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Understanding the resource curse (or blessing) across national and regional scales: Theory, empirical challenges and an application*

David A. Fleming, Thomas G. Measham and
Dusan Paredes[†]

The relationship between resource extraction activity and economic growth has been widely studied in the literature, and the resource curse hypotheses emerged as a theory to explain the effects of resource windfalls on national economies. However, within countries, resource booms and busts can have distinctive effects across local economies, as extractive regions face particular economic consequences unlikely to be observed in nonresource regions. Empirically, most studies analysing the resource curse have relied on cross-country models to estimate effects and inform policy; however, the use of regional – within-country – analysis has gained attention from scholars lately, promoted by two advantages: it avoids unobserved country heterogeneities confounding economic outcomes caused by resources and exploits the subnational quasi-natural experimental conditions generated by endowments. This paper contributes to the resource curse literature by discussing its theoretical causes across scale (regional vs. national effects) and highlighting the empirical challenges involved in the analysis of mining economic impacts across regions. We complement the discussions by econometrically modelling economic growth across nonmetropolitan substate regions of Australia during a period of resource windfalls, finding that in most cases, resources have been a blessing for local economies, although negative effects have also been experienced in parts of the country.

Key words: Australia, economic growth, mining boom, natural resource curse, nonrenewable resources, regional development.

1. Introduction

Like most primary sectors, the mineral and fossil fuel extractive industries (referred to as mining, henceforth) have historically been linked to several positive and negative environmental and economic externalities. Focusing on the economic impacts of resource extraction, a large and growing body of literature has analysed the so-called natural resource curse, which relates to the inability of resource-rich countries (or regions) to economically grow as fast as nonresources economies (Mikesell 1997; Anderson 1998; Sachs and Warner

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[†] David A. Fleming (email: david.fleming@csiro.au) and Thomas G. Measham are with CSIRO, Canberra, Australian Capital Territory, Australia. Dusan Paredes is at Department of Economics, Universidad Católica del Norte, Antofagasta, Chile.

2001; Cai and Newth 2013). Among this literature, many scholars have found evidence that natural resource windfalls worsen economic development (Sala-i-Martin and Subramanian 2003; Carmignani 2013), although discrepancies exist in terms of the real causes of these negative effects, with some authors considering that resources are more a blessing – they produce positive economic outcomes – than a curse (Aragon and Rud 2013; Allcott and Keniston 2014). One common theme in the resource curse literature is that the vast majority of empirical analyses rely on cross-country models to provide insights into the relationship between resources and economic development. Evidence of the local economic impacts of resources extraction across regions of a country is much scarcer in the economics literature. This imbalance in the literature is somewhat surprising, given that it has been recognised that within-country models are empirically more robust than cross-country analysis as the former allow researchers to ‘...exploit variation within a country where variables that might confound the relationship between resources and macroeconomic outcomes do not vary and the danger of spurious correlation is minimized’ (van der Ploeg 2011, p. 381).

In this paper, we contribute to the resource curse literature by discussing theoretical and empirical implications when analysing ‘within-country’ contexts, which we do in three main sections. First, we scrutinise the most popular theoretical hypotheses of the resource curse studied in the literature by categorising their respective scale of effects: national vs. regional effects. In other words, we emphasise whether we should consider the causes of the resource curse (or blessing) as operating across the whole national economy of a country or only in regions surrounding mining operations. Second, we provide some insights about the main empirical issues that scholars and planners might face when evaluating regional economic impacts of mining within countries. We do this based on the growing body of literature focusing on ex-post cross-regional analyses. And third, we complement the theoretical and empirical discussions by using the context of the recent Australian mining boom decade to empirically assess whether resources have been a curse or a blessing for Australian regional economies in terms of nonmining employment and income growth. In particular, we consider 449 nonmetropolitan ‘local government areas’ (substate regions of Australia), 2001 and 2011 Census data and different econometric models to evaluate the mining boom’s impact on economic growth. We conclude by providing policy implications and challenges for future research.

2. The scale of effects from the resource curse causes

The resource curse theory has been widely researched and empirically analysed in recent decades, and evidence of its effects has been studied in both developing (Sala-i-Martin and Subramanian 2003; Aragon and Rud 2013; Zuo and Schieffer 2014) and developed countries (Goodman and Worth 2008; Hajkowicz *et al.* 2011; James and Aadland 2011; Weber 2014).

