and demand to 2035. The labour force is projected to grow at an annualised rate of 1.3 per cent over the period 2010-2035, from 197,720 to 278,700, while the demand for labour is projected to grow at an annualised rate of 2.7 per cent, from 190,680 to 381,680 over the same period, based on the above GDP growth assumptions. The large increase in labour demand is due to the high growth in the non-oil and -gas sector, which is more labour-intensive in industries such as services, construction and agriculture compared to the oil and gas sector, which is more capital-intensive. These projections show that demand for labour will exceed the available labour force by 2020, which will dampen growth unless there are large numbers of additional imported workers.

Figure 4.

Labour force and labour demand (in thousands) from 2000-2035



Source: Author's calculations

The 6 per cent GDP growth target

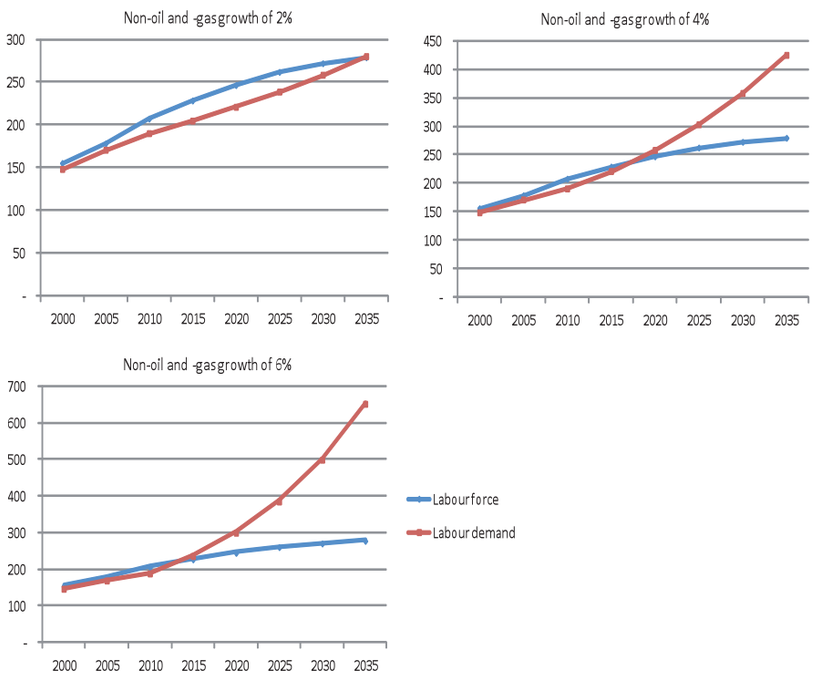
Figure 4 clearly illustrates that the growth in demand for labour will outpace the growth of the total labour force, based on an annualised GDP growth of 3

per cent (2.5 per cent and 3.5 per cent growth in the oil and gas and non-oil and -gas sectors respectively). Maintaining the growth assumption in the oil and gas sector, to achieve 6 per cent GDP growth implies a 8 percent growth in the non-oil and -gas sector, which seems very optimistic by historical standards. This also means the labour requirements will be extremely high.

Figure 5 plots labour force and labour demand through 2035 for various non-oil and -gas sector growth scenarios. The charts show that the labour requirements increase exponentially with increase value-added growth. The point at which labour supply and demand are in balance is shown in Table 1. In the first scenario, where value-added growth is 1 per cent, labour supply will always be larger than labour demand (since labour supply is projected to grow at an annualised rate of 1.3 per cent).

Figure 5.

Labour force and labour demand (in thousands) for various non-oil and -gas growth scenarios



Source: Author's calculations

Table 1.

Year when labour demand equals labour supply

Non-oil and gas growth	Year
1%	N/A
2%	2035
3%	2023
4%	2018
5%	2014
6%	2013

Source: Author's calculations

In the other cases, the balanced point is reached earlier with increasing value-added growth. Hence, this analysis shows that based on the existing institutional growth framework, achieving the 6 per cent growth target is highly improbable. The benchmark scenario of 3 per cent growth already poses serious challenges, and various policy measures will be explored in the next section including their effectiveness.

4.0 Policy Implications and Measures

There are two key findings from the projection results above. The first is that the female LFPR is gradually converging to the male LFPR, with more females entering the workforce, and they are projected to make up about 48 per cent of the total labour force by 2035. The other, perhaps more pertinent, point is that the growth in labour demand is projected to outpace the growth in labour supply if non-oil and -gas growth is greater than 2 per cent. Thus, to sustain economic growth, Brunei will need to import more foreign labour, with the criticality depending on economic growth.

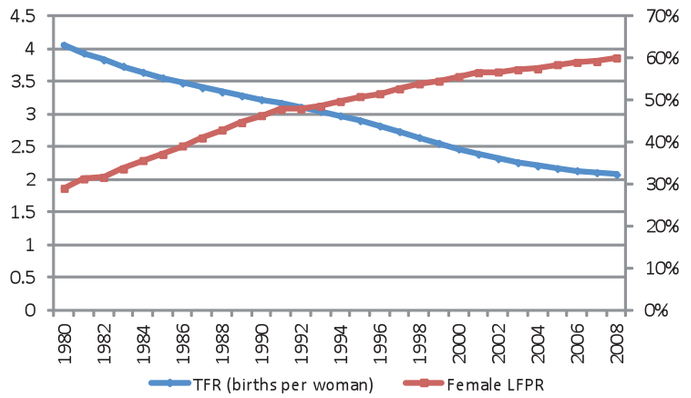
Effect of increasing female labour force

The steady increase in the female LFPR is also accompanied by a decline in total fertility rate (TFR). Female LFPR increased from 29 per cent in 1980 to 59 per cent in 2008; while TFR decreased from 4.1 births per woman to 2.1

over the same period (see Figure 6). The trend of declining TFR is an issue as the population pyramid will gradually change to one that is constrictive (i.e. lower percentage of younger people). The problems associated with an aging population are well-documented (see UNFPA, 2002).

Figure 6.

Female labour force participation rate and total fertility rate from 1980-2008



Source: World Bank (2010), ILO (2010) and author's calculations

Effect of increasing dependence on foreign labour

Foreign workers, or temporary residents, make up about 50 per cent of the total labour force in 2009, the majority of which are in the construction, manufacturing and service industries. Based on the benchmark situation as described in Section 3, labour demand is projected to exceed the labour force by 103,000 in 2035. If this shortfall is to be met by importing foreign labour, the proportion of foreign workers will increase to 63 per cent of the total labour force.

While it must be acknowledged that Brunei has been dependent on foreign labour to support the growth of the economy for decades, especially in alleviating labour scarcity in low-skilled industrial segments and serving as a buffer in times of recession, there are public concerns about their increased presence, especially with regard to social issues such as illegal immigration

and costs of enforcements measures (Masli, 2010) as well as human trafficking (U.S. Department of State, 2009) and other issues like job competition (Mahmud, 2007). In addition, the low wages of foreign workers have displaced locals in some jobs and created disincentives for businesses to invest in skill upgrading, innovation and technology, which therefore impedes economic development and transformation.

Therefore, for economic, social and political reasons, there are perhaps justifiable concerns about the desirability of having a large foreign workforce in Brunei.

Policy Measures

Hui and Hashmi (2004), in their study on the implications of the Singapore GDP growth target on labour requirements of the Singapore economy, proposed various policy measures, including raising the total fertility rate, increasing the labour force participation of older workers and improving labour productivity. These policy measures will be investigated in some detail, including their effect on reducing the gap in meeting future labour demand.

I. Increasing the total fertility rate

While the increase in female LFPR has resulted in a corresponding increase in the total labour force, the decline in TFR will adversely affect the workforce, which is indicated in Figure 4 as the labour force is increasing at a decreasing rate. The Government has already taken steps to provide better incentives to increase TFR by enacting the Maternity Leave Order 2011, which allows 15 weeks of leave, compared to 8 weeks previously (see Hassan, 2011), which could possibly raise TFR to the replacement level, which is believed to be 2.5 (see Bandial, 2011).

However, the prospects of increasing TFR are not very promising. Using the annual population growth from the UN over the period 2010-2035 under the high fertility variant (fertility rate projected to remain at 0.5 children above

the fertility in the medium variant), the total labour supply is projected to be 284,180 in 2035 – an increase of 5,480 over the medium variant which is used in Section 2 above. There is still a large shortfall when compared to the labour demand under the benchmark case; hence policies focusing on increasing TFR are insufficient to close the gap to meet future labour demand.

II. Increasing the labour force participation of older workers

The LFPR of both male and female workers in the 55-64 and 65+ age groups has been steadily decreasing. Brunei's statutory retirement age has increased from 55 years to 60 years (see Mahmud, 2009); hence it is not unreasonable to assume that the LFPR of older workers may increase over time. In order to assess the effectiveness of increasing older workers' LFPR to increase total labour supply, the LFPRs by gender and age group are extrapolated based on the highest observed LFPRs in countries such as Hong Kong, Japan, Republic of Korea and Singapore, which are of similar living standards in terms of GDP per capita, over the past decade and assume that these rates are achieved in the year 2035. The LFPRs are shown in Table 2.

Table 2.

Highest observed labour force participation rates in Hong Kong, Japan, Republic of Korea and Singapore from 2000-2009

Gender / Age Group	Hong Kong	Japan	Republic of Korea	Singapore	Assumed LFPR for Brunei in 2035
Male					
55-64	65.1%	84.6%	76.8%	79.6%	84.6%
65+	10.7%	34.1%	42.9%	27.1%	42.9%
Female					
55-64	30.9%	53.2%	48.7%	42.5%	53.2%
65+	2.0%	14.4%	23.3%	9.3%	23.3%

Source: ILO (2011)

Based on the above LFPR assumptions, total labour supply is projected to increase to 333,100 in 2035 – an increase of 54,400 but still substantially lower than the required number of 103,000. Given that the above LFPR assumptions are extremely optimistic, the policy measure of encouraging older workers to remain in employment alone is insufficient to meet future labour requirements. In addition, there are other issues to consider such as their employability and skills relevance in the future economy, willingness to sacrifice leisure for work and additional costs due to the dominance of seniority-based compensation, among others.

III. Increasing labour productivity

We define labour productivity to be real GDP per employed person, since total hours worked is not recorded in Brunei. Table 3 shows the real GDP and labour productivity growth rates in the past two decades. Productivity growth has largely remained negative, even in "productive" sectors such as construction, wholesale and retail trade, financial, insurance and business services (see Koh, 2010).

Table 3.

Real GDP and labour productivity growth rates from 1989-2009

Year	Real GDP growth	Labour productivity growth
1990-1994	2.5%	-1.4%
1995-1999	1.7%	-1.6%
2000-2004	2.6%	-0.4%
2005-2009	0.2%	-2.4%

Source: UN (2010), IMF (2010) and author's calculations

As discussed in Chapter 3, based on our benchmark assumptions, real GDP and labour demand are projected to grow at annualised rates of 3 per cent and 2.7 per cent respectively, implying an annualised growth rate of about 0.3 per cent in labour productivity. While this rate may seem slightly optimistic in comparison to historical productivity growth rates which have for the most part been negative, it is not unreasonable to assume future improvements in

productivity brought about by a more competitive business environment, investments in high value-added sectors and more highly trained workforce, which are areas the Government is focusing on.

