

Overview and synthesis of regional economic effects of the CSG industry during the construction phase

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Executive summary

The growth in CSG in southern Queensland has brought substantial changes to regions where development has occurred during the construction phase. In this report we review some of the most important literature evidencing changes across regions that have hosted CSG expansion in recent years. The literature reviewed demonstrates that the CSG industry has increased local family income and employment in the mining sector. In terms of indirect effects, local job multipliers from the CSG industry into other non-mining areas are less consistent across regions of the Surat Basin, where most CSG wells were located prior to 2014. Income inequality increased less than in the rest of the country and immigration of skilled labour has been observed in some CSG regions, such as the township of Chinchilla.

Although most of the evidence in this report focuses on quantitative analysis of primary and secondary socio-economic impacts, at the end of the document is also provided a comprehensive list of different studies that have focused their analysis on wider socio-economic phenomena related to the CSG expansion in Queensland.



1 Introduction

Unconventional fossil fuel (UFF) production is expanding around the world. With production already established in North America and Australia, the sector is expanding rapidly in Asia, South America and Europe. The growth of UFF has posed challenges to the health and prosperity in gas extraction regions with increasing numbers of people. Whereas conventional energy development tends towards intense, site-specific impacts, the imprint of UFF extraction is generally extensive rather than intensive, tending to be co-located with other productive land uses and in the proximity of human settlements. This means that a wider range of people are likely to experience positive and negative sides of development, which may reach as many as 300 million people around the world in coming years (Measham and Fleming, 2014a).

Of the different forms of unconventional gas, the most developed in Australia is coal seam gas (CSG), which has rapidly expanded in the state of Queensland in the past decade (GA, 2012; Fleming and Measham, 2015a). Queensland possesses over ninety per cent of the country's economically demonstrated resources (EDR) of CSG known to 2011 (GA, 2012), distributed mainly across the Surat and Bowen basins. Moreover, exploration activity has revealed increasing quantities of commercially viable resources: the EDR of CSG increased from 15 trillion cubic feet in 2003 (GA and ABARE, 2010) to around 39 trillion cubic feet in 2014 (Simshauser and Nelson, 2015). Consequently, the establishment of CSG production wells has grown considerably since 2003. By 2014, thousands of wells had been developed along with substantial pipeline infrastructure to distribute the gas. The initial rationale for developing this unconventional gas resource stemmed from public regulation to displace coal for gas in electricity generation (Queensland Government, 2014). However, the increase in gas quantities available has outstripped the limited and relatively small domestic (eastern Australia) market. Lured by the Asian gas price premium (a phenomenon whereby gas supplied to the Asian market commands a considerably higher price), gas producers have shifted the focus to exports with thousands of additional wells planned and the development of liquefied natural gas (LNG) export processing facilities commencing operations in 2015 in the town of Gladstone.

The CSG development in Queensland has translated into several economic impacts for the state, regions and communities hosting the extraction activity. In this article we highlight the main regional economic effects caused by the expansion of CSG in Australia since its inception in early 2000s. In particular we first briefly highlight some of the macroeconomic effects that the development of the industry has produced for the country and in particular for the state of Queensland. We then move to the main focus of this article: to report the empirical evidence of regional economic impacts of the CSG industry in the Surat and Bowen basins and provide more detail of impacts on communities hosting the extraction activity. We do this by discussing a



framework to understand the indirect effects likely to emerge in regions and communities as consequences of the economic shocks produced by UFF expansion across space, and by providing research evidence of these different direct and indirect consequences during the CSG construction phase.

The projected and expected effects of the CSG operational phase, which is in its early stages, are not in the scope of this review. We also refrain from scrutinising potential gas market effects of the new LNG export plants built in Gladstone Harbour, which will undoubtedly produce important consequences to local gas prices and therefore to the whole economies of Queensland and eastern Australia (Simshauser and Nelson, 2015). However, to help contextualise the likely impacts of the operational phase in the future of local economies across Queensland it is important to understand the changes that regional communities have experienced in the wave of the development of the industry in the last ten years.

