Received Date : 03-May-2016

Accepted Date : 05-May-2016

Article type : Special Issue

Antipodean agricultural and resource economics at 60: Booming sector economics*

John Freebairn^

Contributions of Australian economists to understand the effects of a boom export industry are reviewed. Effects are considered on: the real exchange rate; output, prices and factor incomes of the boom industry, other trade exposed industries and non-traded industries; and national income and its distribution. Theoretical models and empirical models are reviewed. Different effects are considered for supply-side versus demand-side driven booms, and then for the price increase, investment increase and production increase phases of the boom. Evaluations of industry and macroeconomic policy options are canvassed.

Key words: mining boom, boom sector, exchange rate, inter-sector competition

1. Introduction

Booming sector economics assesses the effects of an exogenous stimulus to expand one sector of the economy on the outputs of other sectors of the economy, relative prices including the real exchange rate, and national income and its distribution. Also assessed are the implications of a booming sector for government macroeconomic and industry policies.

An important impetus for the Australian literature was the mining boom of the late 1960s and early 1970s.[1] The mining boom from 2003 to the present[2] ignited a second round of papers.

---

*With the usual caveats I thank Robert Dixon, Ross Garnaut and Andy Stoeckel, and the guest editors Julian Alston, Kym Anderson and Phil Pardey for comments on an earlier version.

Analyses of Australian mining booms is a subset of a broader set of studies beyond Australia, including assessments of the energy boom experiences in Great Britain, Norway and other oil exporting countries of the 1970s, and the current US oil and gas fracking boom. Other sector booms in Australia include mining booms in the 1850s and turn of the twentieth century, and short term agricultural price booms of the Korean War in the early 1950s and to a lesser extent the mid-1970s and 2007-10.[3]

This paper seeks to trace the main findings from the Australian literature on booming sector economics, beginning with Gregory (1976) through to the present. Section 2 describes the different causes of, and some of the different contexts of, a booming sector. The early theoretical models largely based on trade theory discussed in Section 3 focus on the comparative static effects of a booming sector. Alternative and later developed models considered in Section 4 have relaxed some of the special and simplifying assumptions to include additional sectors and more realistic sector interactions, sticky prices and disequilibrium, international mobility of labour and capital, governments as key players in the economy, and multi-period stages of a boom. Empirical analyses based on computable general equilibrium models and the interpretation of available time series data for the observed effects of a boom sector on actual economy outcomes are considered in Section 5. Section 6 moves to papers evaluating the effects of the current Australian mining boom. The pros and cons of options for government policy responses are considered in Section 7.

Only passing comment will be given to two issues often found in the global boom economy literature, but usually ignored in the Australian context. One, the "resource curse" refers to effects of a boom sector which supports misuse of the income windfall, corruption, inattention and a loss of competition and innovation in the rest of the economy found in some developing countries (with a literature survey by Van der Ploeg, 2011, and a specific CGE application to PNG by Chand and Levantis, 2000). Arguably, for Australia the combination of the quality, timeliness

---

^John Freebairn (email: j.freebairn@unimelb.edu.au) is at Department of Economics, University of Melbourne, Victoria, Australia.

[1] The 1970s boom involved two phases: the development of the export iron ore and bauxite industries, and the off-shore oil industry; expansion of coal and uranium exports. Resource discoveries, new transport technology, changes in regulations, and rapid economic expansion of Japan were key underlying driving forces. Mining as a share of GDP increased from 2 to 6 per cent.

[2] The mining boom of the early twenty-first century involved both large increases in the value of exports of iron ore and coal to meet a largely unanticipated increased demand from China, and new technology in exploration, extraction and transport of LNG. The mining sector share of GDP doubled to nearly 10 per cent. Connolly and Orsmond (2011) and Penny et al. (2012) provide background discussions.

[3] For more details see, for example, Battellino (2010) or McLean (2013).

and impact of economic analysis together with informed government advisers helped to avoid poor policy responses to mining booms.

Two, decisions on the timing of extraction of a non-renewable resource and sustainability (Hartwick, 1977, Dasgupta and Heal, 1978) seldom are considered in the Australian literature. In part, this omission reflects the wide range of available minerals and energy, and, for many, the large known reserves relative to current extraction rates together with confidence in future exploration successes.

