# LABOUR MARKET CLOSURES AND THEIR IMPACT ON THE CGE MODELLING RESULTS FOR A NEW RESOURCE PROJECT

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**ABSTRACT**

Results from Computable General Equilibrium modelling are dependent on a number of assumptions regarding the way the economy reacts to different types of shocks. In particular, the assumptions used to determine labour market closures are important in the impact they have on results, especially when considering regional shocks. This paper tests different labour market assumptions for a long-run simulation using the two-state MMRF-Green model to simulate the introduction hypothetical resource-processing project in Western Australia. The results show that the labour market adjustments that are produced by the model are not always entirely realistic, particularly in terms of the scale of adjustment. The paper concludes that, while it is generally accepted that labour migration goes a long way to equalising labour market differentials across regions in the long-run, it is likely that other factors do come into play. However, due to the lack of research in the area, particularly in the Australian context, no ready solution or alternative is available and, for this reason, further study would be valuable.

## BACKGROUND

Results from Computable General Equilibrium (CGE) modelling are dependent on a number of assumptions regarding the way the economy reacts to different types of shocks. In particular, the assumptions used to determine the labour market closures are important in the impact they have on results, especially when considering regional shocks.

The aim of this paper is two-fold. The first aim is to examine the impact of different labour market assumptions of a long-run simulation using the two-state MMRF-Green model of a hypothetical resource-processing project, ABC Metals, in Western Australia. The results are analysed to identify the immediate and flow-on effects of each assumption. As part of this analysis, three separate sets of results were produced, with the difference between them being the closures used to determine the reaction of the labour market to a specific regional shock with specific reference to migration of labour between regions.

The second aim is to look more closely at the benefits and limitations of each of these labour market closures in regard to how well they reflect the true reaction of the labour market to regional shocks.

The intention of the ABC Metals project example was to imitate a scenario that was realistic in the context of a new business investment project for Western Australia. In this regard, and as discussed more fully by Layman (2004), CGE models have become increasingly popular as a way to determine the merits of providing assistance for major projects in order to justify requests for assistance by business. Therefore, the assumptions made and the closures used in the modelling of the project are very important to major policy decisions.

There are few studies on interstate labour migration patterns for Australia and even fewer that attempt to explain migration as an adjustment mechanism to specific types of economic shocks. This paper refers to a few examples, but it is acknowledged openly that the literature review was by no means exhaustive (due to time constraints). While these examples are useful in that they raise important issues regarding migration behaviours, much of the work that is readily available concerns the out-migration response to negative shocks to a 'home' region (e.g. a rise in the local unemployment rate) rather than in-migration responses to a positive shock to a different region (e.g the advent of a new project).

Unfortunately, this paper does not provide all of the answers in this area. At best (or perhaps worst!) it hopes to raise some questions and touch on areas that might benefit from further study. On this note, the Western Australian Department of Treasury and Finance (DTF) has this week formed an economic research unit, and one of the first tasks planned for this unit is to conduct a study into interstate migration patterns.

**PROJECT DESCRIPTION**

The project used to provide the shock for this exercise was a project from the fictitious company, ABC metals. The total export revenue of the intended project once it is operating is valued at $445 million, with direct input expenditures totalling $122.5 million per annum to the iron ore, gas, and basic chemical industries. Direct labour costs (of $17 million) associated with the new project were also included in the model.

The project was implemented in the model using a similar method to that established in Dixon, Horridge and Johnson (1992). A miniature version of the project, with its investment, capital stock, exports, intermediate demands and employment was placed in a 'dummy' industry in the database. Investment, capital, exports, employment and return on capital for that industry are specified as exogenous. The margins on each cost are apportioned as they occur for the most similar existing industry in Western Australia (iron and steel). Employment for ABC metals is also apportioned according to the existing occupational breakdown that exists in the Western Australian iron and steel industry.

**Table 1**

| **Project details** | |
|---|---|
| | **$ Million** |
| **revenue** | 445.0 |
| **expenditures** | |
| iron ore | 38.0 |
| basic chemical | 69.8 |
| Gas | 14.7 |
| **sub total** | 122.5 |
| Labour | 17.0 |
| **Total Expenditure** | **140.5** |
| **Returns to capital** | **304.5** |

**Table 2**

| **Cost of Labour by Occupational Type** | |
|---|---|
| | $ Million |
| 1 Manager, Administation | 1.06 |
| 2 Professional | 2.15 |
| 3 Associate Professional | 0.70 |
| 4 Trades | 4.46 |
| 5 Advanced Clerical, Service | 0.27 |
| 6 Intermediate Clerical, Service | 1.25 |
| 7 Intermediate Production, Transport | 5.00 |
| 8 Low Clerical, Service | 0.16 |
| 9 Labourers | 1.95 |
| **Total** | **17.00** |

The long-run impact of the project is examined in the simulation, and so the rate of return to capital and the national level of employment were made exogenous, with the national wage and capital stock endogenous. The nominal exchange rate was used as the numeraire.