Although in some cases researchers have found that resources provide a blessing for certain economies (e.g. Aragon and Rud 2013), tracking and addressing the potential causes of the curse are important tasks for national and regional planners in order to obtain positive dividends from resource exploitation (Collier *et al.* 2010). In an extensive review of the empirical and theoretical literature, van der Ploeg (2011) analyses and provides evidence of popular hypotheses explaining the channels through which resources can negatively affect the economic performance of nations or regions. These include (1) appreciation of exchange rates, (2) temporary loss of learning by doing, (3) poor institutions, (4) authoritative political systems, (5) corruption, (6) anticipation of better times and negative genuine savings, (7) volatility of international commodity prices, (8) rent-seeking behaviour and (9) unsustainable policies. Thus, if to some extent a country can avoid or control these channels, resources windfalls can be transformed into blessings for nations. However, even in cases when countries obtain national gains from resources, subnational negative economic growth effects – a regional resource curse – can emerge in regions surrounding extractive industries (Ivanova 2014; Fleming and Measham 2015a), which can originate from some of the listed hypotheses operating regionally as well as from the labour demand shock that mining expansion produces in resource-rich regions and its neighbours. This ‘labour demand shock’ initiated by mining activity can also be considered as a resource curse channel (hypothesis 10), as we discuss below.

Although van der Ploeg (2011) in his survey does not differentiate between the macro- vs. microscale effects of the nine resource curse hypotheses listed, it is important to consider that while they operate through macroeconomic changes, others can have distinctive regional consequences beyond their national effects. The first two hypotheses are interconnected and can be categorised as macroeconomic consequences. The appreciation of exchange rates as the product of exports from a resources bonanza (aka Dutch disease) produces a negative impact on the competitiveness of other exportable goods sectors, which produces deindustrialisation and consequently a loss of the ‘learning by doing’ type of economic growth that is generally associated with the know-how and skills linked to manufacturing (Corden and Neary 1982). However, different from Dutch disease, a ‘loss of learning by doing’ can also emerge in regions not only as a consequence of currency appreciation, but also as the result of the crowding-out that other tradable sectors can face as consequence of mining labour demand.¹ We expand more on this below.

Hypotheses (3) to (6) also relate to macroeconomic effects, as the rule of law and national government agencies (generally) have homogeneous characteristics within countries. However, in developing country contexts

¹ This effect relates to our resource curse hypothesis (10). On the other hand, Dutch disease will be in any case a localised (regional) effect as it will affect the competitiveness of regions where nonmining exportable sectors are located. However, this localised consequence is a product of the macroeconomic change given by the appreciation of the exchange rate, happening in all the country, and not by local effects of mining operations.

with weak institutions or when local governments and authorities have the capacity to outlaw national ordinances, resource curse effects can emerge from these channels in mining regions, independently from what occurs in a nation as a whole (Hodler 2006; Libman 2013; Alexeev and Chernyavskiy 2014).

Unlike other resource curse hypotheses, the volatility of commodity prices, rent-seeking and unsustainable policy effects are likely to have a differentiated effect in resource-rich regions compared to their consequent macroeconomic effects. In the first case, even though the price volatility of a commodity can affect a nation's economy as a whole (as a product of variable trade gains, unstable exchange rates, etc.), in mining regions, it will directly affect employment generated by the resources industry. Highly volatile mineral commodities can translate into the opening, closing and reopening of mine sites across space in the short to medium terms, affecting labour markets' equilibrium among regions. In addition, the higher the volatility of prices, the higher the uncertainty of long-term benefits, which will affect local investments in long-term assets (such as housing and infrastructure) and generate employment instability and stagnation in other areas of the economy (Ivanova 2014). Rent-seeking behaviour is also a phenomenon that affects economic performance at a regional scale (especially in developing context with poor property rights), as local governments or privates may set aside alternative productive activity in pursuit of short-term profitable resource extraction activities. This could have flow on effects, for instance in agricultural productivity, as land in agricultural areas may be devoted to the exploration and exploitation of resources (for instance a coal mine), potentially affecting agricultural jobs and long-term growth in the region.² Unsustainable policies may have national effects, but also distinctively affect local economies through poor planning and strategic thinking when regions can appropriate and use some of the revenues generated by mining.