A simulated increase in labour productivity by one whole percentage point is able to reduce labour demand significantly, from the projected 381,680 in 2035 under the benchmark scenario to 295,950. When compared to the projected labour supply of 278,700 in 2035, the difference can more easily be filled in by foreign workers, leading to a much smaller change in the proportion of foreign labour in the total workforce. An annualised productivity growth of 1.3 per cent is not impossible, given the experience of other countries that have invested heavily in technological innovation, research and development, education and training schemes, workplace practice improvement, infrastructural upgrading and the use and integration of advanced IT services. A productivity growth rate of 1.3 per cent is in the lower range of what the OECD countries experienced in 1995-2000, which ranges from 0.8 to 2.5 per cent (see Hui & Hashmi, 2004).

To further highlight the importance of productivity in reducing labour demand and hence dependence on foreign labour, a 6 per cent GDP growth target translates to a labour demand of about a million workers in 2035. An improvement of productivity growth to 1 per cent can reduce the labour shortfall by 30 per cent. While the target of 6 per cent may seem elusive when compared to historical experience, productivity gains offer a very promising pathway to achieve the country's aspirations.

Table 4 summarises the impact of reducing labour shortages based on the various policy measures. Based on the benchmark GDP growth scenario, the projected labour shortage is 103,000 in 2035 (compared to a labour excess of 7,000 in 2009). Increasing the total fertility rate, using the high variant case from the UN, has limited effectiveness. Increasing the labour force participation rate of older workers to that of countries with similar living standards and an older retirement age can reduce the labour shortage by about

53 per cent. The most promising policy measure is to increase labour productivity – an increase of one percentage point can reduce the labour gap by about 83 per cent.

Table 4.

Labour shortages based on different policy measures

Year	Benchmark	Increase TFR	Increase LFPR of older workers	Increase labour productivity
2009	-7,000			
2035	103,000	97,500	48,580	17,260

Source: Author's calculations

5.0 Conclusion

In this paper, a macro view of the future labour market is presented, with a model constructed to project labour supply based on the methodology proposed by Kim (2010) and a simple regression model to project labour demand. The results show a convergence of labour force participation rates of male and female, with the female rate gradually catching up to that of the male. By 2035, the ratio of male to female in the total workforce is projected to be 52:48, a marked decrease over 2009 at 57:43. This is also accompanied by a consistent decline in the total fertility rate, and this trend will inevitably alter the population pyramid to that of an aging one with consequences experienced by other developed countries, most notably the increased dependence on foreign labour due to shortages in the resident labour force.

This paper also shows that labour demand is projected to grow at an annualised rate of 2.7 per cent, from 190,680 in 2009 to 381,680 in 2035, based on the benchmark scenario of an annualised real GDP growth rate of 3 per cent. However, labour supply is only projected to grow at an annualised rate of 1.3 per cent, from 197,720 to 278,700 over the same period. Hence the

shortfall will have to be made up by foreign workers, whose proportion of the total workforce is projected to increase from 50 per cent in 2009 to 63 per cent in 2035.

Several policy measures were considered to reduce the dependence on foreign labour – increasing total fertility rate, increasing the labour force participation rate of older workers and increasing labour productivity. While it might be the case that a combination of policy measures may be more effective, such combinatory cases are not explored in this paper as the aim is to compare and contrast individual policies and assess their relative impacts. Among these policy measures, productivity improvement appears to be more promising. However, productivity growth rates have been mostly in the negative region in the past two decades, and much work will have to be done to address this challenge.

Typical of resource-dependent nations, labour distribution in Brunei is distributed unevenly, with the oil and gas sector contributing more than half of the nation's GDP but providing work for only about 5 per cent of the employed population. The majority of the workforce is employed in less economically productive sectors of secondary importance, hence driving productivity in the non-oil and -gas sector is particularly important. Productivity strategies such as providing incentives for productivity transformation, embedding technology into business processes to improve efficiency, cultivating creativity and innovation, creating awareness campaigns, emphasising education and training to improve the knowledge base, as well as setting up a national authority to drive and oversee productivity changes in priority sectors are some of the key areas for consideration. Policymakers need to set productivity as a high-priority theme in the national agenda.

REFERENCES

ADB 2010, *Asian Development Outlook 2010 Update: The Future of Growth in Asia*, Asian Development Bank, Manila.

Bandial, Q. 2011, 'Sustaining high welfare payments a concern', *The Brunei Times*, 13th January 2011.

Bhaskaran, M. 2007, '*Economic Diversification in Negara Brunei Darussalam*', CSPS Report, Centre for Strategic and Policy Studies, Brunei Darussalam.

Cleary, M. & Wong, S. Y. 1994, '*Oil, Economic Development and Diversification in Brunei Darussalam*', Macmillan, London.

Crosby, M. 2007, '*Economic Diversification*', CSPS Report, Centre for Strategic and Policy Studies, Brunei Darussalam.

Goh, D.N. & Thien, R. 2011, 'Brunei focusing on quality of manpower', *The Brunei Times*, 23rd September 2011.

Hassan, S. R. M. 2011, 'Maternity leave guidelines out', *The Brunei Times*, 4th January 2011.

Hui, W.T. & Hashmi, A. R. 2004, 'Foreign Labour and Economic Growth Policy Options for Singapore', *CLMR Discussion Paper Series 04/2*, the Centre for Labour Market Research, The University of Western Australia, Perth.

ILO 2010, *LABORSTA Statistics Database*, International Labour Organization, Geneva.

ILO 2011, *Key Indicators of the Labour Market (KILM)*, International Labour Organization, Geneva.

IMF 2010, *World Economic Outlook Database 2010*, International Monetary Fund, Washington.

JPKE 2011, *2010 Annual National Accounts*, Department of Economic Planning and Development, Prime Minister's Office, Brunei Darussalam.

JPKE 2011, *Quarterly Gross Domestic Product First and Second Quarter 2011*, Department of Economic Planning and Development, Prime Minister's Office, Brunei Darussalam.

Kim, J. 2010, 'Past and Future of the Labor Force in Emerging Asian Economies', *ADB Economics Working Paper Series No. 218*, Economics and Research Department, Asian Development Bank, Manila.

Koh, W.C. 2010, 'Quantum leaps in labour output needed', *The Brunei Times*, 18th September 2010.

Koh, W.C. 2011, 'A Macro-econometric Model of Brunei Darussalam', *CSPS Strategy and Policy Journal*, Volume 2, July 2011, pp. 55-72.

Mahmud, H. 2007, 'Give local workers priority in jobs', *The Brunei Times*, 18th March 2007.

Mahmud, H. 2009, 'HM increases retirement age to 60', *The Brunei Times*, 15th July 2009.

Masli, U. 2010, 'Concern over illegal foreign workers', *The Brunei Times*, 9th December 2010.

Rosli, S. 2008, 'Brunei targets 6% growth in new economic blueprint', *The Brunei Times*, 20th January 2008.

Tisdell, C.A. 1999, 'Brunei's Quest for Sustainable Development: Diversification and Other Strategies', in Obben, J. and S.E. Tan (eds.), *Readings on the Economy of Brunei Darussalam*, Universiti Brunei Darussalam, Brunei Darussalam, pp. 246-312.

UN 2004, 'Chapter VI. Methodology of the United Nations Population Estimates and Projections', *World Population Prospects: The 2004 Revision, Volume III: Analytical Report*, Population Division, Department of Economic and Social Affairs, United Nations, New York.

UN 2010, '*World Population Prospects: The 2010 Revision*', Population Division, Department of Economic and Social Affairs, United Nations, New York.

UNFPA 2002, '*Population Ageing and Development: Social, Health and Gender Issues*', United Nations Population Fund, New York.

U.S. Department of State 2009, '*Trafficking in Persons Report 2009'*, Office To Monitor and Combat Trafficking in Persons, U.S. Department of State.

World Bank 2010, 'World Development Indicators and Global Development Finance', The World Bank Group, Washington DC.

Brunei Darussalam's Labour Market: Issues and Challenges

Lutfi Abdul Razak

Abstract

Using a demand and supply analytical framework, this paper provides a discussion of Brunei Darussalam's labour market in the context of the Long Term Development Plan or *Wawasan 2035*. To achieve this goal, the available quantitative evidence suggests that several issues and challenges need to be addressed on both sides of the labour market. On the demand side, industrial expansion and private sector driven growth require the correction of structural rigidities and an unbalanced incentive structure. On the supply side, the desired skill requirements and labour productivity gains can be met through improvements in the education system, as well as a reassessment of restrictive immigration policies. The new national education strategy, SPN21, should address low levels of tertiary education attainment, a lack of vocational and technical education opportunities and widening gender disparity. Finally, it is argued that the collection and dissemination of more comprehensive and up-to-date data, through Labour Force Surveys or their equivalent, as well as other key indicators of the labour market, is imperative. This would enable researchers and policymakers to constantly monitor and assess pertinent issues related to the functioning of the labour market, as well as to guide and inform more accurate policymaking decisions towards *Wawasan 2035*.

Keywords: *Labour Market, Labour Force Participation, Unemployment, Economic Diversification, Education, Immigration*

Lutfi Abdul Razak is a PhD Economics candidate at the University of Warwick. His research interests include public economics, economics of the third sector, institutional economics and applied econometrics.

1.0 Introduction

Brunei Darussalam is currently in pursuit of an ambitious 30-year development plan called the Long Term Development Plan, or *Wawasan 2035,* by which time it wishes to be recognised for:

1. The accomplishments of its well-educated and highly skilled people,
2. Having a high quality of life,
3. Having a dynamic, sustainable economy (Government of Brunei Darussalam, 2007).

The publication also states that the government and private bodies need to develop and implement well-coordinated national strategies to realise these long-term goals.

Brunei is well-known for its high standard of living, with GDP per capita one of the highest in Asia, and reputable standards in education and healthcare. According to the latest United Nations (2011) Human Development Report, Brunei's HDI[1] value for 2011 is 0.838, which places it in the very high human development category, with a respectable position of 33 out of 187 countries. This HDI value has improved from 0.750 in 1980 – which represents an increase of 12.0 per cent or an average annual increase of about 0.4 per cent – with Leete (2008) highlighting exemplary achievements in healthcare compared to the top 5 countries in the index.