To simulate the impact of the new project on the economy, the capital stock, exports and labour input of the new project (in the dummy industry) were then shocked in order to simulate its introduction into the economy.

The MMRF Green model is a multi-regional model developed by the Monash University Centre of Policy Studies (CoPS), with Australia separated into different regions. In this case, the two-region model is used, with the regions being 'Western Australia' (WA) and the 'Rest of Australia' (ROA). Further assumptions and adjustments to the MMRF-Green model that were made when running the simulations can be found in Attachment A.

## LABOUR MARKET CLOSURES

As discussed above, the aim of this paper is to emulate the various labour market closures that can be used with the MMRF-Green model, with particular reference to interstate migration, and examine the variations in results from the closures.

In the MMRF-Green model, there are three different groups of assumptions that can be used for regional labour market behaviour (Adams, Horridge, Wittwer 2003 p.3):

1. regional wage differentials and unemployment rates are exogenous and regional labour supply is endogenous (through interstate migration);

2. regional labour supply and unemployment rates are exogenous and regional wage differentials are endogenous; or

3. regional labour supply and wage differentials are exogenous and unemployment rates are endogenous.

The participation rate in each state is exogenous in all scenarios. At the national level, most comparative-static CGE models and, broadly speaking, dynamic models as well, assume that labour is flexible in the short term (i.e. that participation rates and/or unemployment rates can move in response to changes in demand) but fixed in the long-term. Wages are assumed to be sticky and are therefore fixed in the short-term. In the long-term, the impact of any increased demand for labour is reflected in higher wages.

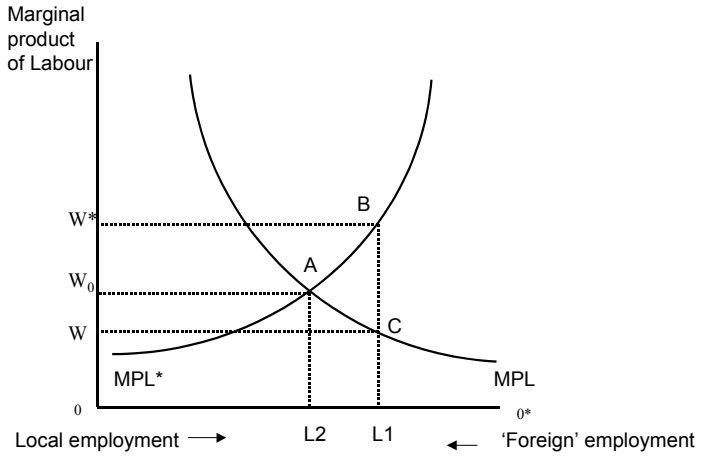
For the purpose of this paper, these three scenarios were replicated in order to examine how the results for the three closures differed. In the first simulation, the wage differential remained fixed while employment flows between the regions was endogenous (although net national employment was fixed). In the second scenario, to create a simulation with fixed employment, the State-level employment variable 'employ' was swapped with the State-level wage differential variable (wage_diff) so that the wage differential became endogenous and employment levels in the regions were fixed. In the third simulation, both regional employment and the wage differentials between the States were fixed, however the unemployment rate in the shocked region was endogenous, allowing an increase in the local labour market supply.

## THEORY: OPEN INTERSTATE MIGRATION

As discussed above, the literature for the MMRF Green model (Adams, P & Horridge, M, 2003) recommends the first closure (with open interstate migration) as the most suitable for long-run simulations. Indeed, keeping wage differentials fixed and allowing migration to flow between regions according to demand effectively simulates the response of a perfectly efficient open market economy. Labour is transferred to where it can be most efficiently utilised. With no obstacles to labour movement, migration would occur until the marginal product of labour is the same across the regions.

**Chart 1**

CAUSES AND EFFECTS OF LABOUR MOBILITY




Source Krugman, P & Obstfeld, M, 1998, *International Economics: Theory and Policy*, p.152

The chart above provides an example of labour market adjustment with perfectly open flows of labour using a two region economy, with the horizontal axis representative of the total labour force. The workers employed in the home economy are measured from the left and 'foreign' employees from the right. Initially, there are $OL_1$ workers in home and $L_1O^*$ workers in foreign.

Given this situation, the wage real wage is lower in home (W) than in foreign (W*). If workers can move freely and are willing to shift regions to gain a higher income, then they will shift from home to foreign, reducing the home labour force and raising the real wage in home, while increasing the labour force but reducing the real wage in foreign. If there are no obstacles to labour movement, then this process will continue until the marginal product of labour is the same in the two countries (Krugman & Obstfeld, 1988, p.151). The eventual labour force will be one with $OL_2$ workers in home and $L_2O^*$ workers in foreign and with wages of both regions paid at $W_0$. That is, this situation would lead to a convergence in real wages and an increase in total output (represented by the amount ABC). The adjustment process in analogous to the adjustment to a positive shock (i.e. an outward shift of the MPL* curve) in Scenario 1.

