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Impacts of unconventional gas development on rural community decline

Working paper

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Executive summary

In this paper we look at the impacts of a new industry, namely unconventional gas, on rural decline. Rural decline is defined as comprising loss of rural youth, reduced human capital and increasing rural poverty. Since the start of the current century, the unconventional gas industry has been expanding around the world, often in close proximity to pre-existing agricultural communities. The implications of this new industry represent a growing area of interest in rural studies. We contribute to this new research area through a case study of coal seam gas (CSG) development in Queensland, Australia, comparing locations where gas development has occurred between 2001 and 2011 against a control group of similar regions without gas development. A key finding of the study is that regions with CSG development have experienced a growing youth population share and, of particular note, a growing female youth population share, which is unlikely to be explained by non-resident workforces alone. CSG regions had mildly more educated populations, but only amongst men. Poverty reduction was also observed in CSG regions, concentrated primarily in specific locations. The extensive spatial footprint of unconventional gas and increased female youth populations indicate a diversion from traditional boomtown effects in previous energy booms. Taken together, the results show signs of mitigating (and in some cases reversing) rural community decline.

1 Introduction

As the world population has become more urban than rural, scholars of rural studies have increasingly grappled with the issue of rural decline. The expansion of urban populations has prompted researchers to look closely at the effects on rural areas, including demographic changes, economic changes and different settlement patterns in rural towns (Bloom et al., 2008; Montgomery, 2008). Much of the focus on rural decline has looked at changes in agriculture, such as increased mechanisation and diminishing terms of trade. Yet, alongside decreases in some traditional economic activities, rural regions are experiencing expansion in other economic areas. One substantial economic change which has developed over the past decade, and which has significant impacts for rural areas with a history of agriculture, is a new industry in the form of unconventional gas. Understanding the implications of new extractive industries such as unconventional gas for rural localities is a crucial issue for the field of rural studies (Woods, 2012). The rationale for putting these new industries under the microscope is that they pose new challenges and opportunities for rural communities. In part, this is due to the operational differences that affect the viability of existing rural communities in different ways from conventional mining and energy production. This paper looks at one such change – the development of unconventional gas – and considers how this is affecting rural decline in communities experiencing coal seam gas development in Queensland, Australia.

1.1 An overview of rural decline

The term 'rural decline' refers to a wide range of issues, from demographic changes through to rural political discourses (Lockie, 2000). Underpinning most of these discussions are three substantive changes, which flow through to issues of identity and aspiration in different rural contexts. The first is rural out-migration, and in particular rural youth out-migration which leads to a skewed demographic profile in rural areas (Stockdale, 2004). The second is declining human capital due to out-migration of skilled and educated young people. The third area is the low incomes of rural regions compared to urban areas (Argent and Walmsley, 2008). In practice this often boils down to questions of whether young people have a future in rural locations (Stockdale, 2004).

With some exceptions such as the UK, out-migration is the dominant trend for most rural regions around the world (Woods, 2011). Out-migration of youth in particular (including in the UK) is an issue because it is recognised as damaging to rural communities in terms of skewed demographic profiles, reductions in services and loss of local culture as expressed through festivals and related events (Stockdale, 2004). Young women are more likely to leave rural regions than their male counterparts (Argent and Walmsley, 2008). The 'exodus' of youth from rural areas has been a concern for decades in Australia, and shows empirical evidence of accelerating over the last two decades (Gabriel, 2002; Argent and Walmsley, 2008). The causes of rural youth out-migration are multiple and complex, but partly explained by push factors including a lack of employment for school leavers. To some extent this is explained by the reduced demand for agricultural labour forces, which has been influenced by farm amalgamations, declining terms of trade and increased mechanisation. Other factors include escaping the perceived dullness of rural locations in favour of 'city lights', and increasing propensity to seek tertiary education which tends to be concentrated in metropolitan areas (Woods, 2011; Argent and Walmsley, 2008). The extent to which rural out-migration is a problem, and what might be done about it, are areas of debate (Gibson and Argent, 2008). While it is not possible to engage with all aspects of youth out-migration in this article, our focus in this paper is to consider how the development of a new industry in the form of unconventional gas is reflected in opportunities to retain rural youth.

Compounding the loss of rural youth, a related component of rural decline is reduced human capital. In particular, a concern about losing 'the best and brightest' has long been recognised in rural studies (Gabriel, 2002). According to Stockdale (2004) those with ability or ambition have little choice but to leave rural communities. Others suggest that the development of human capital in rural contexts may accelerate the departure of the most capable (Corbett, 2007). Some scholars note the potential advantage for rural regions of youth out-migration, provided that some of the emigrants return with the knowledge and skills they have developed through programs which are only available in urban centres (Gibson and Argent, 2008). Thinking along these lines, Stockdale (2004) considers that the number of youth returning to rural communities is perhaps more important than the numbers who leave. In concrete terms this is an important phenomenon to consider as human capital is fundamental for the development of entrepreneurship, innovation and long term growth.