2. Exogenous Shocks

At a broad level, a boom sector can be driven on the supply (quantity) side, or on the demand (price) side. Also, the context and effects of particular booms will depend on other circumstances, including the state of the global economy and of the home-country economy.[4]

In the context of minerals and energy, a supply side sector boom can flow from exploration and discovery of new reserves or by technological change which sharply lower production costs along the extraction, transport and processing supply chain. Most theoretical models assume technical change to increase the effective quantity of the key sector specific input.[5] Typically, the supply shift is assessed as a country- or region-specific change and one that confers an increase in the comparative advantage of the boom sector for an individual country for an extended period. The mining sector is the most common example of a boom sector.[6] For simplicity, many studies treat the supply shift as a long term technical change. Other studies explicitly recognise the shift as a one-off increase in the effective supply of a non-renewable resource. Some studies consider also the implications of the temporary boom sector for the time profile of extraction and for government policy (for example, Allen and Day, 2014).

A demand side or price driven boom sector flows from a global market demand increase. Examples include: the rapid growth in demand from emerging countries such as Japan in the 1960s and 1970s and China in the early twenty first century; and, the market structure changing effect of the OPEC cartel raising oil prices in the 1970s. For a particular country, the price shift represents an exogenous increase in the terms of trade. Also, the global context of a demand boom benefits producers across the globe, which contrasts with the country-specific perspective

[4] For example, Stoeckel in his comments illustrates the interface of the global financial crisis with the millennium boom.

[5] Seen in this context, it has been argued that booming sector economics is no more than a specific illustration of a much older and longer literature analysing the effects of a sector specific technical change.

[6] An interesting variant is the comparative assessment by Qiang (1999) of a boom in mining with a boom in mineral processing in WA.

of a supply boom. Over time, investment and supply responses across the globe to the higher prices reduce the initial price rise for a particular country. With the global investment and then supply response to a demand-side boom, the price jump and sector boom may be short-lived.

Gregory (2012) in comparing the Australian mining booms of the 1970s with that of the early twenty-first century, and Forsyth (1986) in comparing the UK and Australian booms of the 1970s, note the greater relative importance of income versus resource allocation effects (described in the next section) of a supply-side versus a demand-side boom.

Model simplicity often assumes a one period model for analysing the effects of a boom sector on the wider economy. Reality is that booms have phases. The magnitudes of effects of a boom, and in some cases the directions of effects of a boom, on the directly affected sector, and then effects on other parts of the economy, will vary over different phases of each type of boom. The phases of a supply driven boom, including country investment and production phases, almost certainly will differ from those of a demand driven boom. Relative to a supply boom, a demand boom initially has a higher price phase with no quantity response, then a global investment phase, and a later global expanded production phase with a fall in prices.

3. Simplified Trade Theory Model

Early theoretical models to assess the effects of a booming mining sector on outputs of other sectors in the economy, relative prices, and factor returns employed trade theory models. Key papers by Australian authors include Gregory (1976),[7] Snape (1977), Corden (1981 and 1984) Corden and Neary (1982), Cook and Sieper (1984) and Cassing and Warr (1985).

Simplifying assumptions include: a comparative static competitive general equilibrium; a small country as a price taker for both export and import products; international immobility of factors of production; and, an exogenous technical change for an important traded sector as the boom sector. The basic model assumed three sectors, the boom sector, B or mining, the remaining traded sector, T (with export competing agriculture and import competing manufacturing), and a non-traded sector, N or services. Each sector had a sector specific input, including the mining deposit for sector B and a measure of capital. A competitive market allocates a given quantity of a mobile input labour, L, among the three sectors. The mining boom was represented as an exogenous, and for simplicity a costless, increase in the quantity of, or the technical efficiency of,

[7] Gregory explored and compared the effects of tariff protection to the manufacturing sector and a mining boom. This review considers the boom sector analysis only, while recognising an extensive related literature focussed on the analysis of the effects of an across the board reduction of tariffs on manufacturing having similar economy-wide effects.

the fixed input in B, or as an outwards and skewed shift in the national production possibility frontier. Effects of the boom sector on sector outputs and relative prices, the real exchange rate, factor input returns, and national income and its distribution were assessed.