The prosperity enjoyed owes much to the substantial incomes generated from valuable natural resources, coupled with government-driven welfare programmes in education and health, as well as generous, non-targeted subsidies on necessities such as food, housing and fuel. However, the *Wawasan 2035* report (Government of Brunei Darussalam, 2007) also outlines the following emerging social and economic facts that would seem to threaten sustained prosperity:

[1] The Human Development Index (HDI) is a composite measure of life expectancy, literacy rates and standards of living for countries worldwide.

a. Although oil and gas resources have contributed much to the nation's prosperity, economic growth has, on the whole, not kept pace with population growth.
b. The public sector is the main employer of the majority of the citizens and residents and can no longer adequately absorb the growing numbers of young people wishing to enter the workforce each year.
c. There is a widening gap between the expectations and capabilities of the nation's youth and the employment opportunities currently being created.
d. The oil and gas sector that makes up about half of the economy and over 90 per cent of export earnings employs less than 3 per cent of the work force.
e. The local business community continues to be weak and is unable to create the employment opportunities now required.

Each of these facts represents challenges that need to be addressed by policymakers to ensure the success of the long-term development goals stated. This paper will be structured as follows. The next section will give an outline of population trends and two key indicators of the labour market: labour force participation and unemployment. The third and fourth sections look at the issues that affect the demand side and the supply side of the labour market, respectively. The fifth section consolidates both these demand and supply forces by introducing a concept of equilibrium in the labour market, and the final section concludes.

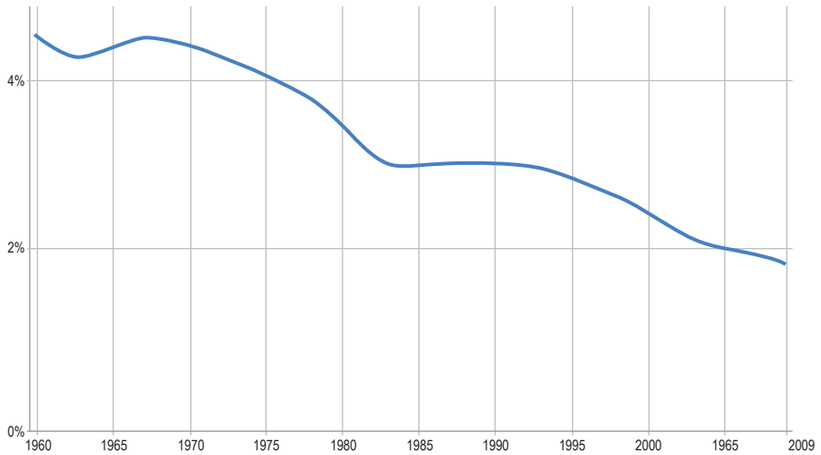
2.0 Population Trends

According to the latest figures, the current population of Brunei Darussalam is estimated to be roughly 400,000. This is considered very small by international standards, and together with a steadily declining population growth rate (as shown in Figure 1) from 4.8 per cent in 1960 to 1.9 per cent in 2009, presents a constraint to labour-intensive economic activities. In addition, the labour market is also limited by government regulations on the

immigration of foreign labour. Although foreign labour represents a significant proportion of the labour force, work permits for foreigners are issued only for short periods of time and must continually be renewed.

Figure 1.

Population growth rate (log) for Brunei Darussalam 1960 - 2009



Source: World Bank (2011)

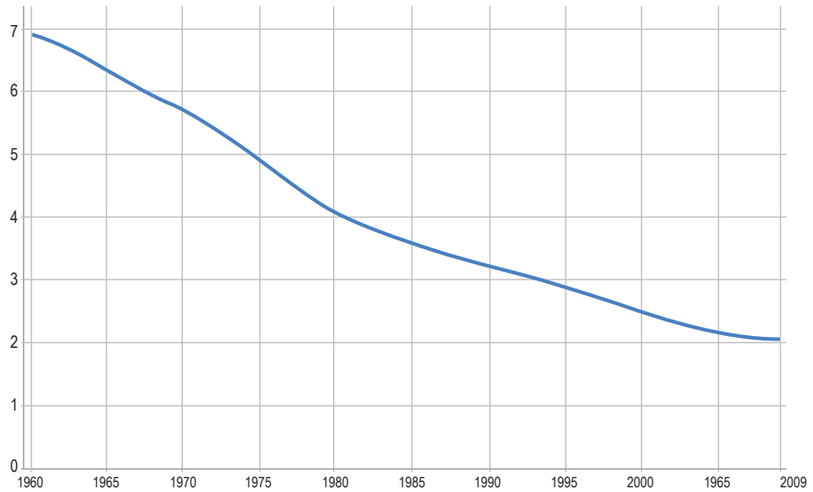
This slowing down of the population growth rate can be attributed to the reduced fertility rate, as shown in Figure 2, from an average of 6.95 births per woman in 1960 to an average of 2.05 births per woman in 2009. The declining fertility trend in Brunei is part of a wider trend that is common across many developed and developing countries, and has been the subject of considerable debate. It is important to study the causes and possible implications of this fertility trends, as it may have a broader social and economic impact. One plausible explanation for the declining fertility trend is that increased female participation in the labour force (which will be elaborated further in the next subsection) tends to be associated with delayed marriage and family planning decisions, and subsequently smaller families.

Another feature of the population is increased life expectancy, which has been made possible due to an improvement in health standards and medical facilities. According to World Bank (2011) estimates, the life expectancy at

birth in Brunei for 2009 was 77.5 years, which is an increase from 62.2 years in 1960. Taken together with the steady decline in the population growth rate, these two factors would tend to contribute to an ageing population. In line with increased life expectancy and longer productive years of the population, the national retirement age has recently been increased from 55 to 60 years old, which also helps reduce the (actual) dependency ratio, or the pressure on the productive group of the population.

Figure 2.

Fertility rate (average number of births per woman) for Brunei Darussalam 1960 - 2009



Source: World Bank (2011)

The dependency ratio is the age-population ratio of those typically not in the labour force (the *dependent* part) and those typically in the labour force (the *productive* part). In published international statistics, the *dependent* part usually includes those in the population under the age of 15 and over the age of 65, whilst the *productive* part makes up the remainder of the population in between 15-64. Estimates from the Asian Development Bank (2011, p. 140) show that the dependency ratio for Brunei declined from 62.7 in 1990 to 43.3 in 2010, which suggests an increase in the productive part of the population relative to the dependent part. However, the combined effects of reduced

fertility rates and increased life expectancy provide reasonable doubt as to whether this trend will continue much longer into the future, reflected in the foresight of policymakers in increasing the retirement age. Additional provisions and precautions might need to be taken beforehand as too high a dependency ratio can cause direct consequences such as increased government expenditures (e.g. on healthcare, social security and education), as well as many indirect consequences.

Against the background of these population and demographic changes, the next two subsections will focus on changes in the structure of the labour market in terms of labour force participation and unemployment.

2.1 Labour Force Participation

The labour force participation rate is a measure of the proportion of an economy's working-age population that is economically active, i.e. either employed or unemployed but actively seeking and available for work. It provides an indication of the relative supply of the labour force that is available for the production of goods and services.

Taken from previous census estimates, Figure 3 demonstrates the breakdown of the labour force by gender and age group, and gives a profile of the distribution of the economically active population in Brunei for 1991 and 2001.

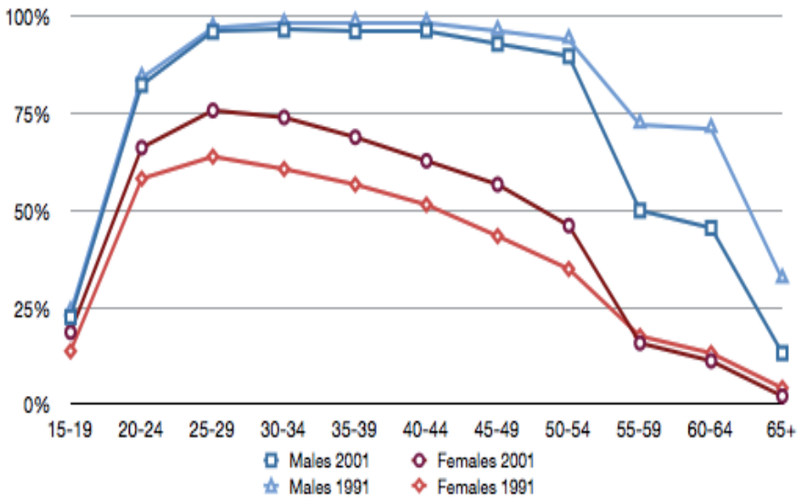
Often for traditional reasons, female participation tends to predominantly lag behind male participation in the labour force. However, as shown in Figure 3, female participation in the labour force has increased between 1991 and 2001, particularly for those within the 15-54 age groups.

Increased female labour force participation is a growing trend that can be

traced back to earlier (Census) estimates[2], as a result of increased opportunities in education and the labour market.

Figure 3.

1991 and 2001 Labour force participation rate (%) for the total population, by gender and age group



Source: Government of Brunei Darussalam (2005)

Many people in Brunei still rely on a strong traditional family support system that extends beyond the nuclear structure, and it is also common to pay for domestic help. This increasingly enables participation in the labour force[3]. In addition, increased governmental support has been given to working mothers,

[2] However, estimates from the Brunei Darussalam Statistical Yearbook (Government of Brunei Darussalam, various years), indicate that the trend of increasing female participation rates in the labour force has been slowing down in the years after 2001. In 2010, the overall labour force participation rate for females (males) was estimated to be 58.0 per cent (76.4 per cent), compared to 57.3 per cent (78.2 per cent) in 2006. Nevertheless, the Census estimates shown here are the latest comprehensive figures that illustrate the breakdown of the labour force participation rate, according to gender and age group. The data collection for the 2011 Census was recently conducted in mid-2011 and the publication of its results is forthcoming.

[3] There is some evidence suggestive of an overall increase in the labour force participation rate in recent years. For example, the latest Brunei Darussalam Statistical Yearbook 2010 (Government of Brunei Darussalam, various years), shows a very slight increase in the overall labour force participation rate from 67.9 per cent in 2001 to 68.0 per cent in 2010. However, this should come with the caveat that these estimates may not be directly comparable as they are based on studies which employ different methodologies and suffer different biases, as discussed in footnotes 4 and 6.

for example, recent improvements to maternity leave guidelines for those in the public and private sector.

The decline in the labour force participation above the age of 55 between 1991 and 2001 for both males and females as shown in Figure 3 can largely be attributed to previous legislation on the national retirement age of 55. Although it is unclear why the male labour force participation rate was previously higher for those aged over 55 in 1991, it should be expected to increase in the years to come, in line with the recent change in legislation on the national retirement age, as previously stated.

Students are not considered economically active and this is reflected in the low participation rates for the 15-24 age-groups, as shown in Figure 3. Typically, students seek to obtain the skills and training that would improve their employment prospects. Young people who enter the labour force without sufficient skills or relevant work experience may encounter employment difficulties.