Increasing income disparities between rural and urban areas – which are common in many countries – are another component of rural decline (Pritchard and McManus, 2000; Hu, 2002; Stockdale, 2004). Low incomes for residents in agricultural regions compared to cities are particularly significant due to the interrelated impacts of market access, trade liberalisation, structural adjustment, declining commodity prices and property amalgamations (Goetz, 1992; Argent and Walmsley, 2008; Connell and McManus, 2011). It is also important to recognise that there are varying levels of poverty between rural regions, in part depending upon the size and productivity of the agricultural sector (Fleming et al., 2010) therefore the rise of the resources sector may affect different types of rural regions in different ways.

While rural decline is a crucial area for study, some call for caution when applying the label to particular locations, as the stigma attached to this phenomenon may hasten its development (Gibson and Argent, 2008). Young people may be inherently mobile – seeking exploration and new challenges – so some of the intrinsic factors such as low incomes in rural areas may not be always be strong drivers of outward migration (Delisle and Shearmur, 2009). Others reject the inevitability of rural decline, viewing it more as the outcome of particular policy choices (Markey et al., 2008). Some have tentatively observed 'rural revival', as jaded urban dwellers seek better lifestyles in rural areas (Connell and McManus, 2011).

2 The rise of natural gas extraction in rural landscapes

Internationally, the growing demand for energy and, at the same time, for lower carbon emissions has fuelled demand for new types of energy resources. Interest in 'unconventional' energy has grown increasingly since the end of the 20th century, requiring new mechanisms to harness this energy (Rogner, 1997). Much of this development has occurred in the USA, where unconventional natural gas has been a major component of strategic programs aimed at increasing self sufficiency in energy with a lower carbon emission burden (Stedman et al., 2012). The 'unconventional natural gases' comprise sources of methane which include shale gas (the most widely exploited), coal seam gas (also known as coal-bed methane) and the lesser known 'tight gas' trapped in rock formations (Law and Spencer, 1993; Wright, 2012). Shale gas is extracted in substantial volumes in the USA, notably in the Marcellus and Barnett shales. Potential for shale gas production has been recognised in several parts of Europe, including Austria, Germany, Norway, Poland, Romania, Sweden, Turkey and the UK (Schulz et al., 2010; Selley, 2005; Weijermars, 2013; Wiśniewski, 2011). Reserves of shale gas are also located in Argentina, Australia, Brazil, Canada and Mexico (Ross and Bustin, 2007; Wright, 2012).

Coal seam gas (CSG), geologically distinct from shale gas, is also expanding throughout the world. Coal seam gas is currently extracted in a dozen countries including the United States, Canada, Australia, India and China (GA and ABARE 2010). Previously thought of as a fugitive gas waste product from conventional coal mining, it is now an industry in its own right due to developments in technology to harvest methane trapped in coal seams (Cheng et al., 2011). This has enabled extraction of methane from deep coal seams which are not economical for conventional coal mining. Along with shale gas, CSG has lower greenhouse emissions compared with other fossil fuels (Gunter et al., 1997).

Australia has all three types of unconventional gas resources, with varying levels of known accessibility (GA, 2012). The largest estimated reserves are for shale gas, notably in Western Australia, although exploration is still in early stages. Exploration for tight gas is even less developed, with no viable reserves identified. Of the different forms of unconventional gas, the most developed in Australia is coal seam gas, which has rapidly expanded in the state of Queensland in the past decade (Morrison et al., 2012; GA, 2012; Fleming and Measham, 2013). 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 (see figure 2.1). Moreover, exploration activity has revealed increasing quantities of commercially viable resources: the EDR of CSG has increased from 15 trillion cubic feet in 2008 (GA and ABARE, 2010) to around 33 trillion cubic feet in 2011 (GA, 2012). Sinking of production wells has accelerated since around 2003, focused particularly in the Surat and Bowen basins. By 2011 over 4,000 wells had been developed, along with substantial pipeline infrastructure to distribute the gas. The initial rationale for developing unconventional gas resources stemmed from increasing the proportion of electricity generated from gas (which has lower carbon emissions) rather than coal. However, the increasing quantities extracted and insatiable global demand for energy have shifted the focus to exports, with the development of LNG processing facilities occurring in the town of Gladstone at the time of writing (GA, 2012).