Two sets of first round effects of a mining boom on outputs of the B, T and N sectors and on relative prices were described, namely resource reallocation effects and higher income effects. For the resource reallocation effects, technical change in the boom sector increases the effective quantity of the boom sector specific input, which shifts out the demand by that sector for the mobile labour input. With a fixed aggregate supply of labour, the higher wage rate and the reallocation of labour results in expansion of the boom sector, B, and contraction of both the other trade sector, T, and the non-trade sector, N. Against given and constant international prices for both the B and T traded sectors, current account equilibrium requires a real currency appreciation (either of the nominal exchange rate or by domestic inflation)[8] and an increase in the relative price of the nontraded product to the traded products.

The income effect of a boom sector increases demand for the nontraded sector. Both the output and price of the nontraded sector increase. In turn, the higher price for N pushes upward the real exchange rate and the wage rate on mobile labour, further squeezing the non-boom traded sector, T.

Both the resource allocation and income effects of a boom sector reduce output in the other traded sector. This is the “Dutch Disease” effect[9] on other export industries, including agriculture, and on import competing industries, including manufacturing, with the latter sometimes referred to as “deindustrialisation”. For the nontraded sector, the resource allocation effects and income effects are negative and positive, respectively, so that the net effect becomes an empirical issue.

Some authors have explored in more detail characteristics of different boom economies in terms of the relative importance of the resource allocation and income effects, including Forsyth (1985) when comparing Australia and the UK of the 1970s and Warr (1986) for Indonesia and the 1970s oil sector. Demand booms, particularly for oil and gas, which generate large economic rents and require little of the mobile inputs, primarily have income effects. By contrast, supply-side booms for minerals, which require substantial country mobile inputs and generate small

[8] Lindner (1978) provides a model of, and indicative estimates for, the relative importance of exchange rate and inflation responses over the first half of the 1970s to the mining boom.
[9] The term “Dutch Disease” is attributed to the Economist magazine (November, 1977) with reference to the discovery of large Dutch gas reserves in the 1960s and their effects on the traded industrial sector.

rents, have relatively small income effects and large resource allocation effects. The demand type of boom is more likely to result in a net expansion of the non-traded sector than the supply boom where resource allocation effects dominate income effects.[10]

The boom economy effects on factor returns follow the pattern of sector output effects. Returns to the specific sector factor input increase for the boom sector and fall for the other traded sector. Returns to the specific factor for the nontraded sector rise (fall) if the sector expands (contracts), depending on the relative importance of the resource reallocation and income increase effects of the boom. The nominal wage for the mobile labour input increases. But, the direction of change of the real wage is an empirical question determined by the positive effect of a nominal wage increase and the negative effect of a higher price for the nontraded sector product on the average cost of living.

4. Some Model Generalisations

The special and simplifying assumptions of the model of the previous sector have been relaxed in many different ways. At a minimum, alternative and plausible assumptions to better reflect particular economies and booming economy experiences modify the magnitudes of effects obtained from the simplified model. Other alternative assumptions can reverse for some variables the direction of effect of a boom economy.

One category of model developments allow for greater details of, and complexity of, the production economy. Corden and Neary (1982), Long (1983), Corden (1984), Cook and Sieper (1984) and Cassing and Warr (1985) add a second country mobile factor, capital, in addition to labour.[11] Then, the relative capital to labour ratios of the different B, T and N sectors have important effects on the resource allocation effects of a boom, and then the sector output responses.

Potentially more realistic models disaggregate one or both of the other traded, T, and non-traded, N, sectors; they allow different capital to labour ratios between the sub-sectors, and they have different income elasticities of demand for subsectors of the non-traded sector. Then, some subsectors expand and others contract depending on relative input mixes and income elasticities of demand.

[10] Dominance of the income effect over the resource allocation effect also is likely for an enclave type situation of the OPEC countries with government collecting additional taxation revenue and most of the inputs to the boom sector imported.

[11] As another variant, Cook and Sieper (1984) consider labour disaggregated between skilled and unskilled.