However, while this represents a perfectly efficient response to a regional economic shock, one of the main question that this paper wants to raise is whether the closure that assumes total labour market mobility between regions is actually the best reflection of labour market behaviour in Australia? And if it isn't, then what alternatives could be considered in order to most effectively reflect labour's response to regional demand in the real world?

## NATIONAL RESULTS

While the direction of the impact, in the form of additional capital increasing the economy's capital stock and enabling production to increase is the same for all scenarios, the three closures effectively created three different responses to the increased demand for labour created by the new investment. The net increase in capital for each simulation is different, with varying degrees of crowding out occurring according to the closures that are set. The broad macroeconomic results are shown below.

**Table 3**

| National Macroeconomic Variables | | | |
|---|---|---|---|
| | Wage Differential fixed | Regional Employment fixed | WA unemployment rate open |
| | | % increase | |
| **GDP** | 0.0666 | 0.0451 | 0.1178 |
| **Household consumption** | 0.061 | 0.0526 | 0.0963 |
| **Exports (volume)** | 0.134 | 0.027 | 0.2801 |
| **Imports (volume)** | 0.0578 | 0.0302 | 0.0752 |
| **Consumer Price Index** | 0.0661 | 0.0406 | 0.0352 |
| **Employment*** | 0.0026 | 0 | 0.0515 |

The project itself is very productive, increasing output substantially relative to the amount of inputs used. In the MMRF-Green model, labour is always paid at the market rate, which means that the project must pay wages that are equal to the economy-wide average for each occupation, and so returns to capital are high. In the scenarios modelled, additional returns to capital flows through to household disposable income and consumption.

It should also be noted that Table 3 shows that employment has actually increased in Scenario 1 despite the fact that that total employment is fixed at the national level. This is due to the fact that, in the closure utilised, the restriction is imposed regionally through regional population flows. In this situation, the population is moving from a low participation rate area (ROA) to a high participation rate area (WA), which eases the national labour restriction. That is, the model assumes that once people cross the border into WA, they assume the participation rate of their new region and effectively become more active in the labour force as a population. However, at the same time, the participation rate for ROA also remains at its original level. That is, there is no assumption that the people more likely to participate leave the region (which would cause a drop in the participation rate in ROA).

For example, if there were two regions, each with a 100 people, but region A has a participation rate of 70% and region B has a participation rate of 60%, then the national labour force is:

70%*100 + 60%*100 = 130 persons

However, if 10 people move from region B to region A (i.e. from a low participation rate region to a higher participation rate region) the labour force becomes:

70%*110 + 60%*90 = 131 persons

It is also worth noting that Scenario 3, where the unemployment rate is endogenous, effectively has no factor restrictions and, as such, operates in a similar manner to an input-output multiplier.

**RESULTS: STATE LEVEL**

**Table 4**

| | GSP* Change from Base $'000 | | POPULATION Change from Base '000 | | GSP PER CAPITA CHANGE % | |
|---|---|---|---|---|---|---|
| | **WA** | **ROA** | **WA** | **ROA** | **WA** | **ROA** |
| **Original** | 81,107 | 653,102 | 1,972 | 18,110 | n.a | n.a |
| **Simulation 1** | 970 | -592 | 9.85 | -9.51 | 0.6928 | -0.0382 |
| **Simulation 2** | 259 | -22 | - | - | 0.3193 | -0.0034 |
| **Simulation 3** | 1,014 | -3 | - | - | 1.2506 | -0.0004 |

*2002-03 data, using 2001-02 values

**Table 5**

| | GDP Per Capita ($) | | Change ($) | |
|---|---|---|---|---|
| | **WA** | **ROA** | **WA** | **ROA** |
| **Original** | 41,137 | 36,064 | n.a | n.a. |
| **Simulation 1** | 41,422 | 36,050 | 285.01 | -13.78 |
| **Simulation 2** | 41,268 | 36,063 | 131.35 | -1.23 |
| **Simulation 3** | 41,651 | 36,064 | 514.46 | -0.14 |

**Table 6**

| | Nominal wage changes | | | |
|---|---|---|---|---|
| | New Wage | | Change ($) | |
| | **WA** | **ROA** | **WA** | **ROA** |
| **Original** | 988.57 | 998.1 | n.a | n.a. |
| **Simulation 1** | 989.55 | 999.1 | 0.97 | 0.98 |
| **Simulation 2** | 993.49 | 998.3 | 4.92 | 0.20 |
| **Simulation 3** | 989.09 | 998.6 | 0.51 | 0.52 |

The GSP per capita results (a rough proxy of economic welfare) from the ABC Metals project above show that different labour market closures do alter the overall impact of an economic impact of a shock to both the regional and national economy. The more efficiently labour can move between regions (given fixed national employment), the greater the impact on national welfare. However national welfare increases by the largest amount when there are no factor restrictions at all.