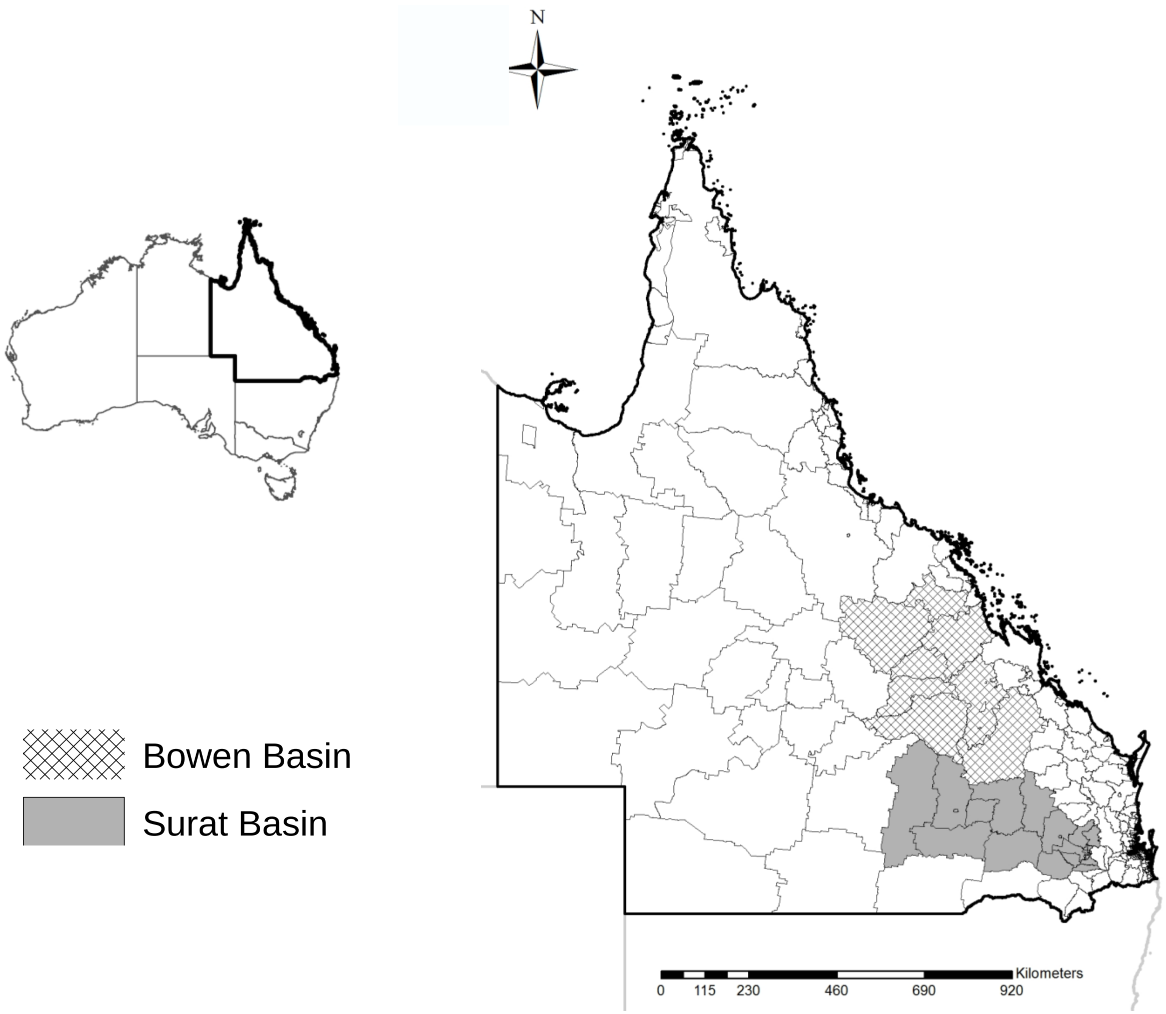

Figure 2.1 Regions with coal seam gas development in the Bowen and Surat basins, Queensland.

Unconventional gas poses different impacts on rural communities compared with other forms of resource extraction. In particular, the imprint of unconventional gas is extensive rather than intensive – an analogy in agriculture might be the way grazing or ranching differs from cropping or horticulture. Whereas the impacts of oil rigs and coal mines concentrate the process of extraction on relatively small areas, unconventional gas spreads its impact across a much wider spatial extent. Whereas intensive energy extraction requires exclusive access to relatively small sites, the extensive extraction of unconventional gas tends to be co-located with other land uses – usually agriculture (Lawrence et al., 2013). This has the effect of thrusting different and potentially competing industries together in the same parcel of land. This can generate new types of conflicts, and potential benefits, which are explored below (Kinnaman, 2011; Measham et al., 2013).

