

Deloitte Access Economics

Building prosperity

Harnessing Australia's
comparative energy
advantage

Conference paper

12 May 2012

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Acronyms

ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
BREE	Bureau of Resources and Energy Economics
CAPEX	Capital expenditure
DRET	Department of Resources Energy and Tourism
FIFO	Fly-in/Fly-out
LNG	Liquefied natural gas
RGDI	Real gross domestic income
RGDP	Real gross domestic product
SWF	Sovereign Wealth Fund

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Key points

- Australia is currently positioned at the cusp of a major transformation in the world's economic weight from west to east. The rapid industrialisation of structurally large Asian economies, predominantly China, has driven world economic growth over recent times and changed the dynamics of key international resource, product and capital markets.
- For Australia, this has translated to strong demand and elevated prices for our energy and mineral resources, and is underpinning massive investments by the oil and gas industry in new capacity.
- While the economic advancement in our region is overwhelmingly positive for Australia, playing to our comparative advantages as a secure and reliable energy exporter, the ongoing development of the oil and gas sector should not be taken for granted. Indeed, developing Australia's world-class energy resources will underpin our future prosperity.

Promoting macroeconomic resilience and performance

- The oil and gas industry currently represents around 2.0% of gross domestic product, with direct and flow-on value added of approximately \$28.3 billion in 2010-11 (based on total sales of \$29.7 billion). Moreover, the industry's systemic significance is continuing to grow on the back of large LNG export investments, mainly in Western Australia, Queensland and the Northern Territory.
 - Separately, these represent some of the biggest projects ever undertaken in Australia; and collectively, they account for around 35.4% of all business investment. Further, if all oil and gas investments are realised, they will comprise over 64% of all committed investment.
 - LNG output is expected to grow by around 250% over the next seven years, with a projected value of over \$35 billion in 2017-18.
- Importantly, the industry's economic linkages are broader and deeper than commonly appreciated.
 - Of total industry value added, about \$4.3 billion is generated by supplying industries across the economy — including the resource support services, maintenance and construction and professional services sectors. These linkages are particularly visible in the thriving resource service hubs which have emerged in Brisbane and Perth.
 - Building on these linkages, robust export performance by Australia's oil and gas industry, and other resource producers more broadly, provided important income and employment support over the course of the global downturn. This played a key role in Australia withstanding the more dramatic economic declines which confronted other developed economies.

Securing the industry's long term strategic platform

- The rapid growth of the oil and gas industry is generating some important challenges for industry and policymakers, including the appreciation of the Australian dollar and consequent weakness in areas such as manufacturing and tourism.
- In order to fully harness the benefits of the resources boom, some key policy principles are crucial:

- ***The ultimate aim of policy is to facilitate the adjustments needed to maximise the economic gains from the resources boom.***
 - Any new rigidities or constraints, such as explicit industry protection measures and mandated local content requirements, will ultimately lower overall economic welfare and place additional adjustment pressure on other sectors.
- ***Australia's reputation as a world class energy exporter should be reinforced.***
 - Australia has many advantages as a developed country with proven resource prospectivity and supply performance, but rising development costs and risks of unwarranted regulatory interference could potentially undermine the economic payoffs from the boom and lead to long term supply contracts being lost to other resource exporters.
- ***Accessing skilled labour is a pivotal concern for the industry given its rapid expansion footing and greater policy attention is needed.***
 - For large capital-intensive projects, the capex phase will necessarily involve increased reliance on mostly temporary workers. This places greater onus on improving labour mobility and flexibility to enable workers to be deployed in their most productive capacity.
 - Various innovative solutions are available and a mix of strategies will be needed to manage sensitivities around fly-in/fly-out workers and higher levels of skilled migration.
- ***It is crucial to guard against any backsliding on Australia's broader institutional settings.***
 - Australia's fiscal and broader institutional settings have led to this resource boom being (largely) well managed, especially compared to previous booms.
 - There have been calls for Australia to reframe aspects of its fiscal settings through establishing a (new) sovereign wealth fund to capture the benefits from high resource prices. A sovereign wealth fund can be used to meet particular policy objectives but needs to be carefully designed to minimise distortions between sectors and to ensure that funds are appropriately quarantined. Given the current budget position, it is difficult to see the establishment of a sovereign wealth fund being an immediate policy priority.
- Structural change is a pervasive and necessary feature of modern economies, being vital to economic advancement and rising living standards. The adjustment pressures and economic disruptions involved as resources shift from lower to higher productivity sectors should not be resisted but they need to be well-managed — and often under substantial political pressure.
- Attempting to slow the structural changes emanating from the resources boom would be costly and ineffective, ultimately lowering the economic dividends for all Australians.

Deloitte Access Economics

1 Introduction

Australia is currently positioned at the cusp of a major transformation in the world's economic weight from west to east. The rapid and pervasive industrialisation of structurally large Asian economies, predominantly China, has driven world economic growth over recent times and changed the dynamics of key international resource, product and capital markets.

These developments are perhaps the largest systemic shift in the world economy in 60 years and, for Australia, are being most prominently channelled through strong demand for our mineral and energy resources. In the oil and gas industry, sizeable developments — indeed some of the largest projects ever undertaken in Australia — are being progressed squarely focused on new and existing energy customers in Asia.

The rapid growth of Australia's oil and gas sector is not without challenges. Certainly, managing the impacts on non-resource parts of the Australian economy, so as to secure balanced development and a sustainable lift in Australia's prosperity over the longer term, raises significant policy issues and has been subject to considerable public and media commentary.

This conference paper forms part of a wider APPEA-commissioned analysis being undertaken by Deloitte Access Economics on the economic contribution of Australia's oil and gas industry. The study is examining the industry's role in Australia's economic development — both over recent years and looking forward over the medium term. A key focus will be to draw out the specific economic implications of industry investment and operations and the commercial linkages with other sectors, essentially as industry activity reverberates through the broader economy.

As a complement to the more empirical aspects, the study will also provide an analysis of 'bigger picture' economic issues of relevance to the industry and policymakers. In essence, it will set out those policy settings which will be necessary to fully harness the benefits of the resources boom.

In the context of this ongoing work, this conference paper presents various perspectives on the contribution made by the industry in enhancing Australia's macroeconomic performance and resilience, especially during the global financial crisis. In doing so, it sets out some preliminary estimates of the extent to which the industry has and will continue to elevate national income. The paper also canvasses the most pressing development and policy issues facing the industry, including:

- How the oil and gas industry is supporting productivity performance.
- Managing the structural adjustments needed to secure sustainable economic gains arising from ongoing development in Australia's region.
- How the proceeds of the resources boom should be managed over the long term.
- Addressing the gaps in skills and the geographic location of Australia's workforce.

2 The economic contribution of Australia's oil and gas industry

Australia is recognised as a leading energy exporter. The increasing industrialisation of the world economy which is being driven by high-growth Asian economies has seen Australia's energy production increase in both value and quantity in recent years. There is soon to be a seismic shift in Australia's gas export performance with the development of various CSG to LNG facilities in Queensland. This will open up large export markets to east coast gas for the first time.