Finally, the labour demand shock generated by mining should be considered a resource curse channel operating exclusively at regional scale. The direct labour demand generated from mining activity does not have important effects on national economic growth as mineral and fossil fuel extractions are capital intensive industries rather than labour intensive ones – in Australia, for instance, <3 per cent of total national employment is in mining (Moffat *et al.* 2014). However, at regional scale, labour demand shocks related to mining will have important economic consequences as, generally, regions surrounding extraction sites have smaller and less diversified economies than urban areas. Thus, in regional economies, the employment demand changes exogenously generated by a mining boom (or

² The potential environmental negative externalities generated by mining in such cases can even increment rent-seeking behaviour in the region as agriculture might lose competitiveness and, therefore, profitability (van der Ploeg 2011).

bust) will alter local economic growth even if the other resource curse causes are avoided nationally and regionally.

Whether an increase in mining employment across space produces a resource curse or blessing (i.e. whether it has negative or positive effects for economic growth) is an intrinsic empirical question because it will depend on which industries are mainly affected by labour crowding-out and/or job spillovers, and the overall income/revenue effects generated. In terms of effects on employment growth in nonmining sectors, a labour demand increase coming from mining will alter employment in other areas and economic sectors as people move across regions and industries to work in the resources industry (Aroca and Atienza 2011). The former movement can produce agglomeration effects and consequently generate job spillovers into nontradable sectors, while the latter movement can generate labour crowding-out in the tradable sector (Allcott and Keniston 2014; Fleming and Measham 2014). Thus, if job spillovers override crowding-out effects, medium-term employment growth can be favourable in resource regions, but the final long-term outcome will depend on how well regions can sustain human capital formation (and retention), manufacturing and similar industries generating learning by doing (Kilkenny and Partridge 2009; Glaeser *et al.* 2015).³ On the other hand, if job spillovers from mining are negligible, local economies are likely to see nonmining sectors negatively affected, reducing employment growth in the medium term.

The direct labour generated by mining also has a regional effect on income generation as salary and wages should increase given the increase in labour demand, so economic growth can also be expected as higher disposable income in regions where miners reside and/or work will increase local investments and the demand for services, generating job spillovers and further growth.⁴ This income effect of mining is also likely to change the distributional pattern of income in local areas, therefore affecting income inequality across space, which can subsequently also affect economic development (Reeson *et al.* 2012; Carmignani 2013). Local government revenues should also increase, but collection and management will depend on local authorities' autonomy from centralised government, and the final impact on local economic growth will be dependent on influences of the previously listed resource curse causes operating regionally.

In summary, if a country avoids the causes of the resource curse at the national level, the economic performance of resource-endowed regions may still be affected by resource curse channels operating at regional scale such as local corruption or unsustainable local investments. However, even where

³ As previously mentioned, this potential loss of 'learning by doing' is a similar effect to the resource curse hypothesis (2), but in this case, it is not the product of Dutch disease, but a consequence of the crowding-out of the tradable sector as a product of labour demand and the relatively higher wages paid by the mining industry.

⁴ Although not the common case, income can also increase in the region as product of compensations or royalties paid by mining companies to landowners.

regions can fully avoid regional scale resource curse causes, the labour demand shocks that resource windfalls exogenously generate in local economies will produce unavoidable consequences in the equilibrium of employment markets and income, changing their growth pattern. Whether growth is affected positively or negatively in resource-rich regions (or where miners permanently reside), compared to the other regions of a country, remains an empirical question. It will depend on final agglomeration, crowding-out, job spillovers and income effects. In this paper, we empirically evaluate precisely this, the influence of mining labour change to local economic growth.

3. Some empirical challenges when assessing local economic impacts of mining

As previously mentioned, within-country analyses of the resource curse provide more robust evidence than cross-country models as they reduce the unobserved heterogeneity generally given by institutional, cultural and historical background across countries. In addition, the consideration of within-country analysis allows resource regions to be considered as treatment groups, while regions without resource endowments can be considered as controls, providing a natural experimental scenario for impact evaluation (Marchand 2012; Fleming and Measham 2015a; Paredes *et al.* 2015).