3 Impacts of unconventional gas on rural communities

The development of unconventional gas has been described as having more potential to change local economies and social relations in rural areas than any other phenomenon in recent history (Stedman et al., 2012). In attempting to understand the types of changes experienced by rural communities, several authors have turned to the energy boomtown and social disruption research of rural sociologists during an earlier energy boom in the 1970s and 1980s (England and Albrecht, 1984; Greider and Krannich, 1985). The boomtown research focused on the impacts of large oil, gas, coal and uranium mines developed in small communities. These projects were associated with overwhelming population growth causing strain on local services, and dramatic changes to social structure. Much of the focus of this research was on the sense of crisis experienced by local residents following increased crime and substance abuse and weakened social ties (Greider and Krannich, 1985). However, it is important to note that the impacts of energy booms are variable in time and space and that the negative impacts associated with boomtowns are not inevitable (Krannich and Greider, 1984).

Some authors have drawn attention to the distinct role of gender in boomtown-like effects (Carrington et al., 2010). Because the resources sector is predominantly occupied by males, the mining sector has different impacts for men and women (Tonts, 2010; Baker and Fortin, 2001; Reeson et al., 2012). Large mines and gas fields concentrate a large number of young single men with little commitment to local communities. This demographic phenomenon has been historically linked to particular types of social impacts such as alcoholism, sexually transmitted diseases and violence, with the effect of discouraging young women from staying in the affected communities and contributing to underlying rural decline (Carrington et al., 2010; Ruddell, 2011; Goldenberg et al., 2008).

While the boomtown research provides a useful starting point for considering the effects of new energy developments, unconventional gas differs in some important ways from the types of projects which were the focus of the original boomtown research (Stedman et al., 2012). First of all, unconventional gas is a more extensive form of resource development, with potentially thousands of wells across a large landscape, such that the effects of resource development are experienced over a wider area (Stedman et al., 2012). Moreover, unconventional gas tends to be located in rural areas with relatively high population density prior to resource development, so more people are likely to experience the impacts of gas development (Stedman et al., 2012, Measham et al., 2013). This means that more people are going to experience the negative sides of development, such as dust, noise and traffic, and possible health impacts (Theodori, 2009; Colborn et al., 2011). Compared to conventional energy projects, many more landholders are likely to be affected by unconventional gas as wells are superimposed over existing land uses, which also means that more people are likely to receive a direct financial benefit (Fleming and Measham, 2013; Stedman et al., 2012). These benefits may be in the form of compensation or rental income for hosting infrastructure, or through employment directly in the resource extraction process or indirectly through job spillovers (Kriesky et al., 2013; Weber, 2012). The degree to which residents receive these benefits is correlated with support for unconventional gas development (Jacquet, 2012).

Like other forms of resource development, a number of environmental concerns have been raised about unconventional gas. These include general concerns such as the threat of increased invasive pests, loss of wildlife and reduced air quality (Bergquist et al., 2007; Brasier et al., 2011). They also include specific concerns, held by farmers and environmentalists, about land subsidence and the risks of damage to aquifers by raising salts to the surface and through the use of chemical additives in gas extraction (Lawrence et al., 2013). In addition to these environmental concerns, the logistics of unconventional gas extraction pose a high risk of disruption to the practice of agriculture. In Queensland thousands of wells, connected by pipes and access roads, will reduce the area available for farming and complicate the logistics of farming in some of the most productive agricultural lands in Australia. Together these environmental and logistical challenges contribute yet another challenge to a wider set of concerns faced by Australian agriculture (Lawrence et al., 2013). An alternative perspective on this theme, noted in Marcellus Shale in the USA, was that the pool of farmers may be reduced, because some may become so wealthy from gas payments that they abandon farming altogether (Brasier et al., 2011).

4 Case study of coal seam gas in Australia

In Australia, two neighbouring locations, the Bowen basin and the Surat basin, have considerable development of unconventional gas in the form of CSG. The former is a region with an established history of resource extraction. Notably, the Bowen basin is one of Australia's largest coal-producing regions, where the development of unconventional gas represents a step further down the path of mineral and energy extraction (Morrison et al., 2012). By contrast, the Surat basin region has had very little exposure to the resources sector prior to the development of unconventional gas. The region includes some of the most productive soils in the country, and its history and identity is focused primarily around agriculture (Lawrence et al., 2013). For this reason, the development of unconventional gas is much more likely to be a challenge for rural communities in the Surat basin compared with those in the Bowen basin, who are more familiar with the resources sector (Schandl and Darbas, 2008; Fleming and Measham, 2013). The location of these basins can be seen in figure 2.1.