**Simulation One – regional employment endogenous, wage differentials exogenous**

At the State level, GSP increases by 0.91% ($970 million) in Western Australia, but falls by 0.05% ($592 million) for ROA. This equates to an increase in GSP per capita for WA of 0.69% (or $285) and a fall of 0.04% (or $14) for the ROA (based on 2002-03 data).

As noted above, the increase in production from the new project creates additional demand in the Western Australian economy. With the wage differential between the States fixed, the primary long-run response to the increased demand for labour resulting from the increase in production is the immigration of labour from lower wage jobs in ROA to higher paying jobs in WA. Any increase in wages due to the increased demand for labour is distributed at the national level and so would be lower than if labour had to be sourced from within the State.

The increase in Western Australian population resulting from the increase in labour demand is 0.5% or 9,000 people. To put this in context, net interstate migration in to WA has been between –5,000 and 6,000 per annum in the past ten years.

The free migration of labour with fixed wage differentials means that the price impact of the increased demand for labour is also spread across the whole of Australia, rather than a single region and so the negative impacts of increased wage costs are mitigated. A ready labour supply and an increase in capital allows for an increase in total production, income and consumption (which is a function of household income in the closure chosen).

However, prices (as measured by the Consumer Price Index, CPI) do increase from their base rate as a result of the increase in demand (by similar amounts in both WA and the ROA, implying that the inter-regional price distortions from the project are limited), and this flows through to higher prices of intermediate goods, which has a negative effect on the competitiveness of the exports. As a result of this increase in the WA and national real exchange rates, export volumes across all industries (except the dummy industry) in both ROA and WA fall. Businesses that compete with imports also suffer because of the appreciation of the real exchange rate, with the higher domestic prices decreasing the competitiveness of locally produced goods.

Employment in all industries in the ROA falls as labour migrates to WA to meet the increased demand created by the ABC metals project. However, while many industries in WA did experience an increase in employment as a result increased demand (reflected in the increased consumption), some of the heavily export oriented industries (such as oil) experienced a fall due to the rise in the State's real exchange rate.

**Scenario Two – regional employment exogenous, wage differentials endogenous**

This second scenario assumes that the regional labour markets are closed and that the participation and unemployment rates are also fixed. In this situation, the only available market response to an increase in demand for labour is a relative increase in the price of labour in the region that has experienced the shock.

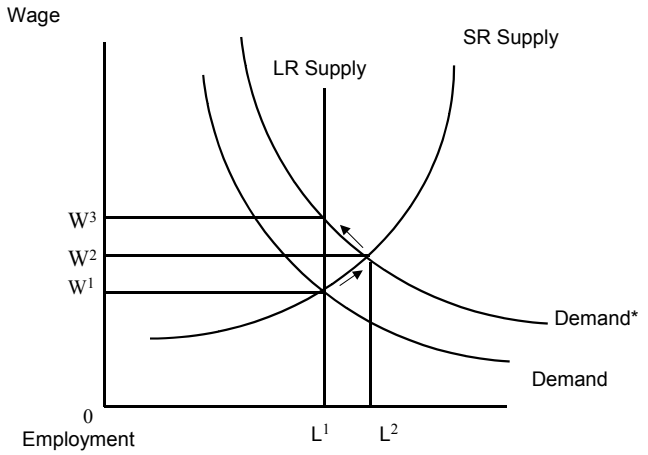
While the initial shock of the increase in WA's capital stock and production is the same as in the first scenario, the lack of labour supply creates a very different long-term result.

Although there is a net positive effect for both the WA and national economy (with WA GSP and national GDP up by 0.382% ($259 million) and 0.045% respectively), GSP/GDP growth is far less than Scenario 1. The difference between Scenario 1 and Scenario 2 WA and national results is analogous to the foreign and total production loss from immobile labour shown in Chart 1. The higher wage response in Scenario 2 leads to some industries in WA, which are higher productivity in ROA, being crowded out.

As shown in the chart below, an outward shift in the demand curve for labour in WA results in increased employment in the short-run (although the short run impact of the project is not considered in this paper). However, in the long-run, employment returns to its long-run supply level and WA prices move upward to reflect the increase in demand. Employment, wages and prices in the ROA are relatively unaffected.

**Chart 2**

LABOUR SUPPLY IN A CLOSED ECONOMY



In this scenario and with a fixed shock to employment from the new industry, employment in most other industries in WA is crowded out from labour being redirected to the new project. However, the industries servicing ABC metals and service industries that would experience increased demand from higher consumption do experience some increase in employment (e.g. health services, sport gambling and recreation, government and defence and education).

The appreciation of the State's real exchange rate also impacts negatively on export oriented industries in this scenario, with the decreased competitiveness flowing from the higher domestic prices. This also means that employment in WA's export based industries and industries that compete with imports also fall.