2 Macro and state level economic effects of CSG industry development

At state level it is difficult to separate the impacts of the CSG and LNG developments into the various components of the CSG value chain. Early state-level studies have focused mainly on the impacts of LNG exports rather than disaggregating these impacts into the various stages of the value chain (BREE, 2014). Thus, several reports and studies have created forecasts of state revenues, gross state product (GSP) growth and effects on the gas market of the Australian eastern coast with the commencement of operations of the different trains in the LNG plants. For instance, ACIL Tasman (2015) forecasts that the cumulative impact of a six-train LNG export facility in Gladstone on Queensland's total GSP would peak at around \$25 billion in 2035 and that the cumulative impact of a six-train LNG export industry on Queensland's real income would peak at around \$16 billion in 2035. Also with six-trains, in terms of employment, Energy Skill (2015) reports that the operational and maintenance phase of the industry could peak with around 17,000 people employed by CSG companies in 2024 if a total of 59,000 CSG wells are finally drilled. Of this labour force, more than 90% (around 16,000) of total labour would be employed upstream – that is, where wells are located and being drilled.

In a different study, commissioned by the Queensland Resources Council, Lawrence Consulting reports that in 2012–13, both direct value added (including salaries to direct full-time employees, purchases of goods and services and community contributions), and second round value added (supply chain and consumption effects) from the CSG sector were over \$11 billion each, providing



a total contribution to GSP of \$23.6 billion to the state of Queensland (Lawrence Consulting, 2013).

3 Regional and community level economic effects

There is considerable literature on the effects of conventional energy extraction on host communities. However, much of the literature focuses on issues of immediate concern, such as labour demand and wages paid to workers (Marchand, 2014). These immediate economic impacts tend to have follow-on effects, some of which may be seen as positive (stimulating local economies) while others can be negative (straining local development). Thus, there are a whole series of indirect effects that emerge from initial economic shocks of resource expansion, often considered to be as much social issues as economic issues, such as changes to migration patterns, rising income inequality and social conflict between long-term residents and new arrivals in the community. These issues are sometimes represented as the social ‘cost’ of resource development, but they comprise effects that can be seen as either positive or negative (or both). To understand how these indirect effects originate, figure 1 presents a simple framework developed to explain hierarchical or cascading effects originating from direct economic impacts of resource activity in regional economies (Measham et al., forthcoming).