4.1 Methods

Based on our discussion of rural decline, in this study we are interested in tracking changes in three indicators: female/male youth population change, educational attainment and poverty reduction. Data for youth population and educational levels are directly available from population censuses. In contrast, poverty levels are not reported officially by the Australian Bureau of Statistics (ABS). In order to have a measure to analyse over time, we used the poverty line threshold, for a family of four (two adults and two children), of $538.88 per week in 2001 and of $863.68 per week in 2011. These poverty lines are calculated and provided by the Melbourne Institute of Applied Economics and Social Research (MIAESR, 2002, 2012). Considering these income lines and the census income data provided in blocks, we generated an 'extended poverty rate' variable for 2001 and 2011 considering the proportion of families of four (a couple and two children) living with less than $599 per week and $999 per week, respectively.

In order to track changes across our three indicators, we considered a regional analysis based on observations at Statistical Local Area (SLA) level. SLAs are the smallest sub-state regions for which census data is available in Australia. For this study we use SLA 2011 boundaries, for which census time series data are available for 2001, 2006 and 2011 (ABS, 2013). Queensland has 475 SLAs in total.

Thus, considering SLAs as our units of observation, we first defined the regions substantially affected by CSG development across the Surat and Bowen basins. We did this by selecting SLAs where most of the wells associated to the CSG industry between 2001 and 2011 were placed. Using geospatial data available from the Department of Natural Resources and Mines of the Queensland Government (DNRM, 2012), we defined 8 SLAs in the Surat basin and 6 SLAs in the Bowen basin, which together encompass more than 95% of all CSG related wells in Queensland, as 'CSG SLAs' (Fleming and Measham, 2013). We also included an observation in our analysis given by the SLA of Chinchilla, which is one of the eight CSG SLAs in the Surat basin. We provide data on this particular SLA to include observations from one particular and representative town in the middle of the CSG development region (Chinchilla), as well as the averages of the two basins.

Finally, in order to compare the changes of our three indicators across the CSG defined regions, we selected a control group given by Queensland SLAs with similar population density in year 2001, as described in Fleming and Measham (2013). This comparison group comprises 81 rural SLAs located across the state without (or with very low) CSG extraction during the period 2001 to 2011. Our control group, when combined with the CSG regions, contained 15 per cent of the State's total population in 2001.

4.2 Results

4.2.1 Migration effects

Levels of youth male and female population share (of total population) between 2001, 2006 and 2011 can be observed in figure 4.1. In the control SLAs (green in chart), a decline in the share of youth population can be observed in all age categories from 2001 to 2011. Looking at the CSG affected regions, for the first age group 15 to 19 year olds, there is no major evidence of CSG regions altering differently to the control group. In contrast, in subsequent age groups we do see differences across years between CSG and non-CSG regions, which vary somewhat between males and females.