This chapter provides a brief overview of Australia's oil and gas industry and sets out preliminary analysis of the industry's contribution to the national economy. As noted above, this work is ongoing and forms part of a wider APPEA-commissioned study.

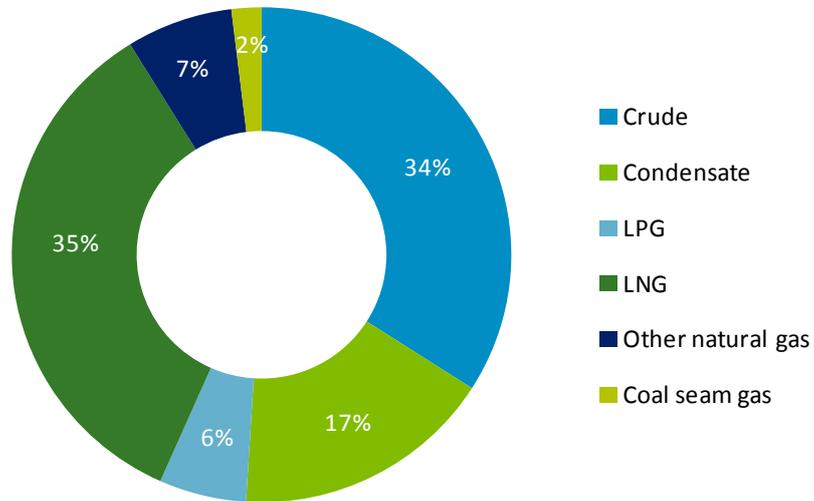
2.1 Snapshot of the industry

Product markets

Over the past two decades, Australia's main petroleum product has alternated between crude oil and natural gas. Since 2003, however, natural gas has become entrenched as the sector's chief offering. This reflects the combination of ongoing natural gas related expansions and less buoyant oil output. Much of the growth in the Australian natural gas sector has been due to the rapid increase in demand for LNG in global energy markets.

In 2010-11, it is estimated that around 35% of upstream petroleum industry sales were attributed to LNG alone, compared to 34% from crude oil (Chart 2.1). Given the relatively emissions efficient advantages of LNG compared to substitute fuels such as coal, it is likely that demand for natural gas and processed LNG will continue to expand. For instance, there has been recent notable increases in gas demand from Japan as that country seeks to meet its energy requirements using less (or no) nuclear power.

Chart 2.1: Product segments in the oil and gas industry, 2010-11



Source: BREE and APPEA

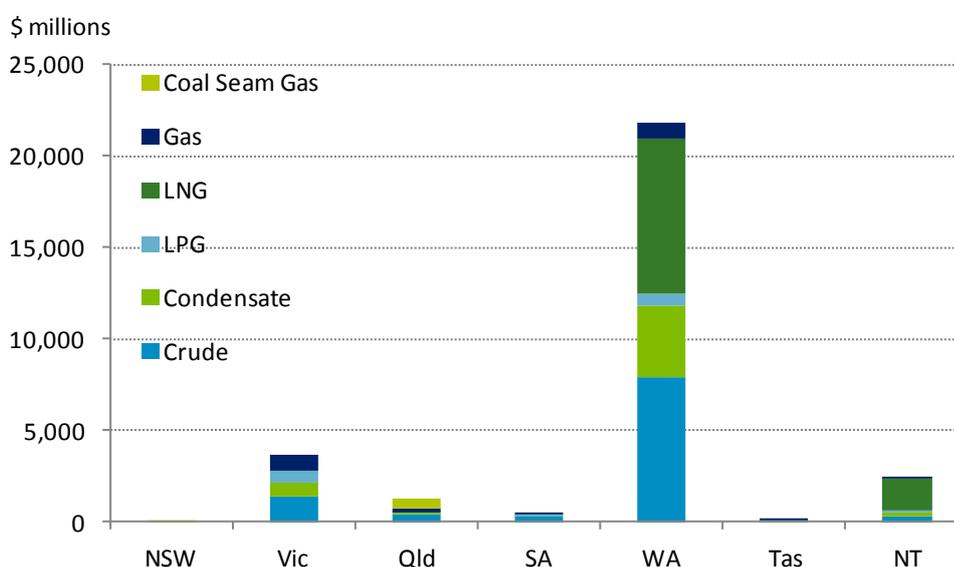
Geographic diversity

Australia is continually expanding its large portfolio of oil and gas reserves. Currently, around 91% of Australia’s oil and 79% of gas production is undertaken in offshore sites located in the Bass Strait, the North West Shelf and Timor Sea. As illustrated in Chart 2.2, Western Australia accounts for the largest proportion of industry activity.

In 2010-11 it is estimated that about \$21.8 billion, or 73% of industry sales, originated from output produced in Western Australia. Victoria accounts for the second largest share of petroleum sales, contributing around \$3.6 billion to industry sales, most of which is sourced from the Gippsland Basin. The Amadeus Basin in the Northern Territory and the Bowen-Surat Basin in Queensland also support a number of oil and gas fields.

Despite the high levels of oil and gas activity around Australia, there are still extensive areas of land (onshore and offshore) that remain either unexplored or are presently underexplored. Therefore, it is likely that the geographic diversity of the industry will increase over time as more mature sites reach capacity and the search for untapped resources in other regions is initiated.

Chart 2.2: Sales from production by region, 2010-11



Source: BREE and APPEA

Trade profile

Around half of upstream petroleum industry production is exported. The remainder of production is purchased and distributed by domestic firms operating in the midstream and downstream petroleum refinery, oil and gas supply and electricity generation markets.

In addition, the trade profile of the domestic petroleum industry has changed in recent years. Australia has moved from its traditional position as a net exporter of oil products to becoming a net importer in 2002-03. This is attributable to both an increase in the domestic demand for oil and a decline in Australian oil production from its peak in 2000. In contrast, Australia continues to be a net exporter of natural gas, with around 48% of production sold to growing Asian economies (ABS 2011). Going forward, it is anticipated that liquid rich LNG developments (for instance, Ichthys and Prelude) will boost LPG production significantly.

Massive pipeline of new investments

Much like the broader business community, the oil and gas industry is highly dependent on a continual stream of investments to underpin future growth. As such, the forward contribution of the industry will be largely determined by:

- underexplored frontier areas that will become attractive commercial investments;
- the consistent release of new exploration acreage covering a range of regions, including at mature and frontier sites; and
- technological developments that will help unlock the full potential of new and existing discoveries (especially for gas reserves such as new unconventional gas production techniques).

There are many significant oil and gas investments which have been committed or are under construction around Australia. The Deloitte Access Economics Investment Monitor provides information on major non-residential investment projects across Australia, in

excess of \$20 million. An analysis of the Deloitte Access Economics Investment Monitor for March 2012 indicates that 34% of all large investments currently under construction in Australia are in the upstream oil and gas sector.

There is also a strong pipeline of committed projects in the sector where construction has not yet commenced. In total, 64% of major committed investments in Australia (which have not yet commenced construction) are in the oil and gas sector.