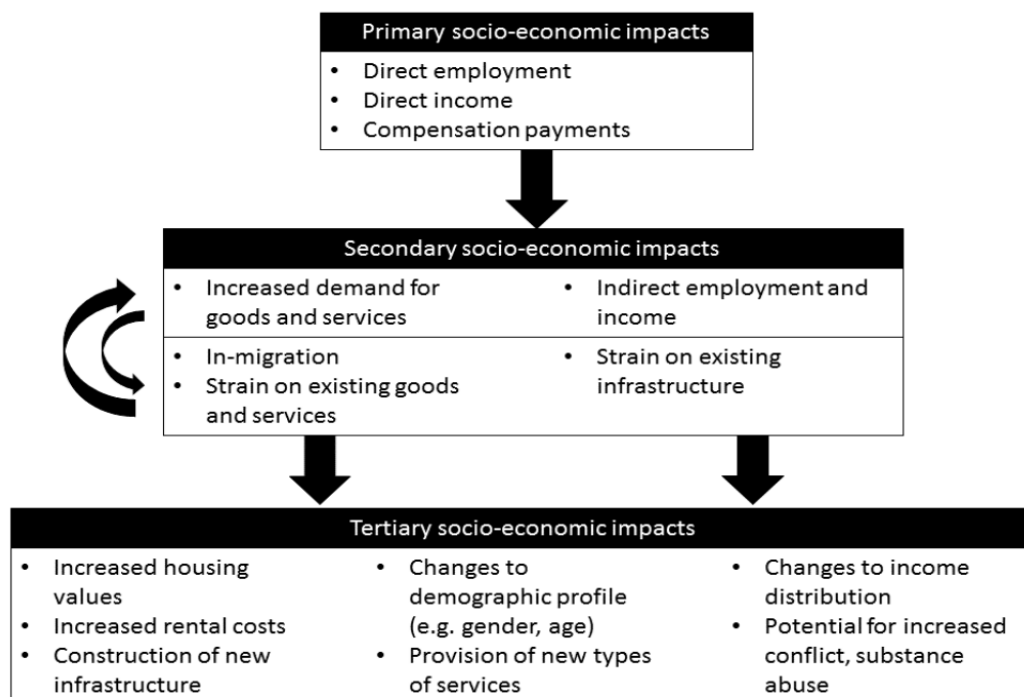


Figure 1. Consequential effects of resource extraction
Source: Measham et al. (forthcoming)

Based on this framework, we discuss the implications of CSG development for regions that have faced extensive well drilling in recent years, and report the evidence found in empirical studies.

3.1 Primary Socio-economic Impacts of CSG Development

3.1.1 Direct Employment

As reported by BREE (2014), economic data from QGSO (2014a, 2014b) shows growth in CSG employment on resource regions between 2001 and 2011, where the unemployment rate in the Surat Basin decreased from 5.9 to 3.1 per cent and in the Bowen Basin from 4.3 to 2.2 per cent (BREE, 2014; QGSO, 2014a, 2014b). This growth in employment is even higher when considering the broader mining sector: over the same period, employment in mining grew from 21 to 32 per cent of the workforce, and in the Surat Basin from 1.3 to 7.2 per cent of the workforce (BREE, 2014).

A report by KPMG found that the percentage of people working in the oil and gas sector alone in the Surat increased by 273 per cent between the 2006 and 2011 censuses (KPMG, 2013).

Furthermore, Lawrence Consulting (2013) reported that the share of employment in the CSG and LNG industry increased from 1.5 to 4.9 per cent of total regional employment in Queensland (including indirect employment) between 2010–11 and 2012–13, with sectoral employment reaching a total of 115,190 workers (BREE, 2014).

Focusing exclusively on extraction regions within the Surat and Bowen basins, Fleming and Measham (2015a) found that employment in the mining sector showed higher growth in areas with CSG development compared to similar regions in rural Queensland (30% higher growth in mining employment in CSG regions). Employment in the Surat Basin has grown more than in the Bowen (around 14 percentage points higher), signalling that positive direct employment effects were stronger in the Surat, a region without a previous history of mining, compared with the historical coal mine region of the Bowen Basin.

3.1.2 Direct Income

During the same construction phase, 2001–2011, Fleming and Measham (2015a) found that family income grew by 12 to 15 per cent more in CSG hosting regions than in comparable rural regions of Queensland. This provided evidence not just that CSG development was associated with higher income growth, but that the growth was not restricted to workers residing temporarily in CSG regions (BREE, 2014). Thus, income effects of CSG benefitted host regions, as income increased for the average family residing in extractive regions. Similarly, KPMG (2013) found that in both the



Bowen and Surat basins, the proportion of high income residents had grown between the 2006 and 2011 census, increasing twofold in the Bowen.

However, it is important to mention here that the findings of Fleming and Measham (2015a) and KPMG (2013) do not differentiate between sources of income increases, as depicted in figure 1. That is, income increases encompass CSG effects on direct income (industry wages), compensation paid directly to landowners from gas companies, and indirect income (new wages or salary increases in other sectors/industries).