To assess the economic impacts of resource industries, local planners and industry often use input–output (I-O) models to estimate benefits to different sectors. However, these models generally miss the intertemporal and cross-regional effects of mining, among other issues (Kilkenny and Partridge 2009; Fleming and Measham 2014). Differently from static I-O models, the use of ex-post econometric models provides the advantage of controlling for time–space considerations. Although studies econometrically evaluating the impacts of mining on regional economic development are still not abundant, some researchers have provided important insights on this matter (e.g. Black *et al.* 2005; Marchand 2012; Partridge *et al.* 2012; Reeson *et al.* 2012; Caselli and Michaels 2013; Cavalcanti *et al.* 2014; Weber 2014; Fleming and Measham 2015a; Paredes *et al.* 2015).

The (quasi) natural experimental conditions of mining and the use of econometric modelling are supported by the exogeneity of the labour demand shock produced by mining booms and busts. Theoretically, the nonendogeneity of mining in a region is reinforced by three important factors: (i) mining is given by the extraction of subsoil resources provided by nature, (ii) the industry operates driven by profits derived from international markets, and (iii) mining investments are made by nonlocal, generally multinational, companies. Regardless of these factors, endogeneity in econometric specifications may still arise from two sources: (a) local governments may be more or less inclined to have mining development on their land, which could affect economic performance, and (b) mining activity could be covered by employment from nonmining regions through

long-distance commuting workforces (Jamett and Paredes 2013; Rolfe 2013). Source (a) is not particularly relevant within countries or large provinces (federal states), where generally local/regional governments do not have the decision-making power to provide (or reject) mining permits over centralised national (or provincial/state) governments. However, when regions can affect mining activity decisions, endogeneity can be addressed by the use of instrumental variables such as resource reservoirs, which are correlated with the explanatory variable (mining activity), but not the dependent variable (the impacts from mining being measured) (Partridge *et al.* 2012). On the other hand, source (b) can also raise some issues for economic evaluations, considering that modern mining booms are commonly linked to long-distance commuting workers not permanently residing in extractive regions. For this reason, when evaluating the impacts of mining across regions of a country, it is important to look at increases in mining employment not just where mines are located, but also where miners reside. In this paper, we empirically evaluate this by analysing different growth effects of mining labour changes across regions.

Another empirical challenge for regional resource curse research is data availability at subnational level. While in general it is impracticable to obtain reliable and comparable salary/wages, revenue and output data from mining companies – across space and time – for research purposes (i.e. they are not easily available for replication of estimates), mining employment is observable and therefore an important and reliable variable reflecting mining dependence on local economies. From changes in this variable across regions, the local economic growth dynamics associated with mining can be modelled. In specific, nonmining employment growth can be evaluated using a ‘local multipliers’ type of model, where mining labour demand enters as independent variable in the equation (Moretti 2010; Fleming and Measham 2014), while local income growth can also be modelled as this will be correlated with mining employment changes, and causality can be assumed as mining employment is not determined by salaries of rural regions, but by resource endowments and commodity prices.

When modelling regional economic growth, it is also important to consider the spatial dimensions of mining activity. The long-distance commuting work force of modern mining is only one influence from surrounding regions into the economic performance of mining regions. Levels of unemployment, population density and human capital in surrounding regions are other key elements to consider when evaluating mining effects on regional growth. This fact implies the potential existence of spatial autocorrelation of residuals terms, as well as potential spatial heterogeneity of any econometric specification. Both problems have been widely discussed in the spatial econometrics literature and different methods exist to control them (Anselin 1988; Neelawala *et al.* 2013). On the other hand, it is also important to consider the heterogeneity of effects across regions as averaging results of effects across regions can produce misinterpretations of mining impacts. The

use of geographically weighted regressions (GWR), in this sense, can contribute to the spatial analysis of mining impacts over a certain period of time, within a country, as it can provide information on regions that are facing particular effects from mining, compared to others.