The Deloitte Access Economics Investment Monitor was used in conjunction with the Bureau of Resource and Energy Economics Major Mining Investments database to identify major oil and gas projects which are either currently under construction or have been committed. In total, 16 projects were identified. The total capital expenditure associated with these projects exceeded \$200 billion with over \$140 billion attributable to projects which are currently under construction.

A growing LNG export market

As with many other energy commodities, reserves of natural gas do not often reside near major centres of demand, necessitating international trade. Liquefaction provides an economic means for transporting natural gas over long distances, by reducing its volume by more than 600 times. This effectively brings production from remote gas reserves in Australia closer to market. While international pipeline-based natural gas trade is about twice the size of LNG trade, a considerable expansion of LNG global trade is under way, with Australia likely to emerge as the second largest supplier in the coming years.

In particular, strong demand for LNG export markets in the Asia-Pacific region has been driving the push to increase Australia's LNG capacity. Around \$165 billion of capital investment has been pledged for LNG projects that are either under construction or have been committed. If all these projects proceed as planned, Australia's LNG exports are likely to increase more than three-fold over the next five years (Christie et al 2011). In terms of actual output, LNG is expected to grow by around 250% between 2011 and 2018. Additionally, a number of LNG developments are also under consideration and could see LNG exports approach the likes of coal and iron ore in terms of their contribution to total export earnings in the longer term.

Consequently, much of the large investments occurring in the oil and gas sector have been due to the rapid development of LNG operations in Australia. At present, there are several LNG projects at various levels of commercial development. Of projects under construction, four draw from gas fields in the north Western Australia (Gorgon, Prelude, Ichthys and Wheatstone) and three are in Queensland (Queensland Curtis LNG, Gladstone LNG and Australia Pacific LNG). A fourth major LNG facility at Gladstone (Arrow LNG plant) is at an advanced stage of commercial assessment, with a final investment decision expected later this year.

2.2 Preliminary economic contribution analysis

The analysis in this section is based on preliminary economic contribution results. Further analysis, particularly around estimates of the regional economic impacts and linkages between the oil and gas sector with other parts of the economy, will be presented in the full report released 22 June 2012.

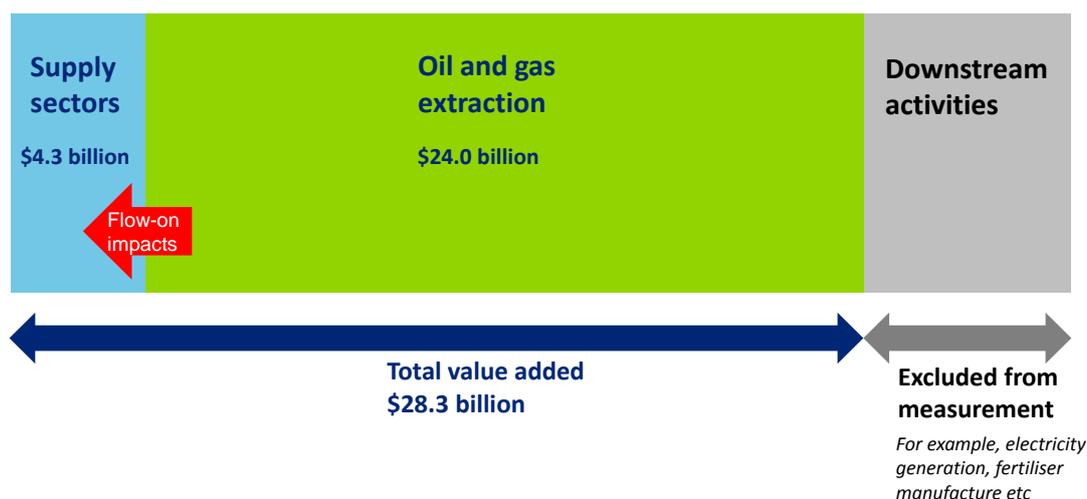
A snapshot of current economic contribution

The unprecedented level of investment and growth in the oil and gas industry is exerting significant influence over the surrounding regions in which these resources are located and indeed on the broader Australian economy. This study measures two dimensions of the oil and gas industry's economic contribution:

- The first measures the direct impact of oil and gas operations. This is based on the value added through the sales of production from individual projects. The direct impacts are usually the largest component of an industry's economic contribution as they represent the benefits associated with its core commercial operations.
- The second aspect involves measuring the flow-on, or indirect contribution of oil and gas projects. This is the value added generated in other sectors of the economy through the upstream oil and gas sector's intermediate demand linkages. The flow-on contribution is based on the profits and wages paid in other sectors, namely supply sectors, where the benefits associated with increased petroleum activity are typically highest.

Figure 2.1 outlines which elements are quantified in the economic contribution analysis.

Figure 2.1: Profile of the industry's contribution



Source: Deloitte Access Economics

Overall, the oil and gas industry contributed around \$28.3 billion to the Australian economy in 2010-11. This accounts for around 2.0% of the national economy. A considerable portion, around \$24.0 billion, of these overall gains accrue to core oil and gas reserve operators.

The remaining \$4.3 billion is distributed among supplying industries across the economy. Such industries include exploration support and professional services, maintenance and construction, transport and storage and wholesale trade (see Table 2.1).

Table 2.1: Linkages with other sectors in the economy

Sector	Flow-on contribution (\$m)
Maintenance and construction	785
Exploration support and professional services	788
Transport and storage	351
Wholesale trade	116
Other downstream	2,193
Total	4,268

Source: Deloitte Access Economics

It is also important to recognise that linkages between sectors have regional, interstate and international dimensions. Therefore, where goods and services for the oil and gas industry are procured has significant implications for the dispersion of economic activity. For example, in recent years there has been an emergence of professional services hubs in Perth and Brisbane tailored towards the resources sector. Moreover, the large financial services sector in Sydney and Melbourne are also being heavily utilised by the oil and gas industry.

Ongoing economic contribution

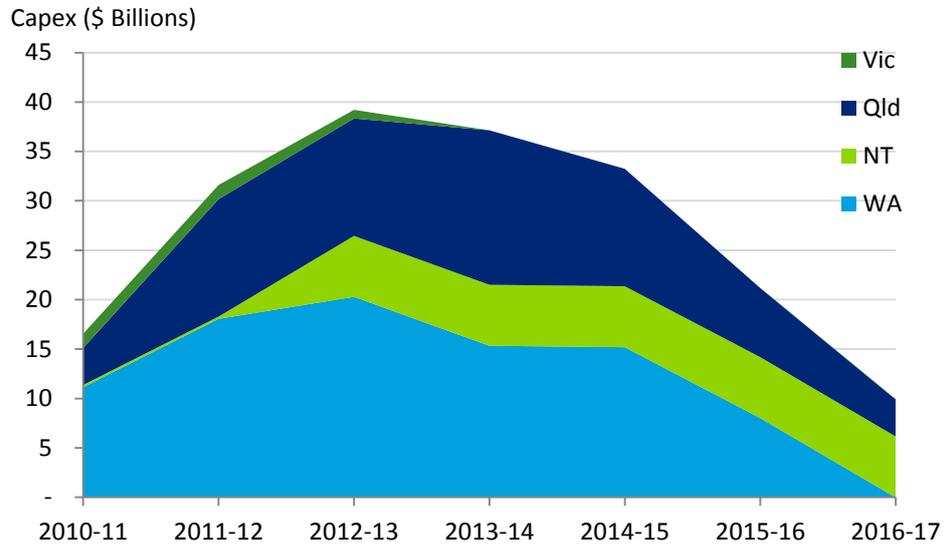
Going forward, the dispersion and timing of gains across the national economy depend on the stage of development of individual projects. At present, the oil and gas industry is in the midst of a large capital expenditure (capex) phase due to the expansion of current projects or the construction and development of new sites. In line with the requirements of installing large-scale capital, this capex phase is most commonly associated with the high use of construction, manufactured goods and professional services.