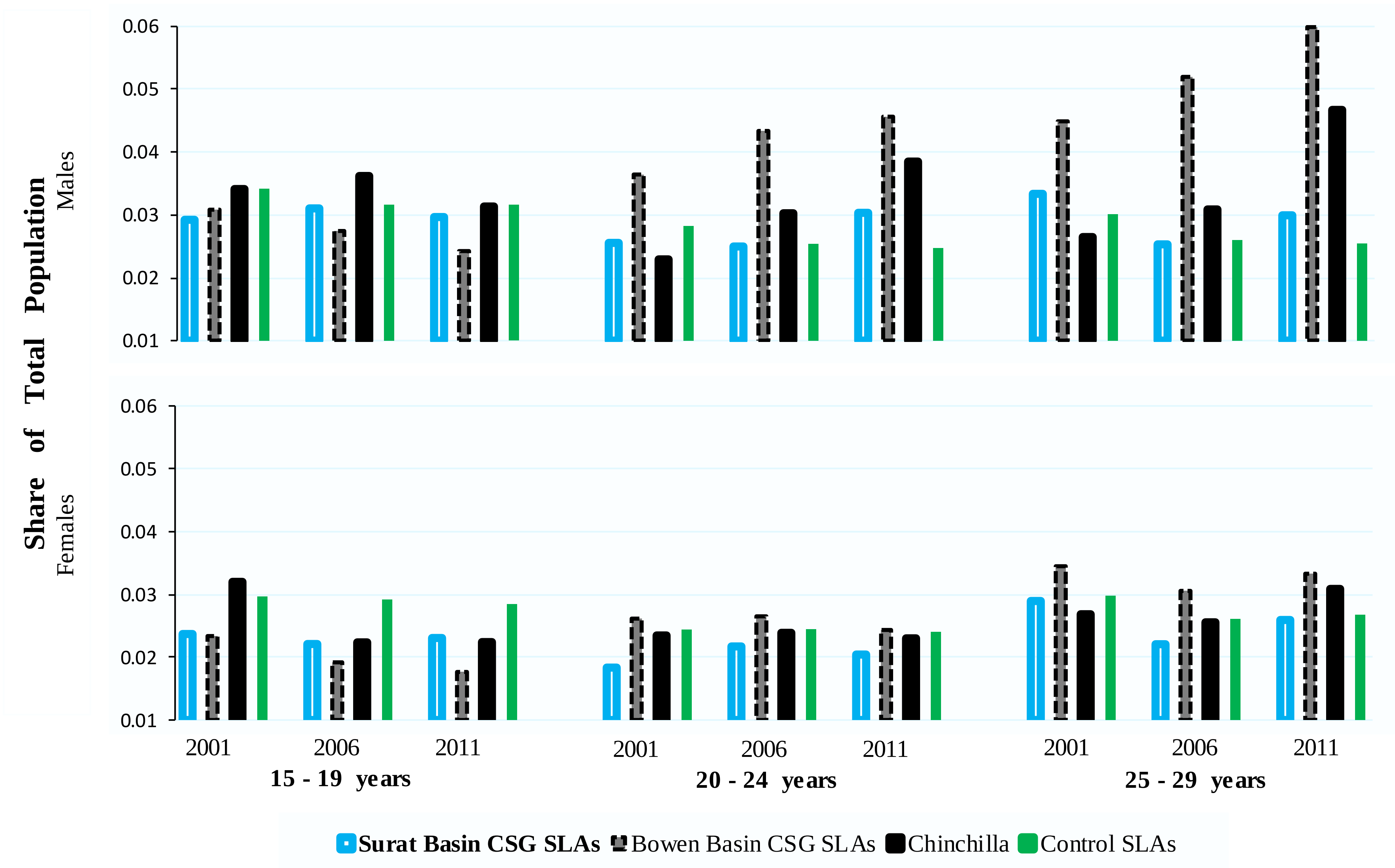

Figure 4.1 Male and female population share of total population for studied area based on Census data for 2001, 2006 and 2011 (ABS 2013)

For males, the data show increases in all CSG affected regions in the age category 20 to 24 between 2001 and 2011. The same occurs in the age group 25 to 29 for the Bowen basin CSG SLAs and Chinchilla. For the Surat (in blue) we see an initial decrease from 2001 to 2006 followed by an increase between 2006 and 2011 for the age group 25 to 29.

For females in the age group of 20 to 24 we see evidence that the share of the population increased in the Surat region between 2001 and 2011. For females in the age group 25 to 29 there was an initial drop from 2001 to 2006 and then an increase between 2006 and 2011, demonstrating a growing female population share in this age range for CSG affected SLAs in both the Surat and Bowen basins. An increase in female population share is particularly noticeable in the town of Chinchilla (in black) in 2011, which showed the opposite trend to rural out-migration in the control regions.

4.2.2 Skills and education

The skills and educational attainment for youth in the control group and CSG affected regions is presented in tables 4.1 and 4.2. The most striking result is the overall decline in university degrees across observations and the increase in certificate level (trade) qualifications over the decade from 2001 to 2011. This trend is evident for both males and females in the 20 to24 age range, and for females only in the age range 25 to 34. There is some evidence that males in CSG affected regions have had different educational impacts compared to males in non-CSG affected regions. In particular, the decline in university degrees for males in the age range of 20 to 24 is less severe than that for the control group (while maintaining similar increases in certificate qualifications). In addition, increases in the percentage of males in the 25 to 34 age range with university degrees were recorded in the Surat SLAs but not the Bowen SLAs. There is no evidence of dramatic changes in female educational attainment between the CSG regions and the control group in either age category.

Table 4.1 Education attainment across males and females in cohort 20-24 years

	2001 (%)				2011 (%)			
	Surat CSG SLAs	Bowen CSG SLAs	Chinchilla	Control SLAs	Surat CSG SLAs	Bowen CSG SLAs	Chinchilla	Control SLAs
Males, 20-24								
Bachelor Degree	13.61	22.24	24.32	19.07	10.91	16.82	16.89	9.27
Certificate level III and IV	57.96	66.82	56.76	65.22	68.07	74.43	74.32	74.46
Certificate level I and II	10.18	2.63	0.00	6.37	8.43	5.24	4.05	9.56
Females, 20-24								
Bachelor Degree	46.53	43.27	36.54	36.03	24.36	35.63	27.37	25.58
Certificate level III and IV	24.14	27.25	26.92	30.67	45.88	39.21	52.63	43.43
Certificate level I and II	16.89	15.40	13.46	12.82	12.06	11.15	8.42	14.07