4. An empirical application using the Australian mining boom case study

Australia is among the countries that have historically had positive economic performance linked to natural resources extraction industries (a resource blessing) (van der Ploeg 2011). During the first decade of the twenty-first century, the country experienced a considerable mining boom, where the value of its mining exports and employment more than tripled and doubled, respectively (Reeson *et al.* 2012). At the same time, GDP grew substantially more than the rest of the world in the wake of the global financial crisis. Given these points and the availability of regional data, Australia provides a good case study to analyse whether or not mining differentially affects the economic performance of local areas, even when macroeconomic indicators are behaving positively.

The Australian mining boom was supplied by hundreds of mines located across different regions of the country and between 2000 and 2010 more than 120 mines started operations (or were reopened) in all states and the Northern Territory (Fleming and Measham 2014). Consequently, mining employment increased across most local government areas (LGAs) of the country (Figure 1). In this way, mining activity across regions of Australia appears as a natural experiment derived from resource endowments and exogenous commodity price shocks; the variable given by mining employment change is a useful tool to assess whether the resource curse affects local economic growth across regions.

We employ econometric models using 2001–2011 census time-series data aggregated to LGAs and available from the Australian Bureau of Statistics (ABS 2014). Our data consist of 449 nonmetropolitan LGAs of the country to which we apply a reduced-form growth model given by the following:

$$\ln(y_{2011,i}) - \ln(y_{2001,i}) = \alpha + \beta \text{MinEmp}_{01-11,i} + \theta' \text{Emp}_{2001,i} + \delta' \text{IPUE}_{2001,i} + \varphi' W(\text{IPU})_{2001,i} + e_i. \quad (1)$$

In this model, *MinEmp* is the (log) change in mining employment in region *i* (an LGA) between 2001 and 2011, which is used to assess the effect of mining on the growth outcome of *y*. In our case, we use two models based on the variable used in *y*: a ‘local multipliers’ model, where nonmining employment growth is predicted (Moretti 2010), and a income growth model, where median family income is used as dependent variable. As the both models consider changes in logs for both *MinEmp*₀₁₋₁₁ and the dependent variable, the β s to be obtained can be directly interpreted as elasticities.

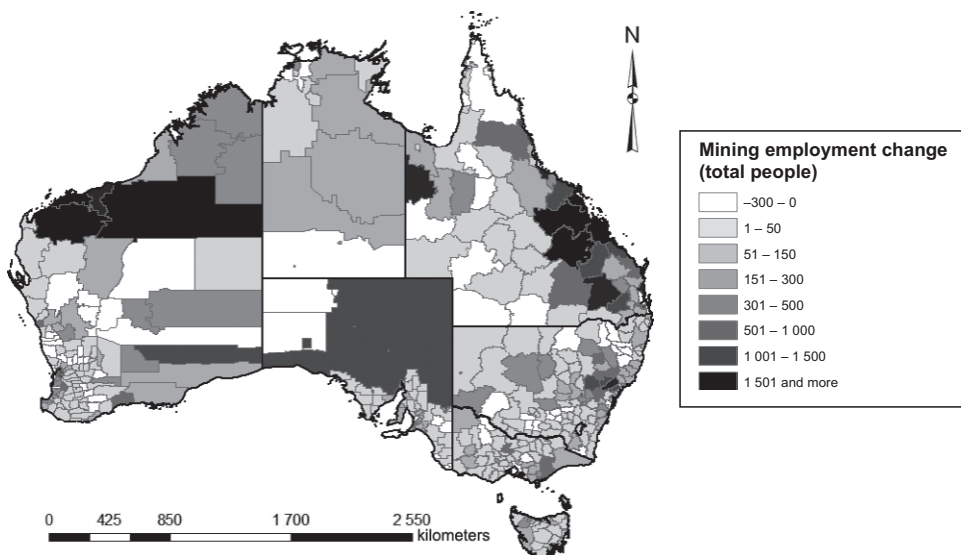


Figure 1 Mining employment change across Australian LGAs, 2001–2011. Source: Author's elaboration with ABS (2014) data.