In a similar way, the resource support services, transport and wholesale trade industries are likely to benefit from the operational phase when new projects become fully commercialised. Therefore over the next few years, as the oil and gas industry moves into an operational phase, the supply-side industries which benefit from project activity may also shift.

In particular, the forward economic contributions will be determined by the level of investment tied to projects in the oil and gas industry, both committed and under construction. Chart 2.3 illustrates that the industry capex levels from these projects peak at around \$39.2 billion in 2013.

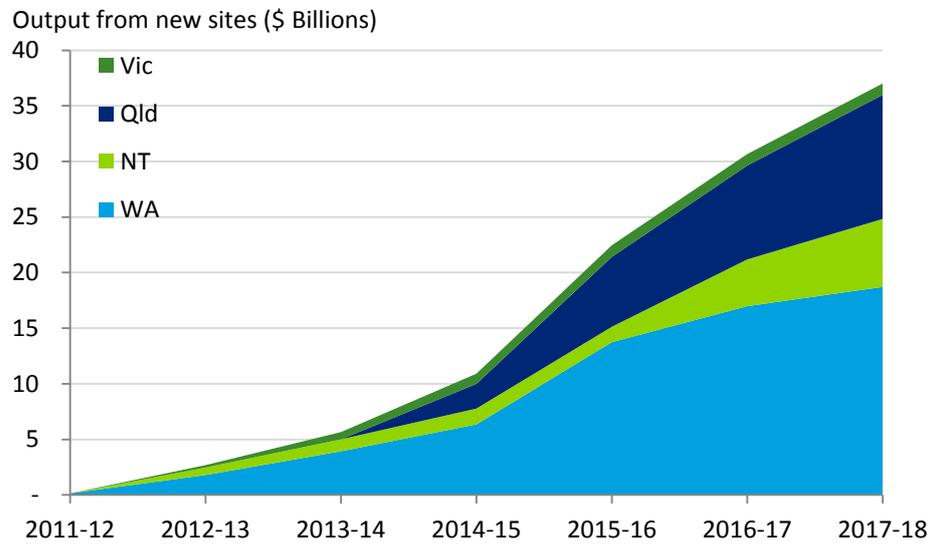
Analogously, Chart 2.4 outlines the amount of output generated from new projects as a result of these capex investments. It can be seen that as capex begins to dissipate over time, the amount of new output in the oil and gas industry accelerates. Hence, as the sector moves into an operational phase, it is likely that higher output growth will also lead to higher future economic contributions.

Chart 2.3: Oil and gas industry capex profile



Source: Deloitte Access Economics

Chart 2.4: Medium term growth in industry output



Source: Deloitte Access Economics

It is important to note that the capex and output levels indicated above are based on current data. As such, new discoveries and future development announcements may serve to extend industry investment.

Broader ongoing benefits

There are also a number of social and wider flow-on impacts that form a part of the ongoing contribution of this sector. For instance, the revenue created by the growing oil and gas sector is taxed (i.e. the petroleum resources rent tax and company tax) and in some cases used to expand the supply potential of the economy. This is achieved by investing in the infrastructure around oil and gas sites and encouraging training in resources and support industries. Moreover, ongoing resource demand will in turn encourage the emergence of new service offerings that are better tailored towards resource extraction support services.

The size and breadth of oil and gas investment facilitates the development of a network of pipelines and infrastructure that makes it more cost effective to expand into frontier areas, by better linking these sites with existing projects across Australia. These infrastructure linkages will become critical in the future as much of the investment activity is likely to be directed towards frontier areas — where deposits are typically of a lower quality or are more difficult to extract using available technology.

Areas of further analysis

As noted previously, this summary paper is to be followed by a comprehensive report. Specifically, employment impacts and broader economic linkages supported by the oil and gas industry will be addressed using the Deloitte Access Economics in-house CGE model.

The level of employment across operations is an important part of the industry's direct economic contribution and also its indirect impacts. It is widely acknowledged that the income and employment support provided by the oil and gas industry assisted in moderating some of the adverse impacts of the recent global downturn. The role of oil and gas industry employment will be analysed in terms of both overall worker numbers and the pattern of employment which will be affected by contract arrangements such as fly-in/fly-out (FIFO). These distinctions are especially relevant when accurately apportioning location-specific economic benefits.

3 Strategic policy issues: securing the industry's potential

The rapid growth of the oil and gas industry is generating some important challenges for industry and policymakers, especially in the context of areas of weakness in the Australian economy such as manufacturing and tourism.

This section outlines some of the most pressing development and policy issues confronting the sector, particularly in relation to its rapid expansion in response to a favourable regional environment, and its role in driving long term national prosperity.

3.1 Fostering deeper engagement in the Asian century

The world economy is currently going through a transformative change, perhaps the largest shift in world economic order in the past century. Large Asian economies, principally China and India, which together represent almost 40% of the world's population, are rapidly industrialising and becoming richer. These countries' irreversible economic advancement is currently having and will continue to exert a major influence on the Australian economy.

Given Australia's proximity to the region and capacity as a world-class energy exporter, the shift in the global economy towards Asia will have an enduring effect on the oil and gas sector. Similar to how the North West Shelf was developed with a core regional focus, the massive investment pipeline of LNG facilities across northern half of Australia is being underpinned by robust energy demand from long term Chinese and Indian energy customers, along with more established Japanese markets.

Australia's trade relationship with China, and to a lesser extent other emerging Asian economies, has provided enormous economic benefits over the last decade on the back of surging resource exports. Indeed, there is a natural complementarity between China's considerable requirements for a stable supply of commodities and Australia's abundance of high-quality resources and proven export performance. Because of this relationship, Australia will continue to have a deep stake in China's ongoing economic development.

Importantly, this has various economic and strategic dimensions, many of which are deeply interwoven.

In terms of the economic implications, Australia's international trade in goods, services and capital is crucial to long term economic development and our standard of living. The trade intensity of the Australian economy (exports and imports) has risen steadily over the past 50 years as now stands at around 46% of economic activity. Certainly, access to overseas markets has helped foster high rates of economic growth, develop new industries and infrastructure, and strengthen trade and economic linkages with the rest of the world.