2.2 Unemployment

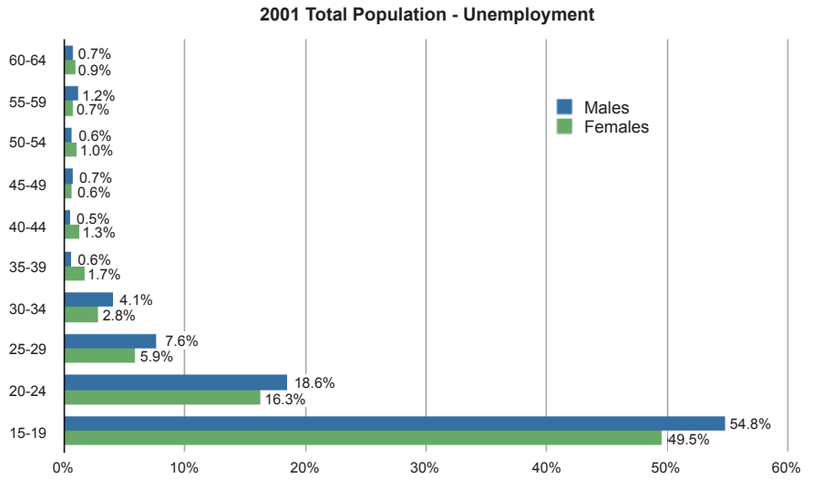
Unemployment is a central concern of labour market issues. The formal definition of an unemployed person is one who is not currently undertaking paid work but is able, willing and actively seeking work. Taken together with those who are employed, they make up the labour force and are considered as part of the population that is economically active. The rest of the population are considered economically inactive, and include children, students, retirees, those who are unable to work such as disabled people, and those who choose not to undertake paid work such as housewives.

Figure 4 shows the distribution of unemployment in Brunei by gender and

age group from the 2001 Population Census[4], with an overall unemployment rate of 7.2 per cent[5]. The unemployment rates recorded were highest amongst young people, with each subsequent age group recording a lower rate. The estimates also show that females experience less unemployment compared to males in each age group. Whilst neither finding is too surprising, the extent of youth unemployment is an area of concern with approximately 50 per cent of those in the 15-19 age group that are economically active unable to find work.

Figure 4.

2001 Unemployment rate for the total population, by gender and age group



Source: Government of Brunei Darussalam (2005)

[4] Cheong & Lawrey (2009, p. 35) explain that the Census is not specifically designed to estimate unemployment and is likely to overstate unemployment as formally defined by the International Labour Organization (ILO). This is because the Census data does not distinguish between part-time and full-time employment, incorrectly records unemployment for temporary residents despite legal inconsistencies regarding employment law involving temporary residentship and does not make seasonal adjustments to account for school leavers during the Census period. Nevertheless, the Census estimates shown here are the latest comprehensive figures that illustrate the breakdown of the unemployment rate, according to gender and age group. The data collection for the 2011 Census was recently conducted in mid-2011 and the publication of its results is forthcoming.

[5] There is evidence suggestive of a reduction in the overall unemployment rate since 2001. For example, the Brunei Darussalam Statistical Yearbook (Government of Brunei Darussalam, various years) shows a decrease in the unemployment rate from 7.2 per cent in 2001 to 2.7 per cent in 2010. However, this should come with the caveat that these labour force statistics may not be directly comparable since they are based on studies which employ different methodologies and suffer from different biases, as discussed in footnotes 4 and 6.

In a recent survey paper on unemployment issues in Brunei, Cheong & Lawrey (2009) note that, aside from the Population Census, labour force statistics are also collected by the Labour Department through its list of registered job seekers[6]. With a significant number of registered job seekers currently employed, only 65 per cent of the sample from their study can be formally classified as unemployed. This corresponds to an estimated overall unemployment rate of 2.2 per cent during their period of study in 2008[7]. They find that the main cause of unemployment was frictional, with a majority of their sample having left work voluntarily or still looking for their first job. However, in contrast to typical frictional unemployment, they also find that 74 per cent of the unemployed from the sample had been without a job for more than 6 months. This long-term unemployment that is experienced is a more serious form of unemployment. In addition, they also alluded to the presence of structural unemployment with "*a significant mismatch between skills and desired employment*" (Cheong & Lawrey 2009, p. ix), which implies an inefficient allocation of labour resources[8]. For local job seekers, they infer that the reservation wage, the lowest wage below which they would prefer to stay unemployed rather than employed, is higher than the market salary for the jobs which they are qualified for. Despite the absence of a formal unemployment benefit system in Brunei, this unwillingness to accept lower wages can be explained by family support and the unintended consequences of governmental subsidies, as Cheong & Lawrey (2009, p. 47) state:

6 Cheong & Lawrey (2009, p. 35) explain that the list of registered job seekers collected by the Labour Department may not be a definitive measure of unemployment for the following reasons: (a) firstly, job seekers may be employed, but looking for a better (paying) job, (b) secondly, not all the unemployed register with the Labour Department, (c) and thirdly, those who have registered with the Labour Department and have subsequently found work are under no obligation to inform the Labour Department and have their names removed from the list. Thus, there are disparities between the definition used by the Labour Department and the formal definition for unemployment, and hence may not be directly comparable to the Census data or international statistics.

7 According to the data cited by the Brunei Darussalam Statistical Yearbook (Government of Brunei Darussalam, Various Years), Brunei's unemployment rate for 2008 stood at 3.7 per cent. Unemployment figures tend to fluctuate throughout the year for a variety of demand-side or supply-side reasons.

8 Another form of unemployment is cyclical or demand-deficient unemployment, which occurs during periods of economic downturns or recessions.

> *"... in Brunei with its subsidised rice, sugar, petrol, gas, education and healthcare, the necessity to work for low wages is less pressing than in some other countries. In other words, these welfare schemes, while helping to alleviate poverty, might actually result in longer periods of unemployment for some sections of the community."*

Persistent long-term unemployment is a burden as it reduces the productive capacity of an economy. In a paper that analysed the aggregate demand for labour using dynamic econometric models, Anaman (2003) concludes that the natural rate of unemployment in Brunei has increased. The natural rate of unemployment is achieved at the full-employment level of real output and without structural change or supply-side adjustments attempts to reduce unemployment below this level would tend to be inflationary.

With limited available, reliable and up-to-date statistics on the labour force, as described above, many issues with regards to unemployment remain unresolved and continue to pose many questions. The answers to such questions could be obtained with more frequent and comprehensive surveys, such as the internationally-accepted Labour Force Survey (LFS)[9]. In addition to labour force participation and unemployment, other key indicators of the labour market (KILM)[10], a multi-functional research tool of the ILO, could also be collected to further examine the health of the labour market on a more regular and comprehensive basis, such as the employment-to-population ratio, youth unemployment, long-term unemployment, time-related

9 The last (published) Labour Force Survey in Brunei was held in 1995. The LFS is a standard household-based survey of work-related statistics that would enable cross-sectional and time-series analyses for policymakers and researchers. Alternatively, panel data could be collected on multiple phenomena including work-related issues over multiple time periods for the same individuals or households to enable panel data analysis, an increasingly favoured form of (longitudinal data) analysis. The US Panel Study of Income Dynamics (PSID) and the British Household Panel Study (BHPS) are popular international examples which have been used to study labour market issues.

10 For further details on the KILM, see http://www.ilo.org/kilm. In 2007, Brunei became an official member of the ILO, an agency of the United Nations. There are some disparities in the unemployment rate and the labour force participation rate figures quoted by the International Labour Organization (2010) compared to those described above within this section. The reasons for this are not immediately clear, but the general points discussed should still hold.

underemployment, employment in the informal sector, hours of work, part-time workers, educational attainment and illiteracy, hourly compensation costs, occupational wage and earning indices, labour productivity, working poverty and income distribution. The benefit of employing the KILM would not just be to highlight the most current labour market trends, but it would also serve as a tool for policymakers and researchers in constantly monitoring and assessing pertinent issues related to the functioning of labour markets.

Unemployment can occur as a result of the demand side or supply side pressures of the labour market, and the next two sections examine these features in the Brunei context.

3.0 The Demand for Labour

One of the key elements of the Long Term Development Plan (Government of Brunei Darussalam, 2007) includes a strategy to address the future demand for labour:

> *"an **economic strategy** that will create new employment for our people and expand business opportunities within Brunei Darussalam through the promotion of investment, foreign and domestic, both in downstream industries as well as in economic clusters beyond the oil and gas industry."*

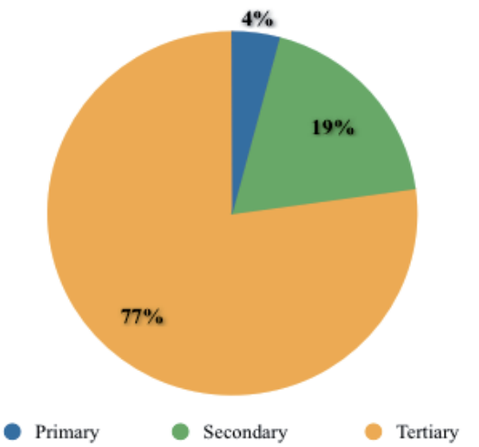
The strategy highlighted above indicates that increased emphasis will be given to the wealth-producing secondary sector, rather than the wealth-consuming service or tertiary sector, to increase exports and reduce over-reliance on imported consumer and capital goods, which would increase the circular flow of income within the economy. This would entail an expansion in the share of total employment in the secondary sector, which stood at 19 per cent in 2001, as shown in Figure 5[11]. However, the disadvantage posed by

[11] The industrial sectors that were included in the calculation of this figure for the secondary industry were: Manufacturing; Electrical, Gas & Water Supply; Construction.

the lack of economies of scale afforded by a relatively small domestic market and labour force coupled with competitively-priced imported goods presents a major challenge to this objective. Nevertheless, there is some recent evidence suggesting that the expansion of the secondary sector may already be underway[12].

Figure 5.

Share of Employment by Industry in 2001 (%)



Source: Government of Brunei Darussalam (2005) (author's own calculations)

It is widely acknowledged that the Brunei economy needs to diversify to reduce its heavy reliance on oil and gas revenues. The issues and challenges of economic diversification have often been debated in the past, and more recently, in-depth coverage has been detailed by authors such as Crosby (2007), Bhaskaran (2007), Lawrey (2010), Haji Hashim (2010) and Duraman & Tharumarajah (2010). Although the wealth generated from natural resources has allowed for good infrastructure development, the provision of public goods and a relatively high material standard of living for citizens, one

[12] According to the data cited by the International Monetary Fund (2011, p. 21), the share of private sector employment in secondary industry (i.e. Sawmilling & Timber Processing; Other Mining, Quarrying & Manufacturing; Construction) was 39 per cent in 2009. Using the same Census data that was used to construct Figure 5, the share of private sector employment in secondary industry in 2001 was 29 per cent (Government of Brunei Darussalam, 2005). However, different industrial sectors were categorized (c.f. footnote 11) and thus caution should be exercised before making direct comparisons and deriving conclusive statements.

negative side-effect has been the structural rigidities left in the labour market.