In equation (1), we also include additional covariates that could affect income and nonmining employment growth across regions and that have previously been tested in the empirical literature (e.g. Partridge *et al.* 2008). The vector *Emp* controls for the initial economic conditions of the respective region in terms of the employment share of tradable industries (manufacturing, agriculture and mining). *IPUE* is a vector controlling for 2001 levels of income, population, unemployment and education. In particular, we use population density to control for agglomeration effects, median family income and unemployment rate to control for economic strength and labour demand, and the share of adult population with university degrees to control for human capital effects. To account for geographic economic spillovers, the vector *IPU* includes similar income and unemployment variables, and total population (instead of density), but considering the weighted average (*W*) of all adjacent LGAs. The Appendix provides complete definitions, descriptive statistics and measures of the variables.

Our main interest rests on the parameters associated with mining employment, but as previously discussed, we understand that any misspecification of spatial autocorrelation will have direct consequences on bias and efficiency of our estimators. Given this, we also consider spatial econometric models given by the spatial autoregressive with spatial autoregressive disturbances (SARAR) models (Kelejian and Prucha 1998; for an application see Fleming *et al.* 2010) and GWR models (Fotheringham *et al.* 2002; for an application see Partridge *et al.* 2008). These models are used to check for spatial issues and robustness of results by considering spatial autocorrelation and the spatial heterogeneity of relationships, respectively. In particular,

GWR allow us to estimate an elasticity (β) for each LGA, which is done by estimating separate regressions for each sample observation including the region of interest (i) and its spatially weighted neighbouring regions in each sample, up to a certain distance (bandwidth). Thus, when regression points and observation points are the same, one regression is estimated for each observation, allowing elasticities to vary across LGAs (Partridge *et al.* 2008), although between neighbours they will not vary much as GWR assumes that more proximate locations are more alike, with weights decaying with distance. In other words, the GWR estimation criteria smooth the spatial distribution of estimated coefficients, so high elasticities will be surrounded by other high-elasticity areas and a similar pattern will apply for low elasticity. In our case, the GWR characteristic should be considered for the correct interpretation of results because even when some LGAs can have low mining influence, its elasticity can be pushed by neighbours with more mining influence.

One advantage of our data is that all information is based on the place of enumeration at census night. Thus, observations will provide a high concentration of miners in the actual areas where mines are located (or nearby LGAs) and spread values across other regions where counted miners were sleeping during off-shift days, where they and their families permanently reside.

4.1. Results from models and considerations

Table 1 reports OLS results for both nonmining employment and family income growth models. Estimations included binary variables for states/territories and for five different remoteness category regions defined by the ABS (2014), though their coefficients are not reported here. We follow this last strategy to control for any unobserved idiosyncratic effects given by regions' accessibility (remoteness category) and administrative state, which could not be captured by our other covariates. We also estimated SARAR models using a nonstandardised queen adjacency matrix, which provided very similar results – not reported here but available along with codes to replicate all estimates in the online supporting materials.

Elasticities for $MinEmp_{01-11}$ in Table 1 are positive and statistically significant. Results suggest that, for the period 2001–2011 and holding other factors constant, a 100 per cent increase in mining employment (i.e. a doubling in the number of miners) was associated with a 4 per cent increase in nonmining employment in the average LGA. For family income growth, the effect was associated with a 2 per cent increase.

Looking at other statistically significant covariates, initial income is positively linked to further nonmining employment growth, signalling the importance of initial economic conditions for the growth of other nonmining industries. Counterintuitively, unemployment rates are also positively linked to employment growth, but this is a common finding in the literature as it just

Table 1 OLS results ($n = 449$)

	Nonmining employment Δ	Family income Δ
Mining employment change ($MinEmp_{01-11}$)	0.038*** (0.012)	0.021** (0.009)
Share of agricultural employment	-0.037 (0.112)	-0.037 (0.058)
Share of mining employment	0.391* (0.231)	0.139 (0.207)
Share of manufacturing employment	0.374 (0.297)	-0.089 (0.153)
Family median income	0.041*** (0.011)	0.002 (0.009)
Population density	-0.591 (0.464)	-0.544*** (0.204)
Unemployment rate	0.019*** (0.006)	0.007** (0.004)
Share of adult population with university degree	-0.335 (0.711)	0.830 (0.539)
Unemployment rate in adjacent LGAs (W)	0.010** (0.005)	0.008* (0.004)
Family median income in adjacent LGAs (W)	0.002 (0.009)	0.014* (0.008)
Population in adjacent LGAs (W)	0.027** (0.013)	0.008 (0.009)
Constant	-0.644*** (0.121)	0.074 (0.085)
Adjusted R-squared	0.41	0.23

Notes: Robust standard errors in parenthesis. Except for $MinEmp_{01-11}$, all covariates are measured at year 2001. W = weighted average. * $P < 0.1$; ** $P < 0.05$; *** $P < 0.01$.

shows stagnant regions catching up to more vibrant ones in terms of jobs and income (Partridge *et al.* 2008; Goetz *et al.* 2012).