It is important to recognise that much of the regional economic linkages which we now take as unremarkable were built on the back of Australia's substantial energy exports to Asia. This energy gateway has and will continue to confer significant economic advantages to the nation:

- It raises national income and wealth, and diversifies our economic base by reducing dependence on smaller domestic markets.
- It allows Australia's natural resources to be exploited at scale and in a more efficient manner.
- It opens up business opportunities beyond the resources sector, for instance in tourism, education and business services, agriculture and advanced manufacturing.
- It promotes Australia's 'brand' and values overseas, facilitating deeper business and cultural understanding.

Sensitivities regarding our interrelationship with China

While it is true that Australia has gained enormously from China's development trajectory, this exposure presents vulnerabilities associated with any economic disruption in that country. In regard to these downside risks, a couple of points are important.

- Firstly, Australia's exports to China represent one, albeit large, serviced market in the region. Our geographic proximity to Asia and considerable resource prospectivity are profound economic advantages that should not be downplayed. China has selected Australia as a preferred but not exclusive provider, and in the absence of this market many of the major LNG projects underway may not be commercially viable. Quite simply, the option of selling the current quantity of resources to another country or to domestic users is highly unlikely to be available. It is however possible, that a proportion of this output can be diverted to newly industrialising South East Asian countries as their economies grow into the next decade.
- Secondly, the development pattern currently underway in China is intrinsically structural in nature. There is bound to be some cyclical turbulence along the way, but the nature of energy contracts is long term which benefits both buyer and seller.

Given China is now Australia's largest trading partner, its level of investment in Australia is quite small — especially compared with other large trading countries like the United States and Japan. This is changing, however, as China is effectively escalating its offshore investment push. In this regard, China's state-owned enterprises and investment funds have concentrated on purchasing assets to effectively diversify the country's enormous foreign reserves, secure reliable supplies of minerals and energy and provide a hedge against rising commodity prices.

Some concerns regarding foreign investment — whatever their origin — in Australia's strategic energy resources are legitimate, especially where these involve foreign government interests. So far, these have been adequately managed within existing foreign direct investment policy frameworks.

However, Australia has always been reliant on foreign capital to develop its major energy export platforms and, accordingly, it is important that relevant policy frameworks and industry's broader engagement with the community focus on the merits of encouraging new sources of foreign capital which reflect changing global economic structures.

3.2 Structural changes within the Australian economy

Structural change is central to the process of securing sustained prosperity in modern economies. Effectively, it underlies much of an economy's inherent 'dynamics'. The key feature of structural change is the transfer of resources from lower to higher productivity uses.

In the context of a resource booms, higher oil and gas activity attracts inputs from lower productivity uses, with market price signals (i.e. the exchange rate and returns to capital and labour) determining which sectors are most affected. The overall gain to the economy is determined by the extent to which labour and capital inputs can produce more highly valued output.

In the short term, the economy can partially adjust by drawing upon a combination of unemployed and underemployed resources or imported labour, finance and capital goods. Indeed, this was the pattern of expansion during Australia's gold rush in the 19th century. However, the long term nature of the fundamental factors driving the recent resources boom, namely the industrialisation of large Asian economies, means that the systemic importance of the oil and gas sector is likely to grow. Therefore, the associated reallocation of resources to the upstream petroleum industry from other parts of the Australian economy is also expected to accelerate.

When analysing the impact of the latest resources boom, the Australian economy is typically divided into three broad sectors:

- resource and resource-related support sectors;
- non-resource tradable sectors which either export or compete with imports; and
- non-tradable sectors which neither export nor face competition from imports.

In the case where an economy is operating with limited excess capacity (such as Australia at present), the rapid expansion of the oil and gas sector must be accommodated by some reduced growth in other sectors. This has undeniably been the case, where the higher exchange rate, driven by elevated resource prices, has reduced international demand for Australia's non-resource tradable sectors such as tourism and education. In addition, mature non-resource tradable industries such as manufacturing and agriculture have been somewhat crowded out by their corresponding import equivalents which are now priced relatively more competitively.

On the other hand, rising revenues in the oil and gas sector have translated to rising incomes across Australia, in turn increasing the expenditure on high-value finance and professional services in non (or less) tradable industries. As a result, more labour and capital are being directed to the petroleum and high-value service industries to take advantage of the current and anticipated growth in these areas.

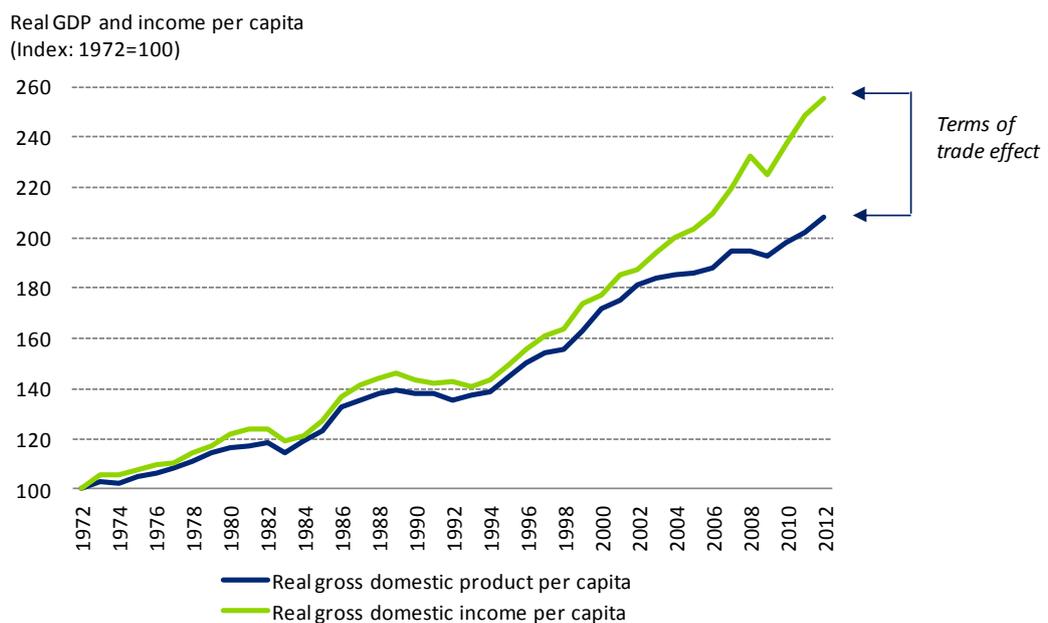
The impact on incomes and output

The net impact of the structural changes occurring in the Australian economy has been overwhelmingly positive. During the course of the global downturn, the robust export performance of the oil and gas industry, and other resource producers more broadly, provided critical income and employment support. This helped Australia withstand the more drastic economic declines experienced by other developed economies.