Table 4.2 Education attainment across males and females in cohort 25-34 years

	2001 (%)				2011 (%)			
	Surat CSG SLAs	Bowen CSG SLAs	Chinchilla	Control SLAs	Surat CSG SLAs	Bowen CSG SLAs	Chinchilla	Control SLAs
Males, 25-34								
Bachelor Degree	14.68	17.05	17.21	16.31	18.67	16.62	21.50	14.15
Certificate level III and IV	56.26	64.25	56.56	64.54	60.92	70.25	64.25	67.87
Certificate level I and II	10.06	5.03	7.38	5.82	4.87	2.41	0.72	3.68
Females, 25-34								
Bachelor Degree	39.80	37.25	42.37	37.20	37.95	39.94	37.34	32.62
Certificate level III and IV	20.30	21.89	21.19	22.49	28.86	30.49	32.47	34.36
Certificate level I and II	9.24	10.69	8.48	11.11	6.50	5.92	5.20	8.67

4.2.3 Poverty

The results for poverty alleviation are reported in table 4.3. Using the expanded poverty line calculation described in the methods section, the proportion of families in the control group was nearly identical in 2001 and 2011. The proportion of families below the poverty line in the Surat and Bowen basins had decreased, but not by much. The most striking finding was that the proportion below the poverty line had greatly reduced in the town of Chinchilla. Whereas in 2001 Chinchilla had a higher proportion of poor (couple with two children) families compared to the control group, in 2011 it had a much lower proportion of poor families, a reduction from around 23 percent to around 8 percent.

Table 4.3 Proportion of families (couples with two children) below 'expanded poverty line' measure

	2001	2011
Surat Basin CSG SLAs (n=8)	21.81%	18.35%
Bowen Basin CSG SLAs (n=6)	7.52%	6.52%
Chinchilla (n=1)	23.40%	8.33%
Control SLAs (n=81)	21.28%	20.47%

Notes: Our 'expanded poverty line' in 2001 is $599 and in 2011 $999 (weekly), for a family of four (couples with two children). Proportions over total excluding families not reporting income in the Census.

5 Discussion

The youth outward migration described by other Australian authors is clearly visible in the control group in figure 2 (Gabriel, 2002; Argent and Walmsley, 2008). The figure shows the decline is gradual but persistent, reflecting a chronic condition occurring in each age youth age category. By contrast, in the CSG affected regions there is clear evidence the trend of net youth out-migration is reversing. This is most pronounced amongst the male population, which one would expect due to growth in a sector with male-dominated employment (Tonts, 2010; Baker and Fortin, 2001). We also note that these figures are based on place of enumeration (location on census night) so non-resident workers staying in the area would be included in this population.

However, the boom in unconventional gas presented in this case study seems to be qualitatively different from the resource 'boomtown' effects reported in previous energy and mineral developments. Rather than accelerating the departure of young women from booming regions (Carrington et al., 2010), the case study presented here demonstrates an increase in female youth alongside the increase in young men. The data for female share of population provide clear evidence of mitigating rural net-outwards migration, and show increases in some age categories. In particular there was a reversal of population decline in the age category 25 to 29 years during the period 2006 to 2011. The evidence presented in this paper does not tell us much about who the extra female youth are, recorded in the 2011 census in CSG affected regions. However, due to the male dominance of the resources sector (Carrington et al., 2010) this increase in female youth is unlikely to represent long distance commuter staff in work camps on census night. Understanding more about these additional young women would be an important topic for further research. More broadly, it is not possible to tell from the data presented in this paper what proportion of youth represent local people retained by the region, compared with those who represent in-migration, or the return of youth to their homelands following a period in the city (Stockdale, 2004).

Part of the reason we see different effects from the 'boomtown social disruption phenomenon' is precisely because the boom is superimposed over a pre-existing agricultural community, rather than a remote frontier environment, which normally rely on large groups of long distance commuters concentrated in small, under-serviced communities (Carrington et al., 2010; Cheshire, 2010). As noted in the introduction, the wider spatial footprint of unconventional gas means that impacts, both positive and negative, are spread over a wider area and are more likely to be absorbed into a larger body of people. While it is beyond the scope of this paper, it will be important to investigate how this translates into the disruption impacts reported in other resource development contexts such as traffic, crime and health impacts (Carrington et al., 2010; Ruddell, 2011; Theodori, 2009; Colborn et al., 2011).