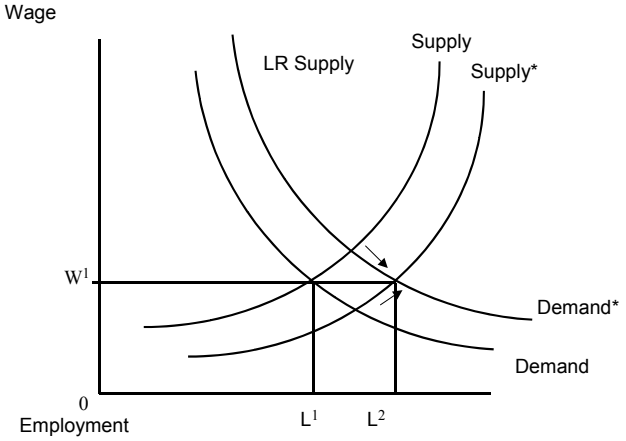
**Simulation 3 – Regional employment exogenous, wage differential exogenous, unemployment rate endogenous.**

While wage-differentials and interstate migration are fixed, this third scenario allows the additional demand for labour from the introduction of the ABC Metals project into the WA economy to be met by an increase in the labour force, through a reduction in the unemployment rate in WA. The same closure is effectively adapted for ROA, but the region is virtually unaffected by the shock.

This closure effectively means that total national employment is no longer fixed as is the standard assumption for long-run simulations but can actually increase in response to the labour demand increase in the region experiencing the shock (i.e. effectively acting as an input-output multiplier).

**Chart 3**

LABOUR SUPPLY – FIXED WAGES WITH OPEN EMPLOYMENT



As shown in the diagram, a shock to WA labour demand (from Demand to Demand*) where wages must remain fixed, but employment is open, means that the supply curve must also move outward and employment shifts from $L^1$ to $L^2$.

As might be expected, a long-run simulation that allows for an increase in the employment without any increase in population and without any shifts in the wage differential has a very positive impact on the economy. According to the simulation, the unemployment rate experiences a fall of 0.5 percentage points (or approximately 4,800 people), effectively expanding the number of total employees but the same amount. The restraint on wages growth in WA through the fixed wage differential means any offset in demand that would otherwise result from an increase in wages due to lack of labour supply (as occurred in the first and second scenario) is non-existent.

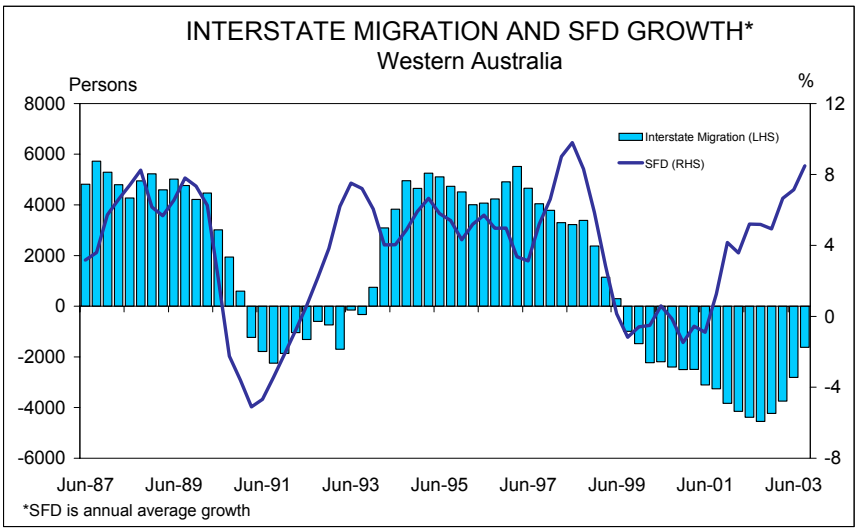
While the increase in employment (and therefore, aggregate income) means that household consumption experienced the largest real increase in this scenario, the effect on prices is limited in the long-run as production is able to increase in response to the increase in demand. Prices (as measured by the CPI) increased by similar amounts for the two States, with the ready supply of labour in Western Australia limiting any extra upward pressure on wages and prices. As shown in Table 6, the wage increase in Western Australia for the simulation is the smallest of all Scenarios. Results also show that it also results in the smallest overall national increases in wages paid to workers.

Not surprisingly then, it is this scenario that experienced the largest increase in GDP overall (and largest GSP per capita increase for WA) as the lack of restraints means that a multiplier effect has effectively been created.

**MODEL RESULTS IN CONTEXT OF HISTORICAL DATA**

One of the biggest question marks over the different assumptions made is how the results of the simulations compare again historical data on State labour markets. The results for the labour market closure that assumes open labour flows for the ABC Metals project are that the population of WA would increase by 9,000 (based on 2002-03 population figures) more than the base case, and decrease by the same amount for ROA.