The dominance of two major employers in the labour market – the public sector and Brunei Shell Petroleum in the oil and gas sector are highlighted by Crobsy (2007, p. 1) and Bhaskaran (2007, p. 19). The market power exerted by these dominant employers in the demand for labour creates an imperfectly competitive[13] labour market – especially in the recruitment of the local labour force. The public sector employed 42,000 out of 74,000, or 57 per cent, of the local labour force in 2004 (Crosby 2007, p. 33). High wages and generous non-pecuniary benefits provided by the public sector can only be matched by the largest private employer. However, Haji Hashim (2010, p. 41) explains that despite considerable power in the labour market, Brunei Shell Petroleum and other oil-related companies employ only approximately 4 per cent of Brunei Darussalam's total workforce, due to the capital-intensive nature of the oil and gas industry.

The unbalanced incentive structure created by the dominance of these major employers contributes to the weakness of the private sector: another unintended consequence. The rest of the private sector is largely unable to compete, as Haji Hashim (2010, p. 41) noted that "*well-educated Bruneians shied away from these establishments and opted for the Government in their bid to secure a more reliable and sustained source of income*", and Brunei is left with a relatively weak residual local labour force. From the latest publication of the Brunei Darussalam Statistical Yearbook 2010 (Government of Brunei Darussalam, Various Years), only 39,025 out of 121,158 employees in the private sector in 2009, or 32.2 per cent of employees, were

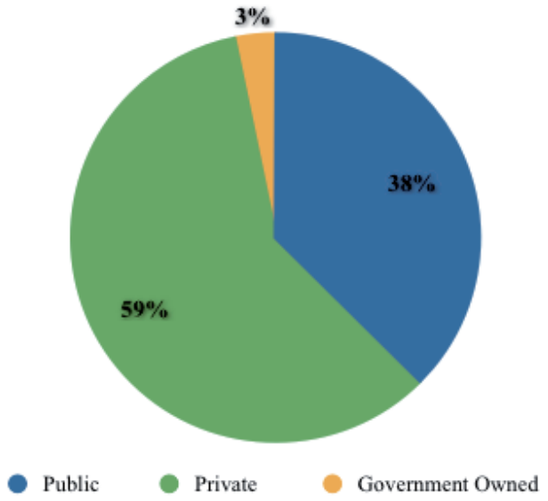
[13] "Imperfect competition" in the labour market is often compared to a monopsonistic employer in the traditional sense, that is, the sole employer in a labour market. Traditional textbook monopsony is unrealistic, since employers compete with one another to some extent. However, in the theoretical spectrum between the polar opposites of perfect competition and monopsony, there lies a range of points where a degree of market power coexists with competition between employers. The most accurate descriptions of the labour market that exhibit this would be "oligopsony" or "monopsonistic competition". Oligopsony refers to a situation where employer market power persists despite competition with other employers, while monopsonistic competition refers to oligopsony with free entry, such that employer profits are driven to zero. Nevertheless, the description of the overall labour market in Brunei would certainly lie closer to the monopsony than perfect competition on this theoretical spectrum, though this should vary by sector.

classified as Brunei citizens or permanent residents, with the remainder of private sector employment filled by temporary residents. The majority of temporary residents or foreign labour would be classified as unskilled or semi-skilled, as will be shown in the next section.

Nevertheless, the bulk of total employment – the sum of the local and immigrant labour force – is provided by the private sector in Brunei Darussalam, with 59 per cent in 2001[14], as shown in Figure 6. Haji Hashim (2010, p. 40) explains however, that "*more than 95 per cent of all establishments in the private sector are considered as micro, small and medium enterprises and a large proportion of them are actively concentrated in the services industry*". From the latest Brunei Darussalam Statistical Yearbook 2010 (Government of Brunei Darussalam, various years), out of the 8,935 establishments listed in the private sector in 2009, only 14 companies employed 500 workers or more, which includes four companies in the construction sector that engage in short-term employment, as highlighted by Haji Hashim (2010, p. 41). This is indicative of the size, and hence strength, of the firms in the private sector. The relatively low wages afforded by the lack of scale presents a challenge for the private sector in attracting highly skilled local or foreign talent. The structural rigidities and lopsided incentive structure caused by an imperfectly competitive labour market as described above are symptomatic of the unique structure of the Brunei economy. Haji Hashim (2010, p. 41) further explains that the existing size and structure of the non-oil private sector in Brunei Darussalam is indicative of the legacy of rentierism – where the economy has been solely dependent on income accrued from abroad for the sale of its main product from a "booming sector" and thereby has a relatively "neglected" non-oil sector. This presents a major obstacle to the private sector-driven growth required for *Wawasan* 2035.

[14] A more recent calculation of government sector employment and private sector employment using data cited from the International Monetary Fund (2011, p. 20-21) would suggest that the private sector accounted for as much as 72 per cent of total employment in 2009. However, this calculation may not be completely accurate as it would entail using two different data sets. Nevertheless, the broad point remains that the private sector provides the largest share of total employment in Brunei.

Figure 6.
Share of Employment by Sector in 2001 (%)

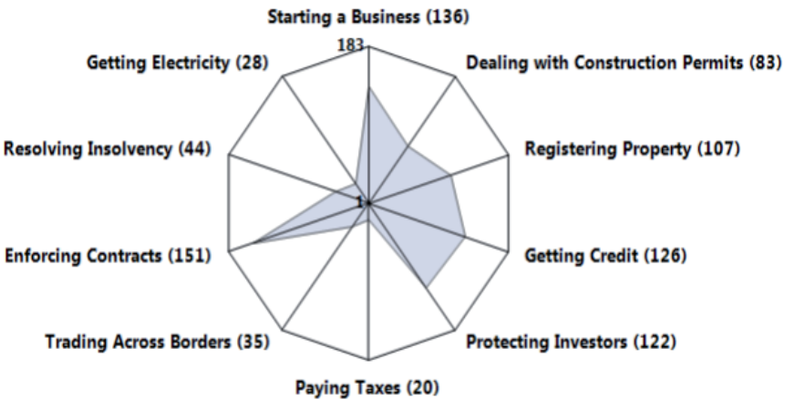


Source: Government of Brunei Darussalam (2005) (author's own calculations)

The overall business environment in Brunei has recently been scrutinised in the latest Ease of Doing Business (EoDB) report (World Bank & International Finance Corporation, 2011). The findings are succinctly summarised in Figure 7, in a ranking of *Doing Business* topics relative to 183 countries worldwide. Although Brunei scores relatively well in some measures, such as Paying Taxes, Getting Electricity, Trading Across Borders & Resolving Insolvency, its performance is relatively poor in other measures, particularly in Enforcing Contracts, Starting a Business, Getting Credit & Protecting Investors as shown. This translates to an overall rank of 83 out of 183 countries worldwide and represents a 29-rank improvement over the previous year, the second successive year Brunei has posted a rank-improvement since joining the EoDB study in 2007. The formation of the EoDB Steering Committee and Working Committee earlier in 2011 should allow and oversee a coordinated effort by relevant agencies and stakeholders towards undertaking reforms that would enable continual improvements in the future, not just in terms of the EoDB indicators, but to the underlying

business and regulatory environment[15]. This in turn should lead to a more competitive and flourishing private sector which would contribute towards a correction of the previously stated imbalances in the incentive structure present in the labour market.

Figure 7.
The Business Environment: How Brunei Darussalam ranks on *Doing Business* Topics



Source: World Bank & International Finance Corporation (2011, p. 8)

The recommendations advocated to promote economic diversification by authors such as Crosby (2007), Bhaskaran (2007), Lawrey (2010), Haji Hashim (2010) and Duraman & Tharumarajah (2010) include, among others, a reduction in the size of the public sector, selective privatisation, a gradual reduction in public sector wages, increased Public-Private Partnerships (PPPs), the establishment of and partnership with large multinational

[15] An improvement to the underlying business and regulatory environment should not just rely on an improvement in terms of the *Doing Business* indicators, but on a broader scale. For example, the World Bank's *Enterprise Surveys,* a comprehensive firm-level survey, can also be conducted to complement the *Doing Business* study, in order to benchmark the quality of the business environment in Brunei. For a comparison of both studies, see: http://www.enterprisesurveys.org /Methodology/Enterprise-Surveys-versus-Doing-Business.

corporations, and increased opportunities in the private sector through grants and other incentives to promote the development of small and medium enterprises (SMEs). This essentially entails the promotion of private sector-driven growth, which in turn would reduce the size of the public sector relative to the private sector and hence reduce the dependency of locals on government jobs through a correction of the unbalanced incentive structure present in the labour market in Brunei. Some of these recommendations may be expensive or politically less feasible, but may prove to be necessary measures to correct the imbalances in the demand for labour. A thorough assessment of each of these recommendations is required to ensure a conducive and competitive environment in the labour market to spur economic diversification and development.

4.0 The Supply of Labour

The supply of labour, which can be thought to be a function of what is produced through the education system and the country's immigration policy, should address the skill needs and desired demand requirements in the market for labour. An educated and skilled workforce is often associated with higher labour productivity levels, and is one that is able to compete in an increasingly globalised world. Another key element of the Long Term Development Plan (Government of Brunei Darussalam 2007, p. 13) outlines a strategy to deal with the growth in the labour force supply:

*"an **education strategy** that will prepare our youth for employment and achievement in a world that is increasingly competitive and knowledge-based."*

The report elaborated further by stating that policymakers "*... will seek to build a first class education system that provides opportunities for every citizen and resident to meet the requirements of our changing economy and encourages life-long learning as well as achievements in sport and the arts*" (Government of Brunei Darussalam 2007, p. 12). In line with this, the

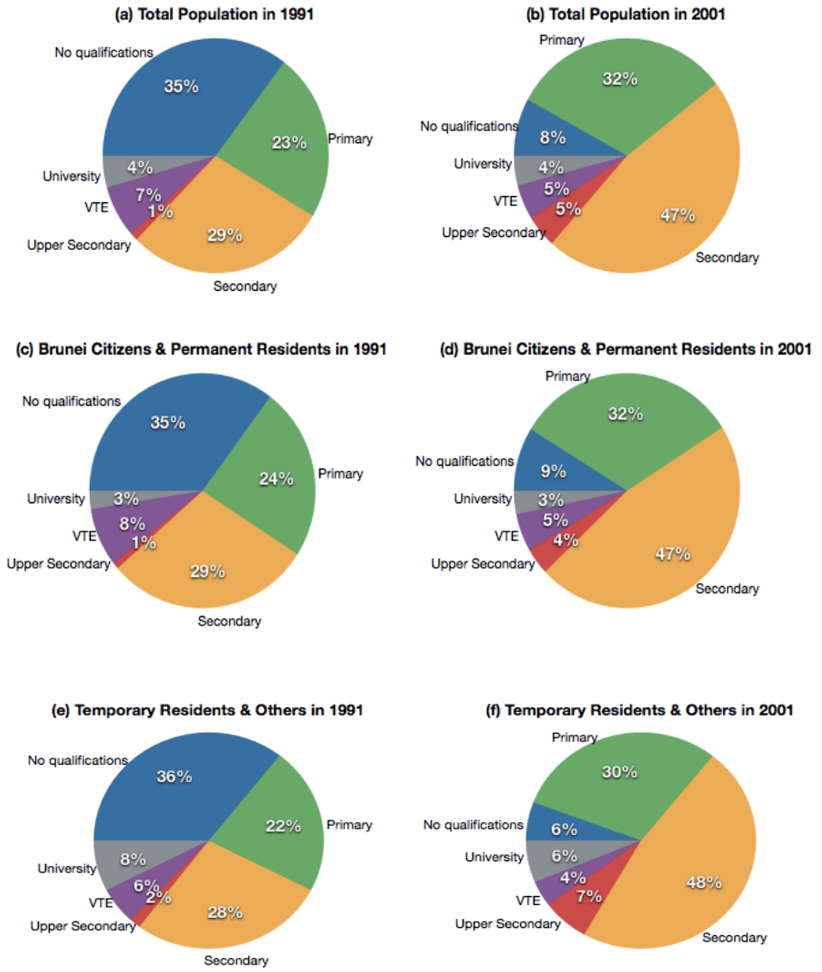
Ministry of Education has recently begun to implement the National Education Strategy for the 21st Century or SPN21 (acronym for *Skim Pendidikan Negara Abad Ke-21).* SPN21 aims to build on the success of the existing education structure, which has seen great improvements in literacy rates and basic education standards. The quality of Brunei's overall education system is reflected in a recent survey published by the Global Competitiveness Report 2011-2012 (World Economic Forum 2011, 444-445), in particular the quality of math and science education[16].