The most striking result for education is the overall decline in university degrees and the increase in certificate level (trade) qualifications. Given that the effect is observed across all focal regions to a greater or lesser extent, it is likely to be driven by broader societal changes rather than specifically the development of unconventional gas. Considering that seeking tertiary education is one of the recognised drivers of rural youth out-migration (Woods, 2011), it would be interesting to explore how widespread the reduced demand for tertiary education is, and what its broader implications are. When we look at the differences within our data, our results show no evidence of any differences in educational attainment between young females in CSG affected locations compared to the control group. There is some evidence of improved education for young males in CSG affected regions relative to the control group. However, male education results may be influenced by non-resident workforces, including visiting engineers and other technical specialists. Therefore the evidence for an effect of CSG development on youth education is limited and not compelling. Relating these results to the literature considered in the introduction, we see no evidence of a change in the rate at which the 'best and brightest' stay or leave (Stockdale, 2004). Rather, the additional people in the CSG affected regions, from an education point of view at least, are similar to the surrounding rural population. This is consistent with the principle that a large proportion of migrants to rural towns come from other rural areas (Halseth, 1999; Argent and Walmsley, 2008).

The results show mixed effects for CSG on rural poverty. Compared to the control group, there was a small effect of poverty reduction in the Surat and Bowen basins. However the impact was not evenly spread. The town of Chinchilla was a standout, going from being a location with higher rural poverty than surrounding regions to having one of the lowest rates of rural poverty. On the surface, this appears to be good news for Chinchilla, but needs to be considered in the broader context of costs of living and quality of life in this town, which is beyond the scope of this paper. In addition, it will be important to understand how much this result represents improved incomes for existing residents, and to what extent it is explained by turnover in the population of the town. If increased costs for housing and services have pushed out people on lower incomes from the town of Chinchilla, then it will be important to understand where these people have gone and how they have been affected by CSG development in general. Other studies have also shown mild income benefits associated with CSG development (Fleming and Measham, 2013)

The focus of this paper has been on the substantive elements of rural decline, namely youth out-migration, skills retention and poverty alleviation during the first decade of CSG development in Queensland. However, it will be important to see how these issues change into the future. Furthermore, it is important to acknowledge that rural decline is also an issue of identity. One of the challenges with resource development more broadly has been about displacing agriculture and rural communities. We see this for example in the Hunter Valley of Australia, where the continued expansion of the coal mining sector has substantially encroached on other land uses to the point of overwhelming other sectors (McManus and Connor, 2013). The extent to which unconventional gas has similar effects remains unresolved at the time of writing. Research from the Marcellus Shale indicates that some residents felt that the additional income stream to farmers and existing residents allowed them to maintain their way of life. Others were concerned about the different types of people moving into their area who might not value their way of life (Brasier et al., 2011). This raises important questions for further research on sense of place and sense of community associated with the development of unconventional gas. Is the cost of reversing rural decline the erosion of regional identity? Or can unconventional gas be developed in a way that is consistent with regional identity?

An important question for further consideration is to what extent the development of unconventional gas pushes existing rural regions towards being simply a 'resource bank' to support economic development beyond the region. This issue is not so much a question of whether the region contributes to the broader economy, so much as the terms under which it does so. The difference lies in the types of services, housing and infrastructure which are developed in the region, with a view towards supporting a wider regional economy rather than expediting the flow of capital out of the region (Markey et al., 2008). In practical terms, the 'resource bank' model is more likely to be dominated by non-resident workforces, infrastructure which is designed to accelerate the removal of resources, and non-local supply chains (Tonts et al., 2013). In contrast, a more place-sensitive model is more likely to involve development of permanent housing, employment of local residents and locally sourced supply chains. The difference will be the outcome of a myriad of decisions, including operational decisions and choices about how the benefits of resource extraction are shared. These will determine the level of support for a diversified economy that remains prosperous beyond the lifetime of gas extraction (Markey et al., 2008). Where the coal seam gas industry sits on this spectrum is a crucial topic for further research.

6 Conclusion

This paper has focused on the substantive components of rural decline: rural out-migration, educational attainment, and poverty reduction; and how these are influenced by the development of unconventional gas. Taken together, the results show signs of mitigating (and in some cases reversing) rural decline during the period 2001-2011. Locations with unconventional gas development have larger, younger populations, with some income benefits, and slightly raised levels of education for men, and similar levels of education for women, compared to other rural locations. Some of the changes we see may be explained by non-resident workforces – notably the increase in young male university level education. However the results show other changes that are unlikely to be explained by non-resident workers in work camps. In particular, the increase in female youth, with similar levels of education to the surrounding non-CSG rural regions, indicates a more reliable sign of retaining or attracting more rural women who do not work directly in the resources sector. A task for further research is to explore how these substantive changes play out in terms of broader aspects of rural decline such as impacts on quality of life and rural identity.

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