Other model extensions in the name of greater realism relax the simplified model assumption that both the boom and other traded sectors are traded only. Some of the sector output can directly provide resident consumption, or some of the output can be used as an intermediate input by the other sectors. In particular, the boom sector purchases intermediate inputs from the other sectors. Such inter-sector transactions are important as indicated in national input-output tables which are the basis of computable general equilibrium models to be discussed in the next section. These market interactions can significantly alter the modelled effects of a boom economy derived from a simplified model. In particular, sector supply complementary relationships can arise, and then with the possibility of expansion of a component of the other traded sector in response to a mining boom as opposed to the simplified model result of a contraction.

Another set of model extensions relax the simplifying assumption of given traded goods prices. Either one or both imperfect substitution of the imported and domestic product and a downward sloping demand curve for the export product result in both endogenous traded sector prices and quantities.

An important simplifying assumption of the model of Section 3 was fixed quantities of the labour and capital inputs for the country experiencing a boom sector. Reality is that most boom economy experiences, and particularly those in Australia, have encouraged the in-flow of non-resident capital and labour.[12] For the very extreme case of an infinitely elastic supply of international factors of production to Australia, the booming sector would have no effect on factor returns, since they are set by the world price, and all of the boom effects would be on factor quantities. A more realistic set of assumptions include partial geographic immobility of some factors of production, a less than perfectly elastic non-resident capital supply function and legislative and other restrictions on labour migration. These model extensions reduce the magnitudes of the effects of the boom sector on factor returns and increase the magnitudes of the changes of the factor quantities and sector outputs obtained from the simplified model assumption of no international factor trade.

A key effect of a mining boom which increases the inflow of international capital and labour is a larger aggregate economy than the simplified model. A larger economy means larger outputs for all sectors than indicated with the simplified model.

[12] See, for example, Maddock and McLean (1984) for labour and the 1850s gold rush. For the mining booms of the 1970s and this century, access to non-resident capital by multinational companies was a major source of funds, and additional migration, including 457 visas for the current mining boom, contributed to the growing sector workforce and elsewhere in the economy.

A related extension of the simplified trade theory model where non-resident capital and labour inputs contribute to the boom introduces government and its taxation and expenditure decisions. In the case of the increase of non-resident capital to finance much of the mining boom investment, government royalties, resource rent taxes and corporate income tax collect a share of the economic rent generated by the boom; with a partial offset of greater government expenditure on complementary boom sector infrastructure, regulation, and so forth. For greater migration of workers, government collects additional income tax and expenditure taxes from the enlarged national wage bill, but with additional expenses on government services to a larger population.

An important simplifying assumption of the basic trade theory model of the effects of a boom sector is one of a competitive equilibrium with flexible factor prices, particularly of labour, to equate supply with demand. Rigidity of real wages results in labour market adjustments to the quantities of employment and unemployment rather than only of wages.

Another category of models to assess the effects of a mining boom on the economy focus on monetary effects, make explicit arguments about the nature of and the effects of expectations, and describe in more detail the time paths of responses to the boom. Porter (1978), Corden (1982), and Turnovsky (1983) are examples. Changes in foreign reserves and accommodating monetary policy for the increase in nominal GDP are shown to have important roles in the time paths of adjustment to a mining boom.

5. Quantitative Models

One of the illustrative applications of computable general equilibrium (CGE) models developed in the 1970s was to estimate the magnitudes of effects of mining booms on the economy. Relevant studies include Dixon et al. (1978), Dixon et al. (1979), Stoeckel (1979), Cook and Sieper (1984) and Cook and Lees (1984). The CGE models include many of the details of the economy thought to influence the effects of a mining boom raised by the theoretical models, including multiple sectors and subsectors, multiple factors of production and their mobility across sectors and globally, different relative factor intensities by sectors, product flows between sectors, and alternative equilibrium model closing assumptions. They help to resolve the relative magnitudes of opposing direction of theoretical effects on net outcomes, including effects of a mining boom on output of the nontraded sector and real wages.

Initial CGE models provided only comparative static assessments; future developments allowed for a time path of effects over different phases of the boom to be estimated. Of course, CGE models still are models, with results conditional on simplifying assumptions about the structure of the economy and on parameter values for decisions by firms, households and governments.