3.1.3 Compensation payments

Although the income increase findings of Fleming and Measham (2015a) and KPMG (2013) do not differentiate between wages and compensation, it is important to highlight some issues about compensation. The experience of CSG in Queensland has tended to be spread out over a wider area, so compensation has occurred across many farms. Moreover, the areas in which extraction is occurring have been characterized by often relatively densely populated sectors and based on well-established rural industries such as agriculture and services supporting the agricultural sector, with the effect that there are more people with a claim to compensation for diverse impacts. Compensation claims may not be restricted to those where extraction occurs, but may also encompass wider areas where roads, pipelines or other infrastructure may cross the paths of regional economic activity, potentially leading to increased average incomes beyond the direct employees of the resources sector. To the best of our knowledge, independent research analysing the flow and impacts of these compensation payments received by local economies in Queensland, has not been conducted to date.

3.2 Secondary Socio-economic Impacts of CSG Development

Indirect jobs arising from the CSG industry have also been substantial. In particular, Fleming and Measham (2015a) found that growth in services sector employment grew 30% more in CSG areas. However, the same authors found little of this evidence in CSG areas of the Surat Basin, meaning that most of the positive spillovers occurred in the Bowen Basin (table 2 in Fleming and Measham, 2015a). Deepening their analysis in the Surat Basin, Fleming and Measham (2015a) found positive job spillovers in the construction and professional services sectors, and negative spillovers in the agricultural sector (see table 3 in Fleming and Measham, 2015a).

Considering the compensation effects extending to more people over wider areas identified as primary economic effects above, it is not surprising that there is some evidence of spillover effects



extending from this income. While empirical study of these effects is currently quite rare, there is some evidence in the U.S. that farmers with additional income may invest this income in additional equipment or agricultural services (Brasier et al., 2015), which can also negatively affect agricultural labour demand – as production shifts from labour intensive technology to more mechanized systems. In relation to this labour substitution effect, Fleming and Measham (2015a) found a negative spillover of the industry on agricultural employment growth for CSG regions between 2001 and 2011.

3.3 Tertiary Socio-economic Impacts of CSG Development

One of the main observations of tertiary effects for conventional energy projects has been a substantial increase in the male population, leading to a gender imbalance. However, migration observed in coal seam gas regions demonstrates that migrants, and particularly youth migrants, came in equal numbers of males and females (Measham and Fleming, 2014b). The explanation for this may not be directly related to CSG expansion itself, but rather the context in which it took place. In particular, the CSG industry developed in and amongst other land uses (principally agriculture) and contributed to spillover effects already in place relating to agriculture as additional demand for services occurred. This means that much of the infrastructure to support a more diverse population is already in place, and that demand for goods and services (which we refer to as secondary impacts) attracts a wider range of people with more diverse skills and backgrounds, such that gender ratios may remain relatively stable and human capital may rise (Measham and Fleming, 2014b).

Regarding impacts on housing and/or land values, theory says that developments such as CSG can present different effects: (1) an increase in housing values as higher disposable income and population in resource regions increases housing demand; and (2) the market value of some properties may increase due to the expectation of compensation for the extraction of subsoil endowments, or simple access to extraction points. Other impacts are also associated with extractive industries, such as (3) a decrease in housing values of properties located in the proximity of extraction points, as negative externalities from extraction activity will affect property values, and (4) a decline in extraction activity can translate into a local oversupply of housing, negatively affecting house values. A final consideration is that (5) the capitalised value of a house equals the long-term capitalised values of user costs and price appreciation. Since the CSG development has occurred relatively rapidly – in short to medium terms – it is not clear that this would affect long-



term pricing. Unfortunately, as shown by a report from the NSW government, so far there is not enough housing or land sales data, and therefore robust empirical evidence, to determine which of these five effects has been predominant across upstream CSG regions (NSW, 2014).