An important economic distinction between the current resources boom and other episodes has been its role in dramatically increasing Australia's terms of trade and the persistence at which this upswing has been sustained. In fact, over the period 2003-2012, the increase in the terms of trade has been more than three times greater than the last mining boom observed in the 1970s. At the same time, the share of oil and gas output as a share of national output has remained relatively stable. This suggests that the higher levels of national income experienced over the last decade have largely been achieved without a corresponding and equally significant increase in output. Essentially, Australia has been the recipient of a 'terms of trade gift', whereby the world economy is now willing to pay more for the goods we specialise in exporting.

Under present circumstances, conventional output volume measures such as real gross domestic product (RGDP) per capita no longer hold as an accurate measure of living standards in Australia. Instead, real gross domestic income (RGDI) per capita, which captures both changes in the volume of output and terms of trade price effects, is used as an indicator for living standards. By comparing the two measures, Chart 3.1 illustrates that since around 2003, there has been a growing diversion between output and income per capita — the difference between each representing the gains from increases in the terms of trade.

Chart 3.1: Comparison of output and income per capita



Source: ABS Cat. No. 5206.0 and ABS Cat. No. 3101.0

Countervailing productivity trends

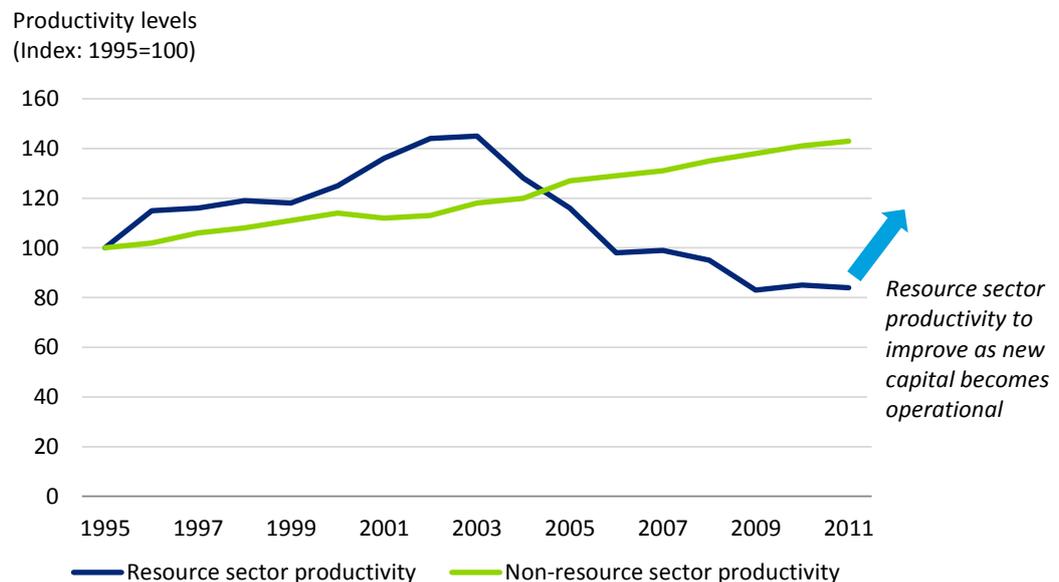
It is generally accepted that productivity growth is the most important determinant of long run material improvements in economic prosperity. In fact, over the past 30 years, it is estimated that around 80% of the increases in living standards in Australia have been due to increases in levels of productivity (Commonwealth Treasury 2010).

A widely used measure of productivity in Australia is 'multifactor productivity'. In its simplest form, multifactor productivity measures the efficiency with which inputs are transformed into outputs. In the short term, this reflects the impact of a variety of factors, such as the utilisation of available labour and capital, economies of scale and scope, and the process of resource reallocation. In the long-term, however, multifactor productivity can be used to represent improvements in the way in which operations are conducted (technical progress), which is ultimately the source of economic wellbeing.

The Productivity Commission (2011) estimates that long run average productivity growth in Australia is around 1% per year. Since peaking at 2.3% in the 1990s, Australian productivity growth has been declining to almost fully stagnant levels (no growth). The steady decline in productivity in Australia has yielded many competing explanations. These include the mismeasurement of output and inputs, changes in the composition of the economy and lags between output and labour growth causing temporary productivity fluctuations. Therefore, given the complex and dynamic relationship between the myriad of economic variables, distilling productivity trends over the short term is a difficult and often inaccurate task. Rather the sources of productivity are commonly viewed in terms of long term influences that manifest over time — that is, underlying productivity.

Productivity trends in the resources sector

A deeper analysis of productivity growth across industries reveals that increases in economy-wide productivity have been outweighed by declines in the quickly expanding resources industry. Chart 3.2 highlights that while non-resource sectors of the economy have seen steady increases in productivity, the broader resources sector has experienced a rapid deterioration in productivity, coinciding with the start of the recent resources boom.

Chart 3.2: Comparison of resource and non-resource sector productivity


Source: ABS Cat. No. 6291.0

This perceived decline in resource industry productivity is not to imply that the sector itself is unproductive, or that structural shifts are inefficiently redirecting inputs. Instead, this reflects the unprecedented levels of investment in the resources sector which has seen the use of inputs ramped up in response to the much higher prices being paid for its outputs. The unique features of oil and gas and other mining projects essentially subdue productivity growth in two main ways:

- **Capital installation delays** — In the short to medium term, the capital expenditure phase of project expansion means that capital inputs grow ahead project completion and the commencement of commercial production. Current measures of productivity classify these capital inputs as largely unproductive, rather than recognise their contribution to the capacity enhancement of projects.
- **Frontier exploration** — It is possible that output growth may never match the input growth in the resources sector. Much of additional capacity is expended on extracting commodities from lower quality or harder to reach deposits that require more inputs. In such cases, investments are made based on the increased value of production, not on the volume of output produced.

It is also important to recognise that any apparent productivity slump in the resources sector is temporary and has little bearing on its underlying productivity. Once projects become commercialised, the sector's productivity is expected to increase accordingly. This increase in productivity will largely be related to a sizable acceleration in the operational capital to labour ratio (also referred to as capital deepening).

Capital deepening in the oil and gas industry raises the resources available for workers to produce more output. As a result, labour productivity, measured by the amount of output produced per hour worked, also increases. Over the medium to long term, as more oil and gas projects become fully operational, it is expected that the industry will have one of the highest ratios of output per worker.

The considerable contribution and linkages between the resources sector and other parts of the economy mean that increases in the capital deepening ratio of this sector will effectively raise aggregate, or multifactor productivity. Indeed, historically, periods of capital deepening have been followed by periods of higher productivity. For example, this was evident during the 1990s, where capital deepening in the IT industry in the late 1980s to early 1990s significantly elevated national productivity.

Public policy should focus on facilitating the effective reallocation of resources from lower performing capital-intensive industries, such as low value-added manufacturing segments, as an avenue to raise productivity. Longer term economic gains are largely determined by the extent to which labour and capital inputs can produce more highly valued output — in essence, those which harness Australia's comparative advantages like the extraction of energy resources.

Policy principle: The ultimate aim of policy is to facilitate the adjustments needed to maximise the economic gains from the resources boom.

Any new rigidities or constraints, such as explicit industry protection measures and mandated local content requirements, will ultimately lower overall economic welfare and place additional adjustment pressure on other sectors.