Some general agreed results from the CGE model estimates of the effects of the 1970s mining boom on the Australian economy, and a couple different results across the models, are as follows. Key results of the theoretical models of a real currency appreciation, significant changes to the structure of the economy in terms of relative sector outputs and the allocation of mobile factor inputs, and an increase in measures of aggregate income and expenditure are quantified. The additional detail of inter-sector product flows captured by the input output table included in the models can result in some trade exposed sectors expanding rather than contracting, but some contract in "Dutch Disease" form. For the traded sector, agriculture is found to decline with minor benefits from extra demand associated with the income effects of the boom and no intermediate input contributions to the mining investment boom (Stoeckel, 1979). Ambiguities of the theoretical model assessments of the effects of the mining boom on output of most non-traded sectors and on the real wage are answered as a net positive effect. The Stoeckel (1979) and Cook and Lees (1984) studies estimate important different effects for a demand driven mining boom versus a supply driven boom. The magnitudes of estimated effects vary across the different models, and the authors clearly write that the estimates are orders of magnitude only.

Another set of quantitative studies have evaluated time series data in an attempt to assess the effects of mining booms. Example studies of booms of the 1970s include Forsyth (1986) in a comparison of the effects of the mining booms on the UK and Australian economies and Warr (1986) for the oil boom on the Indonesian economy. In principle, this methodology reduces the dominance of model assumptions built into the CGE models on the assessment. On the other hand, the reality of many other exogenous forces driving an economy makes it difficult to isolate the effects of a mining boom. Other confounding forces include structural changes associated with technology across other sectors in addition to mining, non-mining changes in the terms of trade, and evolving macroeconomic conditions. These confounding factors, together with the relatively small magnitude of the mining boom relative to the other factors, led these authors to be cautious about the results of this research strategy. On the other hand, the review of the effects of the millennium boom by Minifie et al. (2013) and Gregory's comment on this review provide good illustrations of the use of time series data.

6. **Millennium Mining Boom**[13]

[13] A term coined by Grafton (2012).

A largely unexpected increase in demand from China and other developing countries for iron ore and coal from 2002, and then later new technology for the LNG sector, drove a new Australian mining boom in the early 21st century.[14] The boom provided the impetus for a second round of analyses of a booming sector by Australian economists. Assessments of the effects of the boom have built on the previous work. They have explicitly distinguished between the different patterns of effects of a demand side versus a supply side boom, expanded beyond a comparative static analysis to more details on the different effects of the boom during its price increase, investment increase and then production increase phases, and considered regional as well as industry effects.

The first stage of the demand boom flowed from a tripling of the world price for key minerals and a doubling of Australia's terms of trade between 2003 and 2011. Gregory (2012) and Sheehan and Gregory (2013) measure the first round income effect of the boom as the proportionate change in the terms of trade times the share of exports in GDP for a measure of gross national income (GNI).[15] The boom was estimated to contribute a 12 per cent increase in Australian real income during a period of very low domestic productivity growth and the global financial crisis. In turn, they estimate at least a half of the aggregate gain went to buyers of cheaper Australian prices for import goods associated with the appreciated exchange rate; with other gains to government as higher taxation, shareholders as higher retained earnings and noting that the majority of shareholders are non-residents (Connolly and Orsmonde, 2011). Downes et al. (2014) with a structural macroeconomic model estimate a 6 per cent increase in real GDP, a 13 per cent increase in real income, a 6 per cent increase in real wages and a 1.5 per cent fall in unemployment (and details for exchange rate, sector employment, investment, outputs, consumption and prices, and household income and wealth).

The higher exchange rate squeezed returns to the other exporters, including agriculture, education and tourism, and import competitors, including manufacturing, as expounded in the simplified model. Most of the non-traded sector was estimated to benefit from the boom generated higher GNI.

With some lags, the much higher mineral prices, and from very low prices through the 1990s, provided the rationale and funds for the investment phase of the mining boom, both in Australia

[14] In addition to the mining boom there were other important structural changes which affected outcomes. They include: a boom in food prices, partly associated with the growth of China demand and partly by biofuel policies in the US, Europe and other countries to divert agricultural products into biofuels; and the global financial crisis of 2008, and subsequent monetary and fiscal policy changes.