In terms of income inequality, it is easy to presume that this could be a problem in areas affected by a natural resources boom, given that the mining sector generally pays higher wages than other regional industries. However, Fleming and Measham (2015b) found that income inequality, measured by the Gini coefficient, increased less in the Bowen and Surat basins between 2001 and 2011 (1.3 per cent and 3.3 per cent, respectively) than the rest of the country (around 8%). This can be explained by the nature of the CSG industry, which has an extensive geographical footprint so it can allow for a broader range of stakeholders to benefit from resource extraction, potentially affecting more evenly the initial distributions of income across regions – in comparison to single-point resource extraction activities such as coal mining. However, another contributing factor that could explain this finding is the potential outmigration of lower income residents from CSG regions (BREE, 2014).

Finally, while a detailed discussion of social impacts is beyond the scope of this review, it is important to acknowledge that unconventional gas in regions with pre-existing industries can lead to higher levels of conflict if communities have not previously had much exposure to the resources sector. This can cause substantial tension, social conflict and legal challenge as observed by Sherval and Hardiman (2014) and Turton (2015).

4 Discussion and future work

Although most of the evidence shown above relates to effects produced by the expansion of the CSG industry across Queensland (that is, the drilling of wells), it must be understood that the construction phase of CSG extraction spreads considerably across regions and this development did not occur at once, rather it started in 2003 and is still happening. Therefore, the CSG development phase occurs over a longer period than individual mines, such that installation labour forces may be required for several years. Moreover, the operational phase and the installation phase are less distinct compared to those of conventional resource extraction, with each completed well becoming operational as the installation process moves across the landscape to the next well site.



While some of the labour skills required during the construction phase are highly specialised and need to be brought in from afar, others are much more familiar to agricultural communities, such as the need to fence off every well site to prevent stock intrusion, and can be sourced locally. During the operational phase, many labour requirements are relatively low skilled, and can be sourced either from local towns or from nearby town centres. Whereas conventional mining for coal or metal ores tends to use a small number of large machines, CSG tends to use a large number of small machines, such as water pumps and gas separators, connected by an elaborate system of pipes. Each of these requires checking and maintaining on a regular basis, providing a need for skills that are relatively transferable between sectors. Similarly, skills such as truck driving and grading roads make up a large part of the CSG labour force, and can be sourced locally or from nearby towns and cities. These characteristics have resulted in a net increase in total employment in CSG regions, as well as a transfer of labour from the agricultural sector to the resources sector (Fleming and Measham, 2015a). Thus, activities so far have been dominated by the expansion of the industry, although in many cases operations are already in place, so findings can mix both effects across space. As the industry moves towards a fully operational phase, more evidence will be available to appraise the effects of a settled CSG industry across local economies.

5 Conclusion

The growth in CSG in southern Queensland has brought substantial changes to regions where development has occurred during the construction phase. The literature reviewed demonstrates that the CSG industry has increased local family income by 12 to 15 per cent more than in comparable areas of Queensland during the decade 2001–2011 (Fleming and Measham, 2015a). Employment in the mining sector has also grown faster across the CSG region. However, local job multipliers into other non-mining areas are less consistent across regions of the Surat Basin, where most CSG wells were located prior to 2014. Income inequality did increase in the Surat and Bowen basins from 2001 to 2011, but at a lesser rate than the rest of the country.

The economic changes during the construction phase provide the context for forecasting changes during the operations phase. It will be interesting to consider how employment in different sectors



may change, for example, the extent to which people who left agriculture to work in the resources sector during the construction phase return to agriculture during the operations phase.

Although most of the evidence reported in this article focuses on quantitative analysis of primary and secondary socio-economic impacts, there exist a range of other studies providing insightful perspectives and qualitative evidence of how CSG has affected communities and regions across Queensland. In appendix 1 we provide a comprehensive list of studies (reports and publications in peer-reviewed scientific journals) analysing the CSG industry during recent years, and are not directly cited in this report.

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Appendix 1. Additional research on socio-economics issues related to the CSG industry

In the following we list other studies and reports looking at diverse socio-economic issues related to CSG in Australia and that are not cited in main text above. Please note that a set of additional CSG research on different topics, and not listed here, can be found in the research repository of the GISERA web page: www.gisera.org.au/publications/researchoutputs.html

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