**Chart 4**



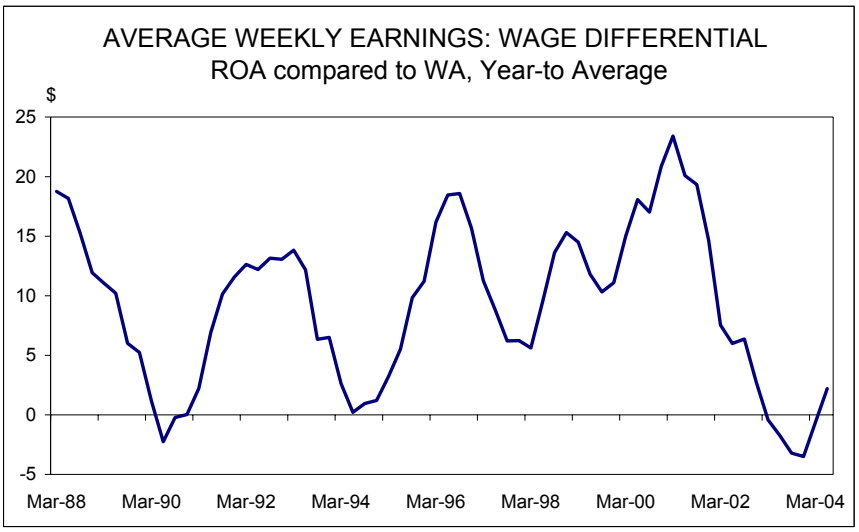

Source: ABS Cat. No. 3101.0 and 5206.0

As shown in the chart above, net interstate migration to and from WA has swung between -5000 and 6000 persons per annum. Therefore, the results imply a very large level of migration (although spread over several years) in order for labour flows to adjust completely for the impact of the new project, which is relatively small in the context of the total economy. This would appear to be excessively high.

Despite the question mark over the numbers produced in the results, many studies do show and accept that labour migration generally goes a long way to equalising labour market differentials across regions (Harris et al, 1970; Groenewold 1990; Industry Commission, 1993; Lawson et al, 2002).

However, what is perhaps possible in reality is that there is a combination of factors that work together. The chart below, which uses a weighted average to determine Average Weekly Earnings (AWE) for ROA, also supports the parallel assumption that wage differentials do remain relatively constant in the long term however there are some sharp movements from time to time. Similar results also hold for the Wage Cost Index since its introduction in 1997.

**Chart 5**



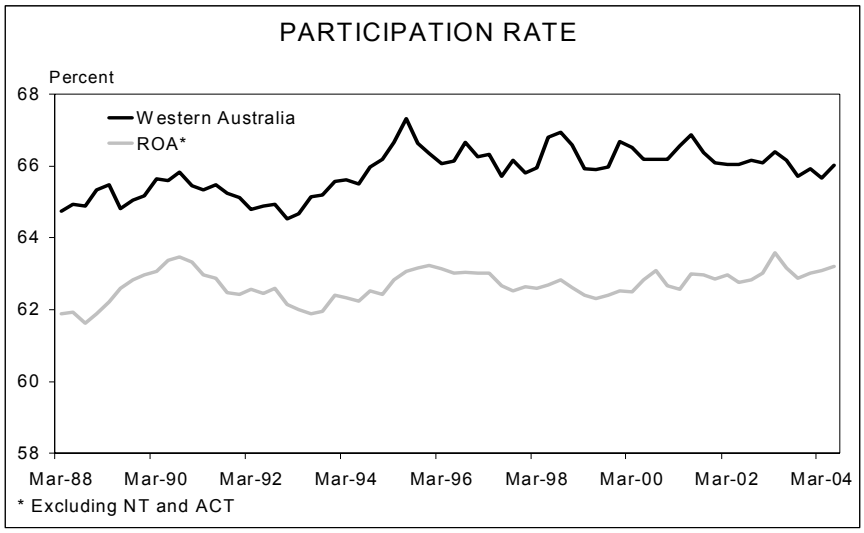

Source: ABS Cat No. 6302.0

One of the shortfalls with this measure is that the consistency in the wage differential (and even average wage) in nominal terms, does not necessarily reflect underlying changes in the real wage or cost of living. As is shown in the scenarios above, real prices can change between regions, while the wage differential (which is measured in nominal terms) remains fixed. Unfortunately, no data exist on the cost of living between regions.

In addition, despite the general consistency, the chart above shows that wage differentials do shift over time. Results from scenario two (where employment is fixed but the wage differential is endogenous) indicate that the increase in the wage differential is approximately $4.70 (based on 2003-04 data). This shift is within the range that is shown in the AWE chart above for a single period but is still a relatively significant shift of the differential that has existed previously. Again, as with the case of migration, it is unlikely that the shock of a single project would cause such a substantial shift compared with the largest magnitude of the overall shifts that have been experienced. However, as in the case of migration, it may leave some potential for shifts in the wage differential to play some part in the adjustment process.