[15] They note that this is just one of several measures, and that there is legitimate debate about the different measures.

and in all other producing countries. The investment phase brings into play the resource allocation effects of a boom sector. Although most of the investment has been funded from retained earnings (Arsov, et al., 2013), an increase of net capital inflow from non-residents, with a partial offset due to imports of some of the investment, the investment boom provided an additional appreciation of the currency. Immigration provided some of the extra labour. With an important component of the capital equipment and services sourced from other Australian industries, many industries in the other traded sector and the non-traded sector directly gained from the mining investment boom. Rayner and Bishop (2013), for example, estimate that the inter-industry demand effects double the share of the economy which directly benefited from the mining boom.

Effects of the mining investment boom associated with new technology driving the LNG boom differ in some important ways from the above description for iron ore and coal. By contrast, most of the funds were an increase in foreign capital inflow, and even with the higher import share of the equipment, resulted in a further upward push to the exchange rate. The higher import share of the investment reduces the resource allocation effect, while the intermediate input demand increase benefits to other Australian industries.

Fleming et al. (2015) consider the effects of the mining boom on the growth rates of employment and family incomes across regions as an additional perspective to across industries or sectors. Using census data for 2001 and 2011 for nonmetropolitan local government areas, they report significant positive elasticities for both non-mining employment and for average family income with respect to increases in the share of employment in mining. These broader benefits are consistent with a combination of income effects and mining industry demands for inputs from other industries spreading the benefits of a mining boom across much of the economy.

Building on the investment phase, the increased production and export quantity phase of the millennium mining boom accelerated over the first half of the 2010s. With the production phase being less resource intensive than the investment phase, moving to the production phase will reverse some of the resource allocation effects of the investment phase.

The income effect when moving from the investment phase to the production phase will vary according to the boom source. For the supply side boom, and in particular LNG, the increase in production with Australia facing an elastic export demand means there will be an unambiguous income effect. Simshauser and Nelson (2015) discuss an important special case adverse inter-industry effect for east coast gas users; namely, the transition from well-below export prices pre-boom to export price parity when the production boom shifts the industry to a net export outcome.

In the case of the demand driven boom for the iron ore and coal industries, the production phase involves a larger quantity but a much lower price because investment and production have increased world-wide versus Australia only for a supply side boom. If price falls more than quantity, as seems the outcome to date, the income effect falls with a shift from the investment phase to the production phase. The falls in mineral prices and the terms of trade from about 2011 work to reverse some of the gains in GNI generated during the price increase phase discussed above.

7. Policy Messages

There has been a consensus that industry-specific policies to restrict industry structural change responses to a mining boom, including tariffs and subsidies for the contracting sectors, restrictions on the boom industry, and taxes or restrictions on international capital and income flows, are counter-productive and redistribute the adjustment burden (see, for example, Corden, 1984 and 2012, and Sheehan and Gregory, 2012). Resisting the structural changes would reduce the national income benefits from: shifting limited resident owned inputs from less valued to higher value uses; and, limiting the inflow of international capital and labour. Providing assistance to one sector of the other traded (or non-boom) sector in response to self-interest lobbying, say manufacturing, ends up increasing the required down-sizing of other industries in the other traded sector, say agriculture. Rather, government policy should focus on institutional structures and regulations to facilitate the reallocation of inputs.

Relaxing the assumptions of full employment equilibrium of the simplified model of Section 3 for the reality of business cycles, and allowing for the potential influences of a boom sector on the macroeconomic state of the economy, set the scene for questions about the implications of a boom, and in particular different phases of a boom, for monetary and fiscal policy. Mining booms, and especially a demand boom, and cyclical fluctuations of commodity prices and incomes, are important macroeconomic shocks. However, mining booms are but one of many causes of macroeconomic fluctuations, and arguably they should not be singled out as a special case.

An interesting fiscal policy discussion has been the pros and cons of a sovereign wealth fund, or a fiscal stabilisation fund, to hold government windfall taxation revenue from a boom to smooth the time paths of government expenditures and international capital flows over the ups and downs of a boom economy (Corden, 2012, Freebairn, 2013, Garnaut, 2013). Positive arguments for a special fund include a short term boom period, greater government foresight relative to private sector foresight, and political or other constraints on the use of the usual budget smoothing instruments. The diverse portfolio of the Australian mining industry and large known reserves relative to current extraction for many of the minerals and energy suggest long term booms, versus the situation of finite and specialised reserves for countries such as Norway and the Middle East who have established sovereign wealth funds. Australia's continued status as a net capital importer questions the virtue of investing the windfall overseas. Inevitable changes of government question continuity of a special fund for many decades.