3.3 Development cost pressures

The core decision facing many existing proponents is whether or not to commit to the large capital costs associated with constructing new (mainly LNG) production facilities.

The costs of establishing these major projects, including liquefaction trains and adjoining pipeline networks has been increasing due to rising construction costs (ie steel input costs) and skilled labour shortages. These pressures have already been evidenced in current Australian resource developments more broadly. Most recently, BG Group announced a budget overrun of \$5.2 billion for its QCLNG project at Gladstone, representing a blowout of around 36% in overall development costs.

Cost over-runs and slippage of development schedules represent substantial risks to projects, especially given the considerable scale of investment. As was cited in the case of BG Group, these are being predominantly driven by a high Australian dollar, where projects are typically sanctioned on a UK or US dollar basis, coupled with a range of 'local market effects'. These include increased regulatory compliance requirements, rising labour costs and weather delays.

In the case of prevailing weather conditions and the value of the currency, both represent uncontrollable aspects of project development. The critical point is to ensure that government policy does not unduly contribute to the overall development risk profile.

Two areas where there appears to be scope to reduce the regulatory burden include:

- Environmental approvals, especially regarding CSG production and integrating changes in project scope. While ensuring adequate environmental projection is clearly necessary, it appears that key aspects of the legislative framework could be

improved to deliver greater certainty to industry and better integrate the requirements of the Commonwealth Government's new Independent Scientific Panel.

- State and Commonwealth Government policies facilitating local content for major project development. There are currently a range of different measures in place for oil and gas projects, which typically have both state and federal requirements. At the Commonwealth level, there have been recent changes to bolster Australian Industry Participation plans, particularly those required to access relevant tariff concessions. It is important that these respective requirements appropriately recognise the long lead times of investments and the complexity or attendant engineering, feasibility and procurement processes.

While strong demand and prices provides some buffer to increased development costs, Australian projects are not immune from price rises. Many producers (individually or through consortium partners) are diversified companies with a global portfolio of projects. These producers make investment decisions based on the relative returns available in different countries. Associated policy uncertainties and cost increases have the potential to increase the risks and costs of investing in Australia and make other countries more attractive.

Policy principle: Australia's reputation as a world class energy exporter should be reinforced

Australia has many advantages as a developed country with proven resource prospectivity and supply performance, but rising development costs and risks of unwarranted regulatory interference could potentially undermine the economic payoffs from the boom and lead to long term supply contracts being lost to other resource exporters.

3.4 Addressing workforce skills

Accessing skilled labour is a pivotal concern for the oil and gas industry. Given its rapid expansion trajectory and largely concurrent project scheduling, there are significant demands on industry to source and place workers to ensure the pace of development can be sustained. These challenges are being effectively compounded by relatively low unemployment and the labour demands placed by buoyant activity across the broader resources sector.

Importantly, workforce pressures are extending more broadly beyond traditional trades and key regional centres heavily exposed to new mining and gas investment activity. Anecdotally, for instance, various state governments are struggling to retain experienced energy market officials, especially in the areas of project approvals and gas regulation.

While investment in the industry is strong, workforce issues require greater policy attention to address development needs.

Oil and gas projects have specific requirements

The different stages of capital-intensive oil and gas developments necessarily require workforces of varying sizes. During the project capex phase, there is a far greater labour requirement as large-scale civil works and facility development occurs. Conversely, project operations typically require far fewer and often more specialised workers to manage the operation and maintenance of production facilities.

This discordance of labour requirements over the life of the project creates additional issues for the industry in matching workforce supply and demand. This is further exacerbated by the regional nature of oil and gas production, where there are smaller localised labour pools, particularly in specialised trades and construction fields.

The primary issue for the oil and gas industry is to source sufficient numbers of workers for their respective capex developments.

- Firstly, local labour forces are unable to meet the required demand. And increasing the size of the local labour force through regional development initiatives is generally unfeasible due to its slower and longer term effects and the immediate labour requirements associated with aggressive project development schedules.
- In addition, the large workforce is only required in the capex phase, meaning that many workers who permanently relocate to the region are likely to be under or unemployed once facilities are commissioned.

Dependence on a FIFO workforce

This reliance on a large temporary workforce places greater onus on labour mobility and flexibility to enable workers to be deployed in their most productive capacity. FIFO workers have presented a broad-based solution to this workforce issue, allowing workers to operate in regional areas without the need to relocate or spend extended periods from their families.

While in many respects FIFO arrangements have showcased an effective and rapid response by producers (and the aviation industry) to substantial workforce challenges, they are by no means a perfect solution to the industry's needs. Skilled labour requirements must also be met at reasonable cost to be of benefit to the industry. Further, the need to transport workers to and from remote areas can drive up development costs and lead to other social pressures.

For example, many regions experiencing rapid gas and mining development have faced an increase in rental prices as temporary workers compete for limited accommodation. Housing shortages may also be faced by locals as companies lock-up accommodation for their workers.

While those directly associated with the accommodation industry benefit from higher prices, other parts of the community can experience additional pressures as the cost of living is forced upwards. Additional demand for goods and services also drives up the prices of necessities as more highly-paid FIFO workers have the capacity to pay elevated prices.

There are also criticisms that FIFO workers do not spend their money in regional areas. This can make their temporary presence appear 'one-sided' — in effect, driving up local prices

for essential goods and services but not sufficiently contributing to regional development and the local economy. One particular (and perhaps unintended) consequence is that the availability of FIFO arrangements has, at times, effectively turned local workers into FIFO workers. Again anecdotally, some local residents have used the opportunity to relocate elsewhere (say the Gold Coast) and be rostered back to the region to work.

Some of these criticisms are somewhat exaggerated (as will be borne out in later analysis) but they do point to areas where industry and government need to work together more intently.

There is a need to consider alternative options to address ongoing workforce issues. For example, targeted skilled migration programs and training for local workers in project-relevant skills can be instituted to meet demand.

In this regard, many producers are already taking active steps to address shortages in skilled workers. For example, direct company-sponsored training and fast-track programs and apprenticeships are being rolled out to meet the demands of various LNG producers in Queensland and Western Australia. These training programs are welcomed and will play a major role in improving the broader skills base of the economy, imparting a positive legacy impact especially given the massive pipeline of energy investments focused on surging demand from Asian customers.

Beyond these initiatives, there are other innovative approaches to addressing the skills shortage. These include as employing or retaining older workers, those who may require greater flexibility for family commitments, or improving the productivity of existing workers. Many of these options have been canvassed in a recent Deloitte report *Where is your next worker?* (Deloitte 2011). Some of these approaches are likely to present viable alternatives for the industry as part of a multi-pronged strategy.

Policy principle: Accessing skilled labour is a pivotal concern for the industry given its rapid expansion footing and greater policy attention is needed

For large capital-intensive projects, the capex phase will necessarily involve increased reliance on mostly temporary workers. This places greater onus on improving labour mobility and flexibility to enable workers to be deployed in their most productive capacity.

Various innovative solutions are available and a mix of strategies will be needed to manage sensitivities around FIFO workers and higher levels of skilled migration.