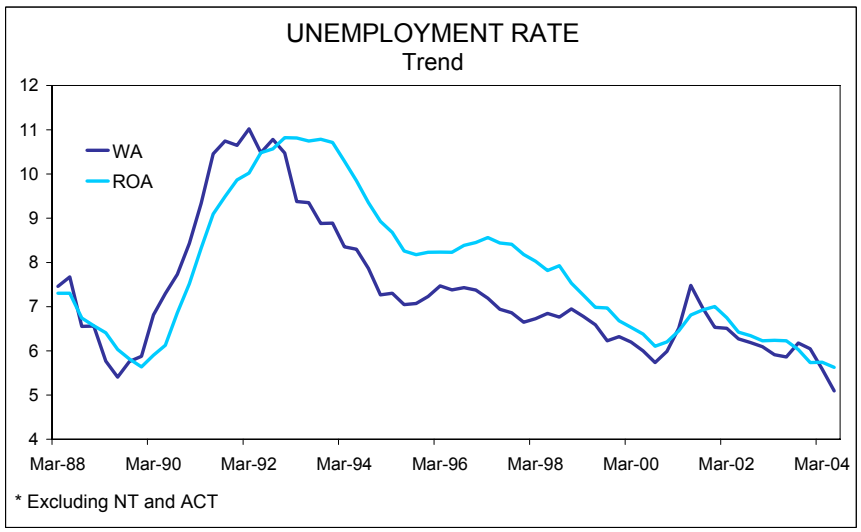
In regard to the third closure, the conventional assumption that the unemployment rate is unaffected by the advent of the project in the long term is sourced from conventional macroeconomic theory, which suggests that unemployment, will fall back to the natural long-run unemployment rate. Any increases or decreases in long-run unemployment are more likely to be the result of structural changes rather than the increase in demand (Dixon, Rimmer, 2002 p.32).

**Chart 6**




Source: ABS Cat. No. 6202.0

**Chart 7**




Source: ABS Cat. No. 6202.0

The charts above show that the unemployment rate and participation rate in WA often move independently from the ROA and national rates, which suggests that they are open to regional shocks, although this are usually considered to be a short term phenomenon. However, such movements do open up for a considerable period of time. Therefore, while fixed unemployment and participation rates are appropriate for a long-run simulation might be ok, changes in these variables would need to be accounted for in the short-run and dynamic simulations.

## STUDIES ON INTERSTATE MIGRATION

The assumption of Vickery and Debelle (1998) is used as the basis for this paper. This is that the Australian States can be considered as a series of small open economies with a fixed exchange rate, with each State subject to State-specific shocks in addition to national or aggregate shocks. When a State is hit by a shock, the option of State specific depreciation or appreciation or adjustments to monetary policy are not available.

As discussed earlier, the Vickery and Debelle study is set in a different context from that created by the ABC Metals project, in that its focus is the adjustment to an adverse state-specific shock that results in a rise in unemployment relative to the national average (Vickery, Debelle 1998 P.3). This is different to the simulations in this paper, in which either the unemployment rate or interstate migration are exogenous.

Harris and Todaro (1970) suggest that labour migration is dependent on: relative wages; relative employment prospects; housing costs; and other migration costs. In this regard, housing is the largest non-tradeable good in a household's consumption basket and is likely be a significant determinant in the real consumption wage across locations. House prices are also likely to increase or decrease with positive or negative shocks and this must be taken into account. Other migration costs are less quantifiable as they include, not just the economic cost of physically relocating, but the also the social costs of leaving networks, family and schools etc. Therefore, the decision to migrate is not purely an economic one.

Therefore, while higher wages might work as incentive to attract workers, other factors do need to be taken into consideration that might help or hinder the decision to move. Relocation costs are not inconsequential and, combined with the time and effort that is required to resettle, there might be a certain level of long term job security and/or an income threshold that would need to be reached before the new wage is sufficient to offset both the economic and social costs of moving and re-establishing in a new region. How much each shift in the wage differential or employment rate effects migration is worthy of further consideration.

This situation would possibly be amplified for Western Australia compared with some other States. Western Australia is further away from and more isolated than other regions and, therefore, the implications of moving are potentially greater.

Furthermore, projects such as that represented by the ABC Metals scenario are unique to other scenarios as they are often in remote areas and so (at least in regards to the direct employment that is created) people would often be considering moving to a place that has fewer amenities and services than the one they are leaving.

Therefore, the direct employment demand that is created is often in an area that will have significant non-economic costs to consider when relocating. For this reason, whether the same economic shock would have the same impact on labour migration, regardless of the location of the project is an important question.