8. Conclusions

Australian economists have used theory and empirical models to significantly advance understanding of the effects of a boom sector on macroeconomic outcomes and on the distribution of the effects across industries, factor rewards and incomes.

The resource allocation and income effects identified in the early simplified trade theory models are dominant drivers of a boom sector on the exchange rate, sector outputs and prices, national income and its distribution. Subsequent studies which include additional inter-sector demand linkages and inflows of international capital and migration result in larger macroeconomic gains and greater dispersion of the benefits of a boom. Most subsectors of the nontraded sector gain, and many parts of the manufacturing import competing sector gain. But, these second round beneficial effects are very small for the agriculture traded sector.

More detailed studies, and particularly computable general equilibrium models, have found different response patterns for a demand side boom compared with a supply side boom. Recent studies find different effects of a boom through its price increase, investment and production phases. Also, because different boom economy experiences in the past, and no doubt in the future, have different drivers, and emerge in different global economy and own economy macroeconomic circumstances, the magnitudes of effects, and for some measures the direction of effects, of a mining boom are boom specific.

A general consensus is that industry specific government intervention policies to cushion the adverse effects of a boom sector on one adversely affected sector of the economy would both reduce national income and increase the adjustment burden for other sectors. More controversial is the discussion of the appropriate fiscal and monetary instruments and their setting to smooth the income shocks of mining booms.

References

Allen, C. and Day, G. (2014). Does China's boom curb Australia's iron ore mining depletion?, *Australian Journal of Agricultural and Resource Economics*, 58(20), 244-262.

Arsov, I., Shanahan, B. and Williams T. (2013). Funding the Australian resources boom, *RBA Bulletin*, March, 51-61.

Battellino, E. (2010). Mining booms and the Australian economy, *RBA Bulletin*, March, 63-69.

Cassing J. and Warr, P. (1985). The distributional impact of a resource boom, *Journal of International Economics*, 18, 83-97.

Chand, S. and Levantis, T. (2000). Dutch Disease and the crime epidemic: an investigation of the mineral boom in Papua New Guinea, *Australian Journal of Agricultural and Resource Economics*, 44(1), 129-146.

Connolly, E. and Orsmond, D. (2011). The mining industry: from bust to boom, in Gerard, H. and Kearns, J. (eds), *The Australian Economy in the 1920s,* Proceedings of a conference, RBA, 111-156.

Cook, L. and Sieper, E. (1984). Minerals sector growth and structural change, in Cook and Porter (eds), *The Minerals Sector and the Australian Economy*, Allen and Unwin, Sydney, 85-128.

Cook, L. and Lees, V. (1984). Some quantitative estimates of the effects of changes in the minerals sector, in Cook and Porter (eds), *The Minerals Sector and the Australian Economy*, Allen and Unwin, Sydney, 249-280.

Corden, M. (1982). Exchange rate policy and the resources boom, *Economic Record*, 58(160), 18-31.

Corden, M. (1984). Booming sector and Dutch disease economics: a survey, *Oxford Economic Papers*, 36(3), 359-380.

Corden, M. (2012). Dutch disease in Australia: policy options for a three speed economy, *Australian Economic Review*, 45(3), 290-304.

Corden, M. and Neary, P. (1982). Booming sector and de-industrialisation in a small open economy, *Economic Journal*, 92(368), 825-848.

Dasgupta, P. and Heal, G. (1978). *Economic Theory and Exhaustible Resources*, Cambridge, Cambridge University Press.

Dixon, P., Parmenter, B. and Sutton, J. (1978), Some causes for structural maladjustment in the Australian economy, *Economic Papers*, 57, 10-25.

Dixon, P. , Powell, A. and Parmenter, B. (1979). *Structural Adaption in an Ailing Macroeconomy*, Melbourne University Press, Melbourne.

Downes, P., Hanslow, K. and Tulip, P. (2014). The effect of the mining boom on the Australian economy, Reserve Bank of Australia Research Discussion Paper, 2014-08, Sydney.