3.5 Establishing a sovereign wealth fund

A number of senior public figures such as Malcolm Turnbull, Ralph Norris and Bob Brown as well as prominent economists including Professor Warwick McKibbin (a former RBA board member) and the International Monetary Fund have called for the establishment of a sovereign wealth fund (SWF) in Australia.

A SWF can potentially serve a variety of aims which mean that the exact policy rationale for establishing a SWF needs to be clearly defined to evaluate its effectiveness. Some of the main justifications for establishing a SWF include:

- Moderating exchange rate appreciations (such as would occur during a resources boom).
- Saving (quarantining funds) for future fiscal imbalances, for example an ageing population — this is sometimes referred to as consumption smoothing.
- Fiscal revenue stabilisation (smoothing volatile revenue flows).

In terms of the first objective, if a SWF is to be used to moderate the effects of a resources boom, it should be invested wholly abroad. Using Australian currency to purchase capital abroad acts to moderate exchange rate increases, assisting the domestic tradeable goods sector which would otherwise be impacted by a higher currency. It can also increase diversification of public sector asset holdings by introducing international asset exposure.

However, there are some costs associated with a SWF. By requiring that funds be invested abroad a SWF may miss out on higher return domestic opportunities, leading to underinvestment and a redistribution of income among domestic firms with subsequent costs for non-tradeable producing industries.

The second broad justification for a SWF is that it can help address issues associated with Australia's ageing population which may lead to structural budget deficits. The final justification often used for an SWF is that it may offer a way to capture the benefits of a resources boom for future generations. That is, put in place a mechanism to provide for intergenerational equity from extraction of Australia's finite natural resources.

It should be noted here that a SWF need not necessarily be funded by an additional impost on the resources industry — indeed, Australia's Future Fund has been financed through general government surpluses and proceeds from the sale of public assets. However, a SWF especially one explicitly linked to the current resources boom, is likely to be financed at least in part from additional imposts on the petroleum and wider resources sector.

Main advantages of a SWF

The objectives of a SWF discussed above could be achieved through running budget surpluses rather than creating a separate SWF (Henry 2010). The main advantage of a SWF over running a budget surplus is that a SWF can be designed to quarantine funds for future needs in such a way that governments are unable to or less likely to raid surplus funds prior to the future need arising; and also that a SWF can focus public opinion on making efficient investments from the proceeds of a resources boom.

However, it should be noted that the way a SWF is designed is critical to preventing it being used by governments to fund deficits, either directly or indirectly by borrowing against the security of the fund.

Some disadvantages of an SWF

One of the disadvantages of an SWF is that it essentially has an identical effect on net debt levels as running a budget surplus. The Secretary of the Commonwealth Treasury (2011) has noted:

The act of paying down net debt out of future surpluses is identical to accumulating financial assets in a sovereign wealth fund. It has the same effect on the government's balance sheet and the level of public saving.

Efforts to reduce government net debt should be the immediate focus — whether this is done by reducing gross debt on issue, or maintaining gross debt but building up financial assets, in a sovereign wealth fund, is an important but second order issue ...

I am not suggesting that a sovereign wealth fund is not without merit, just that we should be clear about the role that it can and should play.

The real return on the Future Fund between 2005-06 and 2010-11 has averaged 2.2% (Carling and Kirchner 2011), which has been relatively similar to the cost of current government debt incurred in recent years. Thus the existence of the Future Fund has not led to an appreciable improvement in Australia's net debt position relative to using such funds to retire debt.

Another disadvantage of a SWF is that it can prevent governments from investing in investments in infrastructure and human capital or superannuation which can also be used to improve the welfare of future generations. In fact, such investments could potentially do more to improve the long term prospects of the country than quarantining current capital in a SWF.

Other implications

At an industry level, there are also difficulties associated with how a SWF might be financed. For example, imposing additional taxes on the resources sector to fund a SWF can, depending on how the tax is designed, could create distortions in the allocation of inputs between sectors in the economy and may restrict the level of growth occurring from a resources boom. A SWF financed from general budget surpluses can avoid some of these problems but Australia is currently running a slender surplus position and large surpluses are not projected for the medium term (Federal Budget 2012).

It is also important to clearly define what the SWF is to be used to fund and for this objective to be clearly worthwhile (the Future Fund is to be used to cover public sector superannuation liabilities). If the objective is not clearly defined, a SWF may be used for politically motivated spending in the future. However, it should be noted that Australia's SWF governance arrangements are considered world leading in terms of their reporting transparency, accountability provisions and clear commercial mandate.

There are also important differences between Australia and countries who are cited as successful examples of a SWF such as Norway. Norway's resources have a shorter expected life than Australia's and comprise a larger share of the overall economy. Moreover,

Norway's fiscal challenges are also more acute with the Norwegian Government expected to have a fiscal gap of 5.5% by 2050 compared to 2.5% by 2050 in Australia.

Thus while SWFs can help a country such as Australia achieve specific policy objectives, they need to be carefully designed with particular thought being given to ensuring funds are raised in a manner which minimises the degree of distortions in the economy as a whole and that funds are appropriately quarantined. Given that Australia currently has a significant level of net debt (albeit moderate by international standards), the value of a SWF also needs to be weighed against the use of budget surpluses to reduce existing debt. Given the current Budget position, it is hard to see the establishment of a SWF being an important policy priority over the medium term.

Policy principle: It is crucial to guard against any backsliding on Australia's broader institutional settings

Australia's fiscal and broader institutional settings have led to this resource boom being (largely) well managed, especially compared to previous booms.

There have been calls for Australia to reframe aspects of its fiscal settings through establishing a (new) sovereign wealth fund to capture the benefits from high resource prices. A SWF can be used to meet particular policy objectives but needs to be carefully designed to minimise distortions between sectors and to ensure that funds are appropriately quarantined. Given the current budget position, it is difficult to see the establishment of a SWF being an immediate policy priority.

4 Conclusions

Over many decades Australia's oil and gas industry has played a substantial role in unlocking Australia's abundant energy resources and reinforcing our international reputation as a world-class energy exporter.

Looking forward, the industry is well-placed to take advantage of the considerable opportunities presented by strong demand for energy resources within our region. This is being underpinned by a remarkable level of investment in new production facilities across the country, predominantly in Western Australia, Queensland and the Northern Territory. The scale of these investments is quite unprecedented and it showcases the industry's enterprise and capabilities to concurrently execute complex and long term projects.

The level of industry investment and the substantial boost in production slated to come on line over the next decade will provide enormous economic benefits to the country. However, in order to fully harness these gains, there will need to be further adjustment in the allocation of resources within the economy. This has already presented various sectoral and workforce pressures, such that the 'multi-speed' or 'patchwork' economy is now a common thread in the national conversation.

A number of policy principles have been presented in this paper regarding an effective way to manage these structural and development pressures, reflecting our proud track record of responding to new opportunities, modernising the economy and engaging with the rest of the world. This paper represents a preliminary part of a broader study and further work is being undertaken to explore the key issues raised here.

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