Figure 8 shows the proportion of the Brunei population according to their educational attainment levels, in Figures 8(a) and (b) for the total population, in Figures 8(c) and (d) for citizens and permanent residents and in Figures 8(e) and (f) for temporary residents and others, in 1991 and 2001 respectively. As shown in Figures 8(c) and (d), there has been a significant reduction in the proportion of the local population holding no qualifications from 35 per cent to just 9 per cent, as well as an increase in the proportion of the local population with primary and secondary level education qualifications between 1991 and 2001. This has been made possible as a result of a generous education policy whereby the government provides 12 years of free education to the citizens of Brunei Darussalam, including seven years of primary school (including one year of pre-school), three years of lower secondary school and two years of upper secondary, vocational or technical education.

[16] In a survey question of the quality of the educational system which asks "how well does the educational system in your country meet the needs of a competitive economy?" on a scale of 1 (not well at all) to 7 (very well), Brunei posted a score of 4.6 (against a worldwide mean of 3.8), which placed it at a rank of 28 out of 142 countries worldwide, whereas in a survey question of the quality of math and science education which asks "how would you assess the quality of math and science education in your country's schools?" on a scale of 1 (poor) to 7 (excellent), Brunei posted a score of 4.9 (against a worldwide mean of 3.9), which placed it at a rank of 25 out of 142 countries worldwide.

Figure 8.

Highest Qualification Attainment (%) by Total Population, Brunei Citizens & Permanent Residents and Temporary Residents & Others in 1991 and 2001[17]



Source: Government of Brunei Darussalam (2005) (author's own calculations)

[17] Vocational and Technical Education (VTE) is taken to be the type of education offering vocational and technical subjects. For the purposes of the 1991 Census, this includes: lower technical or vocational education certificate; passed OND or equivalent; passed HND or equivalent; teachers training certificate or diploma or other certificate or diploma. For the purposes of the 2001 Census, this includes: teachers training; nursing courses; vocational or technical. The Census estimates shown here are the latest comprehensive figures that illustrate the breakdown of educational attainment and hence skill structure of the entire population, according to citizenship status. The data collection for the 2011 Census was recently conducted in mid-2011 and the publication of its results is forthcoming.

However, during the same period between 1991 and 2001, improvements beyond secondary level have been relatively modest, with low achievements at VTE and university level. This has been acknowledged by Bhaskaran (2007, p. 18), who states that "*Basic education in Brunei is good, but tertiary education is poor... Many students are in religious education but not enough are in science, engineering or other professional or vocational courses*". Additionally, he argues that the development of human capital is constrained by the incentive structure[18] and the institutional framework.

These trends in education would appear to continue beyond 2001, as calculated and shown in Figure 9. While there has been an overall increase in the percentage pass rates for primary level examinations (PCE) over the 2000 to 2008 period, the percentage pass rates have been relatively lower at the critical secondary examination level (BCGCE O Level) and have even declined slightly over the 1999 to 2008 period. The challenge for SPN21 is to produce an increase in the percentage of pass rates in the student population at BCGCE O Level and above, or their equivalent, without a compromise in the quality or standards of education[19].

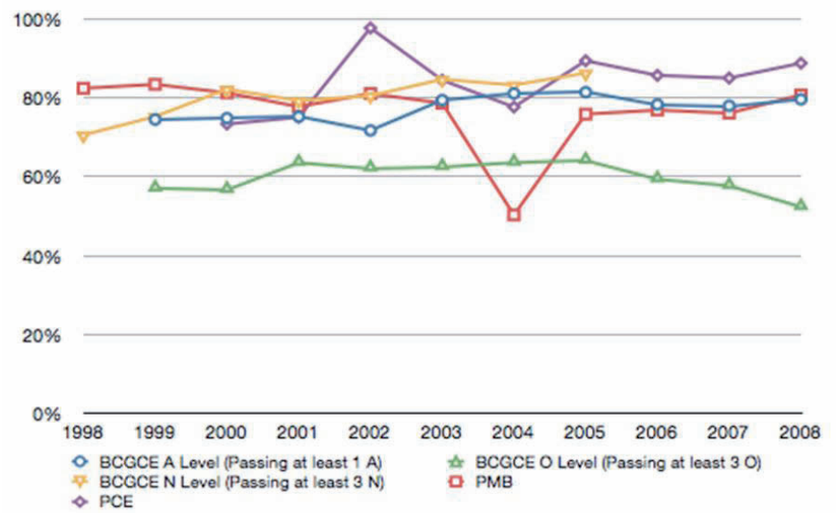
For students who are able to and choose to continue along the academic track, there are many opportunities to further their education to tertiary level, at local and foreign institutions. Over the past decade, a greater number and variety of scholarships have been made available by various public or

[18] According to Bhaskaran (2007, p. 18), the prevalence of government jobs and subsidies creates a set of incentives that do not propel workers to strive and compete, and so excel. He explains further that "if people are complacent because everything is provided for them, there will not be much urge to improve themselves – a lack of keenness to upgrade, hone their skills, keep upgrading etc." Although it should not be taken too literally here that *everything* has been provided for Bruneians, to the extent that there exists the presence of over-generous, non-targeted subsidies and the lack of performance-related pay or the lack of incentives to reward more difficult courses or subjects, the point about the existing incentive structure being skewed towards this outcome should still remain.

[19] In the latest Brunei Darussalam Statistical Yearbook 2010 (Government of Brunei Darussalam, Various Years), the calculated overall performance has remained relatively constant at PCE and BCGCE O Level for 2010 compared to 2008 with pass rates at 89 per cent and 52 per cent respectively, but a slight improvement can be seen overall at BCGCE A Level from 79.6 per cent in 2008 to 81.4 per cent in 2010.

Figure 9.

Pass rates (%) in Public Examinations



Source: Government of Brunei Darussalam (Various Years) (author's own calculations)

publicly-backed institutions[20], as well as the expansion and establishment of more local universities[21]. However, despite these incentives and opportunities, as well as the added incentive of better employment prospects, tertiary education attainment remains quite low. The low pass rates at secondary level as shown in Figure 9 present a major challenge to improve the attainment rates at tertiary education beyond current levels. Although the latest figures for 2009 used in the latest Global Competitiveness Report 2011-2012 (World Economic Forum 2011, p. 442-443) show that the gross secondary education enrolment stood at an impressive 98.2 per cent, which

[20] In addition to government support, private firms in Brunei can also invest in further staff training and employee development. In one of the survey questions published by the Global Competitiveness Report 2011-2012 (World Economic Forum 2011, p. 449), which asks "to what extent do companies in your country invest in training and employee development?" on a scale of 1 (hardly at all) to 7 (to a great extent), Brunei posted a score of 4.1 (against a worldwide mean of 4.0) at a rank of 59 out of 142 countries worldwide.

[21] However, the local availability and quality of specialised training and research services is still lacking in Brunei, which is reflected by the need for locals to seek further education or training overseas. In another survey question published by the Global Competitiveness Report 2011-2012 (World Economic Forum 2011, p. 448), which asks "in your country, to what extent are high-quality, specialised training services available?" on a scale of 1 (not available) to 7 (widely available), Brunei posted a low score of 3.2 (against a worldwide mean of 4.1) at a rank of 116 out of 142 countries worldwide.

placed Brunei at a rank of 35 out of 142 countries worldwide, the gross tertiary education enrolment rate stood only at 17.1 per cent, which placed Brunei at a rank of 95 out of 140 countries worldwide.

The relatively low pass rates seen at secondary level would not be alarming if there were a significant alternative, that is, a vocational track for example, for those who are not suited to the academic route. This is related to the problem noted earlier regarding the constraints of the existing institutional framework for the development of human capital. Bhaskaran (2007, p. 19) explains (in theoretical terms) that "*... people are distributed along a curve since there is a spectrum of abilities in any population. Consequently, every country needs a range of institutions which can develop each strata of ability to the maximum possible.*" He adds that "*We are not sure if Brunei has the full spectrum of educational institutions - vocational schools for those who are not academically inclined or those who start late.*" The reduction in the proportion of the local population with vocational and technical education qualifications between 1991 and 2001, as shown in Figures 8(c) & (d) from 8 per cent to 5 per cent appears to confirm this supposition, and is another area that SPN21 should seek to address[22].

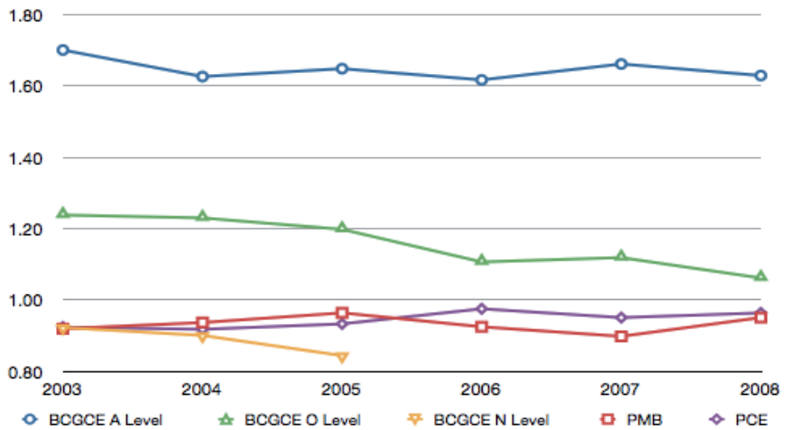
Another aspect of the education system that should be addressed by SPN21 is the issue of gender disparity, where despite equal opportunities there have been unequal outcomes. Figure 10 shows the calculated enrolment ratio of females-to-males in various public examinations, with a greater disparity between males and females recorded at upper secondary level - BCGCE A Levels. The enrolment ratio of females-to-males is shown to be relatively stable at all education levels during this period, except in the case of BCGCE O Levels. At this public examination level, there has been an increase in the

[22] More recent data has not been immediately available to the author. Nevertheless, bolstering the vocational and technical education system is acknowledged as one of the focuses of SPN21, as highlighted in a recent Oxford Business Group Economic Update (Oxford Business Group, 2011). Several plans are afoot to improve the quantity and quality of vocational and technical institutions. This will in turn improve the quantity and quality of vocational and technical graduates to meet the demands of both the students and the national economy.

enrolment of males which is reflected by an improvement in the calculated enrolment ratio of females-to-males from 1.24 in 2003 to 1.06 in 2008[23]. Similarly, Leete (2008) reported that while enrolment in primary and secondary schools was nearly equal, there is a marked contrast when it came to the tertiary level, which favoured females rather than males. This shows that the overall trend of gender disparity has continued to higher levels of education.