Fleming, D., Measham, T. and Paredes, D. (2015). Understanding the resource curse (or blessing) across national and regional scales: theory, empirical challenges and an application, *Australian Journal of Agricultural and Resource Economics*, 59(4), 624-639.

Forsyth, P. (1986). Booming sectors and structural change in Australia and Britain: a comparison, in Neary and Wijnbergen (eds), *Natural Resources and the Macroeconomy*, Basil Blackwell, Oxford, 251-283.

Forsyth, P. and Kay, J. (1980). The economic implications of north sea oil revenues, *Fiscal Studies*, 1, 1-28.

Freebairn, J. (2012). Mining booms and government budgets, *Australian Journal of Agricultural and Resource Economics,* 56(2), 201-221.

Garnaut, R. (2013), *Dog Days: Australia After the Boom*, Redback, Melbourne.

Grafton, Q. (2012). The Importance, drivers and phases of the millennium mining boom, *Resources and Energy Quarterly*, September quarter 2012, 67-83.

Gregory, R. (1976). Some implications of the growth of the mining sector, *Australian Journal of Agricultural Economics*, 20(2), 71-91.

Gregory, R. (2012). Living standards, terms of trade and foreign ownership: reflections on the Australian mining boom, *Australian Journal of Agricultural and Resource Economics*, 56(2), 171-200.

Hartwick, J. (1977). International equity and the increasing rents from exhaustible resources, *American Economic Review*, 66(5), 972-974.

Lindner, R. (1978). Inflationary implications of the growth of the mining sector, *Australian Economic Papers,* 17(30), 37-50.

Long, N. (1983). The effects of a booming export industry on the rest of the economy, *Economic Record*, 59(164), 57-60.

Maddock, R. and McLean, I. (1984). Supply-side shocks: the case of Australian gold, *Journal of Economic History*, 44(4), 1047-1067.

McLean, I. (2013), *Why Australia Prospered*, Princeton University Press, Princeton.

Minifie, J., Cherastidtham, I., Mullerworth, D. and Savage, J. (2013). The mining boom: Impacts and prospects, Grattan Institute.

Penny, K., Melanie, J., Stark, C. and Sheales, T. (2012). Opportunities and challenges facing the Australian resources sector, *Australian Journal of Agricultural and Resource Economics*, 56(2), 152-170.

Porter. M. (1978), Monetary and non-monetary analysis of Australian balance of payment problems, *Australian Economic Papers*, 17(30), 21-36.

Qiang, Y. (1999). How different is mining from mineral processing? A general equilibrium analysis of new resources projects in Western Australia, *Australian Journal of Agricultural and Resource Economics*, 43(3), 279-304.

Rayner, V. and Bishop, J. (2013). Industry dimensions of the resources boom: an input-output analysis, Reserve Bank of Australia Discussion Paper 2013-02, Sydney.

Reeson, A., Measham, T. and Hosking, K. (2012). Mining activity, income inequality and gender in regional Australia, *Australian Journal of Agricultural and Resource Economics*, 56(2), 302-313.

Sheehan, P. and Gregory, R. (2013). The resources boom and economic policy in the long run, *Australian Economic Review*, 46(2), 121-139.

Simshauser, P. and Nelson, T. (2015). Australia's coal seam gas boom and the LNG entry result, *Australian Journal of Agricultural and Resource Economics*, 59(4), 602-623.

Snape, R. (1977). Effects of mineral development on the economy, *Australian Journal of Agricultural Economics*, 21(3), 147-156.

Stoeckel, A. (1979). Some general equilibrium effects of mining growth on the economy, *Australian Journal of Agricultural Economics*, 23(1), 1-22.

Turnovsky, S. (1983). Expanding exports and the structure of the domestic economy: a monetary analysis, *Economic Record*, 59(166), 245-259.

Van der Ploeg, F. (2011). Natural resources: curse or blessing?, *Journal of Economic Literature*, 49, 366-420.

Warr, P. (1986), Indonesia's other Dutch disease: economic effects of the petroleum boom, in Neary and Wijnbergen (eds), *Natural Resources and the Macroeconomy*, Basil Blackwell, Oxford, 288-320.