Groenewold (1992) found that unemployment rates between States do not converge in the long-term, suggesting that labour is not perfectly mobile. In contrast, Debelle and Vickery (1998) conducted cointergration tests between the unemployment rate of each State and the national rate and estimated a cointegrating vector autoregression (VAR) between the eight States and Territories' unemployment rates. They concluded that the labour market does act to decrease employment differentials between States over time (Debelle, Vickery, 1998, p.23).

However, closer examination of Debelle and Vickery's test results indicate that, for the cointegrations tests, only New South Wales and Victoria could be comprehensively said to move with the national rate, with doubt over the smaller State and Territories' rates. This could be due to the fact that New South Wales and Victoria make up 60% of the national employment rate (in 2002-03). Additionally, the cointegrating VAR found one to two cointegrating relationships (depending on the tests chosen) which could also represent a relationship between the two largest States.

Nevertheless, the study also shows that a 1% shock in negative employment causes long run out migration, with nearly two-thirds of the net migration taking place within three years of the shock. Out migration then flattens out, although it is seven years after the initial shock before out-migration is complete.

However, there is little research (able to be found) that identifies a relationship between out-migration that might occur because of a comparative increase in wages (as occurs in MMRF-Green) without any deterioration in conditions in the home region. That is, while there seems to be some correlation between out-migration, should employment prospects worsen in the home region, if employment prospects remain constant, then are people as likely to move for higher wage?

This is particularly relevant in our current economic climate where unemployment rates are at near record lows across Australia. In this regard, Chart 4 shows that net interstate migration has stayed negative during the recent extremely robust economic expansion in Western Australia. This is in contrast to the early to mid-1990s when an economic expansion in WA and poor conditions in other States (especially Victoria) led to substantially positive net interstate migration.

## CONCLUSION

This aim of this paper was to highlight the fact that there is a lack of understanding regarding labour market migration in response to different types of economic shocks and raise some issues that should be examined further in order to more fully understand the adjustment mechanisms of the labour market to regional shocks.

As the various simulations show, closures for the different labour market assumptions do impact on the results produced by GE model simulations at both the State and national levels. This means that we are making policy decisions based on results whose underlying assumptions are uncertain.

By using a hypothetical project to test the impact of the various assumptions, it is also evident that the adjustments that are produced by the model are not always entirely realistic, particularly in terms of the scale of adjustment that is assumed relative to historical movements in the data.

In addition, there are few studies that examine the relationship between regional shocks and long-term labour market adjustment patterns in Australia. While the issue is obviously very complex, with many factors that hinder the ability to determine clear relationships between variables, it is evident that further study in this area would be of benefit.

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ATTACHMENT A

**MMRF-GREEN: BACKGROUND ASSUMPTIONS FOR LABOUR MARKET CLOSURE SIMULATIONS**

The MMRF-Green model is a multi-regional model developed by the Monash University Centre of Policy Studies (CoPS), with Australia separated into different regions. In this case, the two-region model is used, with the regions being 'Western Australia' (WA) and the 'Rest of Australia' (ROA).

One of the assumptions in the MMRF-Green model is that additional capital is domestically owned and, therefore, returns to capital remain in the domestic economy in the same proportion as exist before a shock. In actuality, it is much more likely that a large proportion (if not all) the funding of capital for large projects like ABC metals is from a foreign source and so returns will flow to a foreign entity rather than into the domestic economy.

If consumption is modelled as a function of GNP rather than household income, this assumption has potentially significant implications when determining the impact of the project on the economy. In this regard, domestic returns to capital are included as part of GNP whereas foreign returns are excluded. The assumption that all returns to capital remain in the domestic economy in the same proportion as previously can significantly increase the expected impact on consumption.

To ensure that this assumption would not distort the overall results of the paper, the three simulations used for this exercise were also run assuming the other extreme; that all capital adjustment in the economy was completely foreign owned. This meant that none of the returns to capital for the ABC metals project remained in the domestic economy and, as a result, there would be no direct impact on GNP. While this did impact on the results and served to moderate the effects increase in GNP (and, therefore, consumption), the basic results from the different scenarios remained unchanged (although the degree of change was diminished). In light of this fact, the assumptions that returns to capital are regarding capital were noted but left unchanged for this main part of the paper.

For the purpose of the project, the model was also modified to enhance the equation relating to the rate of return to capital (E_del_f_ror). The original equation allows some industry flexibility around the economy-wide assumption that the economy-wide rate of return reverts to its natural level in the long run, and that it has a relationship between the amount of capital and the rate of return that is received in each industry relative to economy-wide levels.

This works without problem for examples like a tax change where each industry starts from its base level of capital. However, when a significant and discrete amount of capital is added (as with the ABC metals project), then the economy's aggregate capital stock (k(t)) increases dramatically. This means that for other industries, even if their rate of return falls (which would normally indicate a fall in their capital stock), the crowding out that we would expect does not occur. The solution to avoid this was to take out any reference to capital stocks in the equation and to instead fix each industry's long-run rate of return at the economy-wide average.