Figure 10.

Enrolment Ratio of Females-to-Males in public examinations



Source: Government of Brunei Darussalam (Various Years) (author's own calculations)

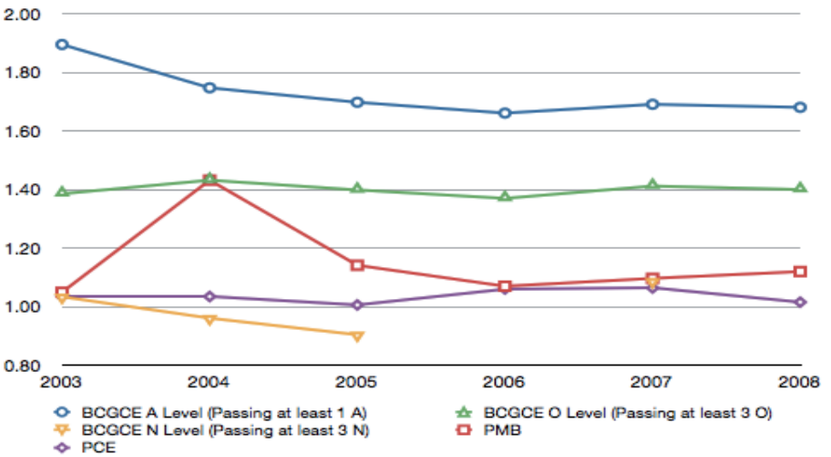
The level at which this gender disparity starts to appear can be ascertained from Figure 11, which shows the ratio of females-to-males in terms of passes in public examinations. While this ratio is roughly unitary at primary and lower secondary level, it becomes clear that the disparity in gender attainment begins to appear at the critical secondary level examination – BCGCE O Level, with the calculated ratio remaining relatively stable at a level of 1.4 during this period. This is followed by an even greater disparity at BCGCE A

[23] In the latest Brunei Darussalam Statistical Yearbook 2010 (Government of Brunei Darussalam, Various Years), the calculated enrolment ratio of females-to-males has remained relatively constant at PCE and BCGCE O Level for 2010 compared to 2008 with a ratio of 1.0 and 1.1 respectively, but a slight improvement can be seen overall at BCGCE A Level with the enrolment ratio of females to males at 1.44 in 2010 compared to 1.63 in 2008. This has been doubly brought about by an increase in male enrolment and a decline in female enrolment in 2010 compared to 2008.

Level, albeit at a level that is calculated to be in decline from 1.89 in 2003 to 1.68 in 2008[24]. The causes for and effects of gender disparity in educational attainment warrant further study, as they can have an impact on the supply of the labour force in an economy.

Figure 11.

Pass Ratio of Females-to-Males in Public Examinations



Source: Government of Brunei Darussalam (Various Years) (authors own calculations)

The increasing gender disparity in educational attainment may have other social effects as well. In a survey of Bruneian women, Anaman & Kassim (2003) confirmed the positive assortative mating model of search for marriage partners across a range of characteristics of husbands. They find that women tend to choose their partners mainly from their educational attainment groups and social class. Given the rapid advancement of women in Brunei over a number of years, both in terms of educational attainment and formal

[24] A further improvement in terms of gender disparity in education attainment at BCGCE A Level can be seen recently in the latest Brunei Darussalam Statistical Yearbook 2010 (Government of Brunei Darussalam, Various Years), with the pass ratio for females-to-males calculated to be 1.55 in 2010 compared to 1.68 in 2008, a somewhat marked deviation away from the trend shown in Figure 11. However, this appears to be driven by enrolment differences (described in footnote 25), rather than an improvement in performance by males or a decline in performance of females. It remains to be seen whether this is a one-off deviation of a promising trend towards gender equality in outcomes. However, the pass ratio of females-to-males has remained relatively constant at PCE and BCGCE O Level for 2010 compared to 2008 with a ratio of 1.0 and 1.4 respectively.

labour market participation, as seen previously, this increased gender disparity reduces the probability of finding suitable marriage partners for educated women in Brunei under the model. As a result, it is plausible that highly educated women may find more suitable marriage partners overseas and decide to emigrate, even reneging on their scholarship contract agreements to serve the country[25].

This represents an outflow of valuable labour resources or a "brain drain"[26]. In a separate hypothetical scenario, young women might opt not to pursue higher education if they anticipate that education might pose a barrier to marriage. These issues present another potential area for further research. To this end, Anaman & Kassim (2003) suggest that the immigration policy may need to be relaxed by making citizenship and naturalisation laws easier for Bruneian women to marry foreign men and encourage more stable family units in Brunei, which they note will be an extension of privileges already given to local married men.

The current immigration policy does not appear to be geared to the active recruitment of skilled foreign labour, as shown in Figures 8(e) & (f), with the majority only possessing secondary education level qualifications. A more aggressive policy in attracting professionals and skilled labour from overseas could be pursued, as practiced in fast-growing nations such as Singapore, to inject greater productivity into the labour force. Whilst some might argue that the influx of skilled foreign labour might crowd out local jobs, it can also create employment opportunities and spur economic growth, as evidenced in many other countries. However, a relaxation of immigration policy may also bring about a wider social and economic impact, and thus careful

[25] Of course, there may be other reasons for reneging on these contractual agreements that will be true for both males and females, such as better career prospects or better incentives elsewhere.

[26] However, Brunei's performance on this score relative to other countries is relatively fair. In another survey question published by the Global Competitiveness Report 2011-2012 (World Economic Forum 2011, p. 448) which asks "does your country retain and attract talented people?" on a scale of 1 (no, the best and brightest normally leave to pursue opportunities in other countries) to 7 (yes, there are many opportunities for talented people within the country), Brunei posted a score of 4.0 (against a worldwide mean of 3.5) at a rank of 42 out of 142 countries worldwide.

consideration must be paid to this. For example, Odihi (2003) surveys some specific socio-economic problems of low-income immigrant workers in Brunei, and considers suggestions to improve their welfare. In addition, some immigrant workers tend to repatriate a large proportion of their income earned in Brunei back to their country of origin, which may be detrimental to the economy.

5.0 Labour Market Equilibrium

As in any market, the forces of demand and supply jointly determine the price and quantity in the market for labour, or in this case, the wage rate and the number of people employed, respectively. However, there are fundamental differences that distinguish the labour market from other markets, such as the market for goods. Although most markets correspond to an equilibrium level without excess surplus or demand, even a perfectly competitive or a highly functional labour market is expected to have a persistent level of unemployment. A perfectly competitive labour market facilitates the easy movement of people and skills to their most productive use, thus minimising frictional unemployment, with a low natural rate of unemployment. Departures from this theoretical outcome are common, as imperfections and rigidities can exist on both sides of the labour market. Nevertheless, the concept of "equilibrium" in the labour market that should be strived for needs to be viewed in this sense. The discussion in the preceding two sections has highlighted a variety of issues and challenges that need to be addressed on both the demand and supply sides of the labour market in order to deliver the economic growth and development desired for the Long Term Development Plan.

As discussed in Section 3, *Wawasan 2035* has highlighted that an increased emphasis will be paid to downstream industries as well as in economic clusters beyond the oil and gas industry. This in turn places a greater importance on employment in the secondary sector – a challenge that needs to be met by labour force supply. In addition, the promotion of private sector

driven growth has also been advocated to aid economic diversification, partly through the creation of a better underlying business and regulatory environment. According to a survey in the recent Global Competitiveness Report (World Economic Forum 2011, p. 128), the five most problematic factors for doing business in Brunei (in rank order) are: restrictive labour regulations; poor work ethic in the national labour force; inefficient government bureaucracy; access to financing; and an inadequately educated workforce. This suggests that there is a close association between the reduction of barriers to doing business effectively and the creation of a better functioning labour market in Brunei. A more vibrant private sector will reduce the reliance of locals on government jobs, and will eventually also shift the onus onto the private sector to address employment needs based on the market through a correction of the imbalances in the incentive structure.

This desired demand for labour can be met by supply either through the education system or immigration policy. As discussed in Section 4, *Wawasan 2035* has placed particular emphasis on the new education strategy, or SPN21, to produce a competitive and educated labour force. This would assist the prevention of more serious forms of unemployment. Young people who are unable to progress along the academic, vocational or technical track after secondary level education and drop out of the education system to enter the labour market may find it difficult to gain employment without sufficient skills that employers look for. This may lead to a prolonged period of youth unemployment, unless they accept low-skilled jobs, undergo further training or re-enter the education system to enhance their skill set. Otherwise, the prospect of long-term unemployment looms. Those in long-term unemployment may eventually drop out of the labour force, which will lower the labour force participation rate and represent a waste of productive potential. Furthermore, a greater proportion of boys compared to girls struggle to continue and drop out of the academic track after lower secondary level, which may suggest that there is a gender preference for boys to favour the vocational or technical route beyond lower secondary education. A lack of opportunities in vocational and technical fields would result in a large

proportion of low-skilled local males in the labour force. However, further improvements in vocational, technical and tertiary education attainment beyond current levels, should not be seen as an end in itself, but as a means towards better employment and an educated labour force. The possible unintended consequences of an over-generous education policy is to create graduate unemployment, where too many people are qualified in too few available jobs, or over-education, where people work in jobs where they are over qualified, both of which represent a waste of valuable resources. Thus, further research should look into whether either scenario is observed in Brunei. The scholarships and opportunities provided for higher education need to be closely tailored to fit the employer requirements in the public sector and more importantly, in the private sector as well, to minimise or eliminate structural unemployment. Aside from education policy, the demand for labour can also be addressed through immigration policy: via a more active recruitment of professionals or skilled foreign labour to supplement the supply of labour. With the aforementioned slowdown in population growth rates and falling fertility rates, a reassessment of existing immigration policy may be necessary in order to meet the goals that have been set out in *Wawasan 2035*.