Although SARAR models control for spatial autocorrelation, they do not control for potential spatial heterogeneity of the estimated coefficients. Hence, we expand the estimation of model (1) by using GWR to analyse the spatial variation of elasticity between mining employment and the dependent variables across the different LGAs. Figure 2 maps $MinEmp_{01-11}$ coefficients (elasticities) from the GWR models.⁵ Although elasticities vary across regions in both models, GWR belongs to the family of nonparametric estimators and additional efforts are required to derive the confidence intervals of the estimated coefficients. According to Monte Carlo tests (with 100 replications), as proposed by Fotheringham *et al.* (2002), family income effects (right-hand-side map) do not present significant spatial variation at the 10 per cent level; therefore, major claims about the variability of these results cannot be made. However, variation in the elasticities of nonmining employment growth is

⁵ Models' convergence bandwidth was 11.4 and 14.7 degrees (both significant at 5 per cent level), respectively.

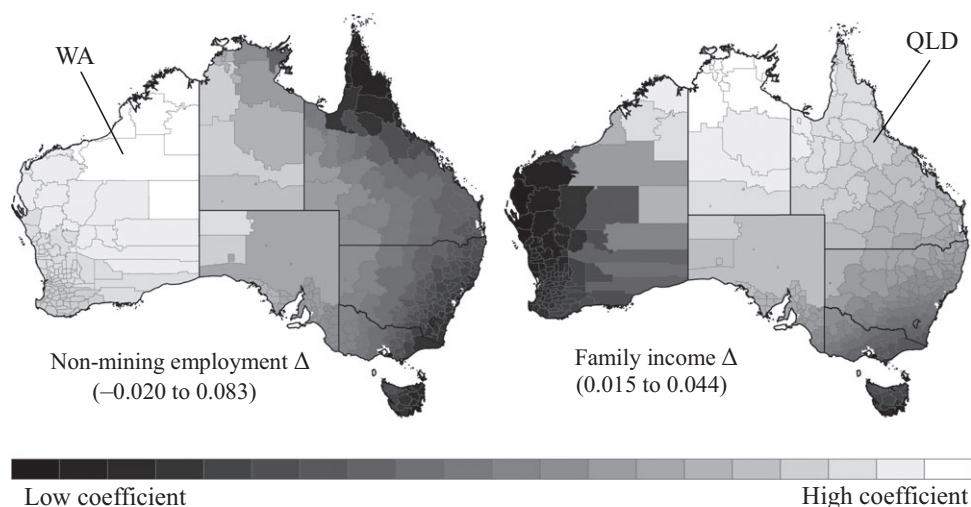


Figure 2 Geographically weighted regression (GWR) coefficients of mining employment change in the nonmining employment and family income growth models. Note: Parentheses show ranges of coefficients.

significant at the 10 per cent level. Thus, the values shown on the left-hand-side map imply that the relationship between mining and nonmining employment change varies widely across the country, ranging from negative 2 per cent to an increase of 8 per cent in the rate of nonmining employment creation when the number of miners doubles – holding other things equal in the LGA.

Explanation of this particular consequence could be due to labour crowding-out from other sectors to meet the demands of the mining industry and a lack of job spillovers generation in eastern regional areas of the country. However, the interpretation of this coefficient must be also weighted by the growth rule that indicates that poorer and lagged regions grow faster than richer regions, which also explains the lower growth rates found in south-east Australia. Finally, it is also important to note that, although not identified in our econometric specification, some previously discussed regional resource curse causes may also be operating, such as poor strategic planning, in these regions.