In addition to adjustments on the demand and supply side of the labour market, improvements can also be made to the infrastructure with regard to the availability, collection and dissemination of information to reduce cost, time and effort for employers to search for employees, and vice versa, to aid a highly functional and flexible labour market. This includes the collection of more up-to-date data regarding employment issues, as well as better coordination between education providers, employers and other stakeholders to assess specific labour demand requirements and focus on the challenge of meeting skill needs. This would ensure a minimisation of frictional unemployment, and lower the natural rate of unemployment. Further improvements to labour market flexibility can be achieved through an assessment of employee needs that can enable further improvements to labour force participation, and enhance the economy's productive capacity.

Furthermore, it should also be noted that other external factors can also influence the Brunei labour market, even more so with the increased economic integration that comes with globalisation. These external influences can be magnified domestically in Brunei because of its small size, and can bring about both positive and negative effects. A relevant example of this is the proposed establishment of the Asean Economic Community (AEC) by 2015 (ASEAN Secretariat, 2009), which aims to transform Asean into a region with free movement of goods, services, investment, skilled labour, and freer flow of capital through the development and implementation of Mutual Recognition Agreements (MRAs). The establishment of the AEC has the potential to transform the economic climate of all countries in the region, including Brunei. This should enable greater market access that can supplement Brunei's small domestic market, as well as improve the competitiveness and productivity of labour with the freer movement of skilled labour. However, globalisation, can also bring about threats and challenges from emerging economies such as Vietnam, India, China and Brazil, which will come in many forms including into the goods and labour markets. Owing to its relatively small size, Brunei may not respond as easily to external opportunities brought about by globalisation, yet competition from outside producers may bring about larger negative consequences, as a result of having a relatively open economy which is heavily dependent on foreign workers and products.

Finally, it is also important to highlight the available trends in labour productivity, a metric that can objectively measure the (economic) performance and quality of the labour force, in the Brunei economy. The OECD (2001, p.11) defines productivity as "a ratio of a volume measure of output to a volume measure of input use". Labour productivity can be measured in a variety of ways. Whilst volume measures of output are normally gross domestic product (GDP) or gross value added (GVA) expressed at constant prices, i.e. adjusted for inflation, the three most commonly used measures of input are: hours worked; workforce jobs; and the number of people in employment. Based on GDP at constant prices and the

number of employed people, Anaman (2003) has calculated a continued decline in labour productivity and zero or negative real GDP growth rates between 1991 and 2001, which he attributes to the result of a decline in real wage per worker, despite an increase in total employment levels[27]. However, the measurement of output and productivity in non-market activities, such as government or in non-governmental organisations, may not be strictly correct in these terms, and thus a more complex methodology or enhanced data requirements is necessary. To this end, statisticians and researchers can follow the accepted guidelines set out by the OECD (2001) to build a more comprehensive measurement of all levels of productivity related to economic activities, which would constitute core indicators for the analysis of economic growth. Nevertheless, the declining trends observed in labour productivity and real wage per worker observed by Anaman (2003) are indicative of a poor allocation of labour resources, where labour is not employed in its most productive use, or declining labour performance in economic terms. This is an area of concern that needs to be addressed through improvements to labour market flexibility and/or in human capital investments that would enable the economic progress necessary to achieve *Wawasan 2035*.

6.0 Conclusions

This paper has highlighted the population and labour market trends in Brunei Darussalam, and has also outlined the issues and challenges that affect the demand and supply sides of the labour market which warrant further research. Each of these needs to be addressed in order to achieve the long-term goals which have been set out in *Wawasan 2035*. On the demand side of the labour market, the correction of structural rigidities and an unbalanced incentive structure is necessary to promote industrial expansion and private sector driven growth. On the supply side of the labour market, improvements in the

[27] Using the same measurement of labour productivity, which can be calculated by dividing real GDP at 2000 prices by the total number of employed workers in an economy, figures from the latest Brunei Darussalam Statistical Yearbook 2010 (Government of Brunei Darussalam, various years) suggest that labour productivity in real terms has continued to decline throughout the 2006 to 2010 period (not shown here, but verifiable).

education system, as well as a reassessment of restrictive immigration policies, would help bring about increased labour force productivity. The key challenges for SPN21 are to address low levels of tertiary education attainment, a lack of vocational and technical education opportunities and widening gender disparity.

Due to the size of the Brunei economy, government involvement in the labour market is still seen to be necessary. Nevertheless, existing manpower planning and forecasting practices by policymakers should take the issues and trends discussed above into consideration in any attempts to correct labour market imbalances. In addition, these practices could also be supplemented with more rigorous labour market analyses through the implementation of more frequent labour force surveys or their equivalent and data improvements in the form of additional key indicators of the labour market.

The forces of demand and supply in the market for labour will determine the size and structure of the labour force as well as the nature and extent of unemployment in Brunei. A highly functional labour market that facilitates the movement of labour resources to their most productive use, as well as one that eliminates structural and other serious forms of unemployment – simultaneously lowering the natural rate of unemployment – should play a key role in achieving the goals that have been set out in the Long Term Development Plan.

REFERENCES

Anaman, K. A. 2003, 'Analysis of the Aggregate Demand of Labour in Brunei Darussalam using Dynamic Econometric Models' in K. A. Anaman & I. Duraman (eds.), *Applied Economic Analysis in Brunei Darussalam: Evaluation of Economic Growth and Trade, Microefficiency and Analysis of Socio-Economic Problems*, Ch. 3, pp. 24-46, Universiti Brunei Darussalam, Bandar Seri Begawan.

Anaman, K. A., & Kassim, H. M. 2003, 'Analysis of Marital Choice of Women in an Urban Community in Bandar Seri Begawan' in K. A. Anaman & I. Duraman (eds.), *Applied Economic Analysis in Brunei Darussalam: Evaluation of Economic Growth and Trade, Microefficiency and Analysis of Socio-Economic Problems*, Ch. 10, pp. 142-163, Universiti Brunei Darussalam, Bandar Seri Begawan.

ASEAN Secretariat 2009, *Roadmap for an ASEAN Community 2009-2015,* ASEAN, Jakarta, viewed 31 December 2011, <http://www.aseansec.org/publications/RoadmapASEANCommunity.pdf>.

Asian Development Bank 2011, *Key Indicators for Asia and the Pacific 2011*, Asian Development Bank, Manila, viewed 31 December 2011, <http://www.adb.org/Documents/Books/Key_Indicators/2011/pdf/Key-Indicators-2011.pdf>.

Bhaskaran, M. 2007, '*Economic Diversification in Negara Brunei Darussalam,*' Centre for Strategic and Policy Studies, CSPS Report, Bandar Seri Begawan.

Cheong, D. & Lawrey, R. 2009, '*A Study of Unemployment Issues among Registered Job Seekers in Brunei Darussalam,*' Centre for Strategic and Policy Studies CSPS Report, Bandar Seri Begawan.

Crobsy, M. 2007, '*Economic Diversification,*' Centre for Strategic and Policy Studies, CSPS Report, Bandar Seri Begawan.

Duraman, I. & Tharumarajah, N. 2010, 'Economic Diversification: Creating a Conducive Environment for Small Medium Enterprises to Flourish in Brunei Darussalam' *CSPS Strategy and Policy Journal* vol. 1, pp. 55-68, Bandar Seri Begawan.

Government of Brunei Darussalam 2005, *Report on the 2001 Population Census*, Department of Economic Planning and Development, Prime Minister's Office, Bandar Seri Begawan.

Government of Brunei Darussalam 2007, *Brunei Darussalam Long Term Development Plan*, Department of Economic Planning and Development, Prime Minister's Office, Bandar Seri Begawan.

Government of Brunei Darussalam (various years), *Brunei Darussalam Statistical Yearbook*, Department of Economic Planning and Development, Prime Minister's Office, Bandar Seri Begawan.

Haji Hashim, A. A. 2010, 'Challenges in Achieving Wawasan Brunei 2035 Goals: Economic Diversification in Perspective' *CSPS Strategy and Policy Journal* vol. 1, pp. 29-54, Bandar Seri Begawan.

International Labour Organization 2010, *Brunei Darussalam: Labour Market Indicators*, International Labour Organization, Bangkok, viewed 31 December 2011, <http://www.ilo.org/wcmsp5/groups/public/---asia/---robangkok/documents/genericdocument/wcms_143030.pdf>.

International Monetary Fund 2011, *Brunei Darussalam: Statistical Appendix*, International Monetary Fund, Washington, D.C., viewed 31 December 2011, <http://www.imf.org/external/pubs/ft/scr/2011/cr11140.pdf>.

Lawrey, R. 2010, 'An Economist's Perspective on Economic Diversification in Brunei Darussalam,' *CSPS Strategy and Policy Journal* vol. 1, pp. 13-28, Bandar Seri Begawan.

Leete, R. 2008, *Wawasan Brunei 2035: Beyond the Millenium Development Goals (MDGs) and High Human Development*, Brunei Economic Development Forum, Singapore, viewed 31 July 2011, < http://www.undp.org.my/uploads/UNDP_Brunei_MDGs_and_HD_Feb2008.pdf>.

Odihi, J. O. 2003, 'A Study of Some Specific Socio-Economic Problems of Low Immigrant Workers in Brunei Darussalam' in K. A. Anaman & I. Duraman (eds.), *Applied Economic Analysis in Brunei Darussalam: Evaluation of Economic Growth and Trade, Microefficiency and Analysis of Socio-Economic Problems*, Ch. 12 pp. 183-199, Universiti Brunei

Darussalam, Bandar Seri Begawan.

OECD 2001, '*Measuring Productivity: Measurement of Aggregate and Industry-Level Productivity Growth*,' OECD Manual, Organization for Economic Co-operation & Development, Paris, viewed 31 December 2011, <http://www.oecd.org/dataoecd/59/29/2352458.pdf>.

Oxford Business Group 2011, *Brunei Darussalam: Focus on Job Skills*, Oxford Business Group Economic Update, 8 February 2011, Oxford Business Group, viewed 31 December 2011, <http://www.oxfordbusinessgroup.com/economic_updates/brunei-darussalam-focus-job-skills>.

United Nations 2011, *Human Development Report 2011 Sustainability and Equity: A Better Future for All – Explanatory note on 2011 HDR composite indices: Brunei Darussalam,* Bangkok, viewed 31 December 2011, <http://hdrstats.undp.org/images/explanations/BRN.pdf>.

World Bank 2011, *Data Catalog - Brunei Darussalam*, World Bank, Washington, D.C., viewed 31 July 2011 <http://data.worldbank.org/country/brunei-darussalam>.

World Bank & International Finance Corporation 2011, *Doing Business 2012: Doing Business in a More Transparent World – Economy Profile: Brunei Darussalam*, The International Bank for Reconstruction and Development/The World Bank, Washington, D.C., viewed 31 December 2011,<http://www.doingbusiness.org/~/media/fpdkm/doing%20business/documents/profiles/country/BRN.pdf>

World Economic Forum 2011, *The Global Competitiveness Report 2011-2012*, World Economic Forum, Geneva, viewed 31 December 2011, <http://www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf>.