5. Conclusions

Many of the popular resource curse hypotheses that have been widely studied in the literature, and comprehensively surveyed by van der Ploeg (2011), can have distinctive regional scale effects, that is even though they operate at national scale and therefore can be addressed using macroeconomic policy, some may also operate at regional scale and negatively affect the growth of local economies. In particular, we argue in this paper that, theoretically, the

resource curse hypotheses given by ‘volatility of commodity prices’, ‘rent-seeking behaviour’, ‘unsustainable policies’ and ‘a mining labour demand shock’ can affect regional economic dynamics even if policy is correctly implemented to control the resource curse at national scale – that is, macroeconomic policy will not necessarily control the occurrence of these four resource curse channels in regions. From these hypotheses, the ‘labour demand shock’ is even more distinctive than the rest as national effects are negligible in comparison with what happens in regional economies. While nationally mining employment rate is generally low, locally it can encompass a considerable part of the workforce. Thus, mining labour changes observed regionally will affect the equilibrium and dynamic of local economies, being in this way a potential source of resource curse (or blessing).

Focusing on this last regional effect, this paper contributes to the growing body of literature on spatial resource curse effects by discussing both theory and empirical evidence related to the economic growth effects generated by mining employment demand shocks. Based on these discussions, we apply different econometric specifications to test the effect of mining employment changes on local nonmining employment and family income growth using as context the recent Australian mining boom. Analysing nonmetropolitan substate regions of the country, the results show that when mining labour doubles, increases of 2 and 4 per cent in family income and nonmining employment growth, respectively, are found in the average LGA. Understanding that the ‘labour demand shock’ can have different effects across space (depending on the agglomeration, spillovers, crowding-out and income effects taking place), we employ geographically weighted regression (GWR) estimations to analyse how the boom affected local economies across space, where in particular effects on nonmining employment generation presented statistically significant variation across the country. As shown in the left-hand-side map of Figure 2, while most regions experienced a ‘resource blessing’ during the recent Australian mining boom decade, there is evidence that some regions experienced a ‘resource curse’ effect on nonmining employment growth. More specifically, mining expansions have been associated with lower economic growth in terms of nonmining employment generation for some eastern regions of Australia.

The discussion and empirical exercise presented here are relevant for policymakers, given that mining investments generally receive political support for the potential positive benefits that this industry can bring to local and national economies. However, our theoretical discussion and empirical evidence shown here implies that regional planners should be cautious of taking employment effects for granted. In addition, the employment and income growth outcomes are relevant for regional planning because beyond economic growth and prosperity, they are the source of several indirect local socio-economic consequences attached to mining booms/busts, as shown in the Australian case, such as migration and long-distance commuting (Measham *et al.* 2013), housing issues (Haslam McKen-

zie and Rowley 2013; Neelawala *et al.* 2013), income inequality changes (Kotey and Rolfe 2014; Fleming and Measham 2015b), crime, alcohol abuse and other related boomtown effects (Lawrie *et al.* 2011).

In conclusion, this paper expands understanding of the scale of effects (national vs. regional) of different resource curse hypotheses and provides econometrically based evidence that, in Australia, resource windfalls are more often (but not always) a blessing than a curse for regions facing mining employment growth. We encourage further research to keep exploring this topic and better understand how resources can affect economies across space, as well as to evaluate whether the Australian context findings replicate what happens in other contexts such as countries that have not seen much of a blessing from resources at national scale.

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Appendix

Table A1 Descriptive statistics ($n = 449$).

	Mean	S. D.
Mining Employment change (absolute) (/100)	1.472	4.424
Share of agricultural employment	0.210	0.175
Share of mining employment	0.035	0.091
Share of manufacturing employment	0.077	0.054
Family median income (/100)	7.911	2.029
Population density (10,000 adult population per square km)	0.004	0.002
Unemployment rate (%)	6.716	3.133
Share of adult population (over 15 years) with university degree	0.060	0.026
Unemployment rate in adjacent LGA (W)	7.096	2.307
Family median income in adjacent LGA (W) (/100)	8.261	1.560
Population in adjacent LGA (W) (/1000)	0.308	0.542
Nonmining employment change (absolute) (/1000)	1.545	4.109
Family income change (absolute) (/100)	4.494	2.331

Source: Author's elaboration with ABS (2014) data.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1. Data and code.