AN ANALYSIS OF DIVERSIFICATION STRATEGIES IN REGIONAL QUEENSLAND USING A TWO-REGION, PORTFOLIO SELECTION MODEL

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ABSTRACT: This paper presents results from the application of a portfolio selection model to Queensland data. The model presented here comprises two-regions, being Brisbane-Moreton and the Rest of Queensland. The reason for this choice of regional disaggregation rests on the recent policy discussion in Queensland, where concerns about congestion in the south-east of the state have resulted in the consideration of policies aimed at encouraging settlement outside this region. While such a policy may reduce population pressures in the south-east, there may be implications not only for regional, but also state economic growth. Traditional portfolio selection models allow the evaluation of regional development strategies, by simulating the impact of changes to the employment structure on regional growth and stability. The additional insight of the two-region formulation used here, is how the geographic location of activity affects overall state growth and stability.

1. INTRODUCTION

For the most part, regional employment instability is considered undesirable. Employment fluctuations impact on government fiscal balances, and there will also be consequences for private investment and expenditure, with the uncertainty likely to result in a decline in both of these variables (See Spellman 2006). These perceived problems have led to numerous studies of regional instability. Many of these efforts to analyse instability have regressed index measures of regional diversity, such as the entropy, ogive, or national proportions measure, against measures of regional instability (for a recent example of this approach, see Izraeli and Murphy 2001). While the indices used in such studies provide a measure of regional industrial diversity, they provide no insight into the possible trade-off between regional diversification strategies and employment growth and instability. This limitation is addressed by the portfolio selection framework. Rather than attempting to measure the diversity of the regional economic base in isolation, the portfolio

selection framework explicitly considers the link between regional diversity, and the consequences for regional growth and instability. This is achieved by using the observed relationships between the various components of the regional economy.

Portfolio selection models originated in the financial literature (see, for example, Markowitz 1952). These models attempt to measure the portfolio of assets yielding the greatest return to the investor for a given level of risk. Conroy (1974) introduced the methodology into regional economic analysis, where it was applied to the problem of minimising employment instability. In the regional setting, the portfolio becomes employment or income by industry sector, with the return to be maximised being the region's economic growth, subject to some level of employment or income instability. In this way, the portfolio selection framework permits the simultaneous consideration of the level of regional employment and the instability of the regional economy. Thus the framework allows the calculation of a regional efficiency frontier i.e., a frontier where regional instability is minimised for given rates of employment growth. These boundary solutions take into consideration the interactions of different parts of the regional economy, so that while individual industries may be unstable, they are collectively stable. This is achieved by considering the variance of each industry's employment, in addition to its covariance with other industries in the regional portfolio.

While the methodology is not without its limitations, i.e., as noted by Sherwood-Call (1990) regions do not have the same degree of control over their portfolios as do investors, and there may also be high costs and significant lags associated with changing a region's sectoral mix, the model provides valuable insights into the consequences of economic diversification. For example, Siegel, Johnson and Alwang (1995) note that the model highlights the role of inter-sectoral relationships, and the need to consider growth and diversity simultaneously. Previous work in this vein in Queensland focussed on the impact of diversification at the state level (see Trendle 1999). The current work extends this analysis, looking at the State and sub-state consequences of diversification strategies. This is especially relevant, given the ongoing focus of policy aimed at encouraging population growth outside the south-east corner of Queensland.

The following section of this paper provides an outline of economic performance in Queensland, focussing on the differences in regional performance in south-east Queensland, and the balance of the state over the 1988-89 to 2007-08 period, the longest period for which employment data with a consistent industry structure is available. This is followed in

section 3 with an outline of the analysis of regional instability, including a discussion of portfolio selection models, while section 4 presents a discussion of results from the two-region model, including its policy implications. A brief conclusion is presented in section 5.

2. ECONOMIC PERFORMANCE OF THE QUEENSLAND ECONOMY

The Queensland economy has grown rapidly over the last twenty years. Gross State Product per capita grew at an annual growth rate of 2.2% over the 1989-90 to 2008-09 period, behind only Western Australia. In 1989, the Queensland population stood at 2.9 million, and increased to 4.4 million by 2009, an annual average growth rate of 2.2% p.a.. Interstate migrants have contributed significantly to Queensland's population growth, with the strong performance of the Queensland labour market providing an incentive for individuals and households to relocate to the state.

An important point masked by these aggregate figures is the geographic variation in growth. For example, while Queensland's population grew at an annual average of 2.4% p.a. over the 1988-89 to 2007-08 period, much of this growth was in the south-east corner (here defined as the Brisbane and Moreton (BM) Statistical Divisions). Over this period, the population of BM grew at an annual average rate of 2.7%, while the population of the rest of Queensland (ROQ) grew by only 1.9% p.a..

Not only was the level of growth within the BM and ROQ regions different, but there were some differences across industries within these regions, while the industry pattern also differed across these two regions. Figure 1 provides details of the industry structure of the two regions used in this study as at 1988-89. The largest difference is the share of employment that Agriculture, Forestry and Fishing made to total employment (15.1% in ROQ, compared to 2.5% in BM). Other large differences occurred in Property and Business Services, which accounted for 9.4% of employment in BM and only 4.7% in ROQ, and Manufacturing, which accounted for 14.2% of employment in BM and 9.8% in ROQ.

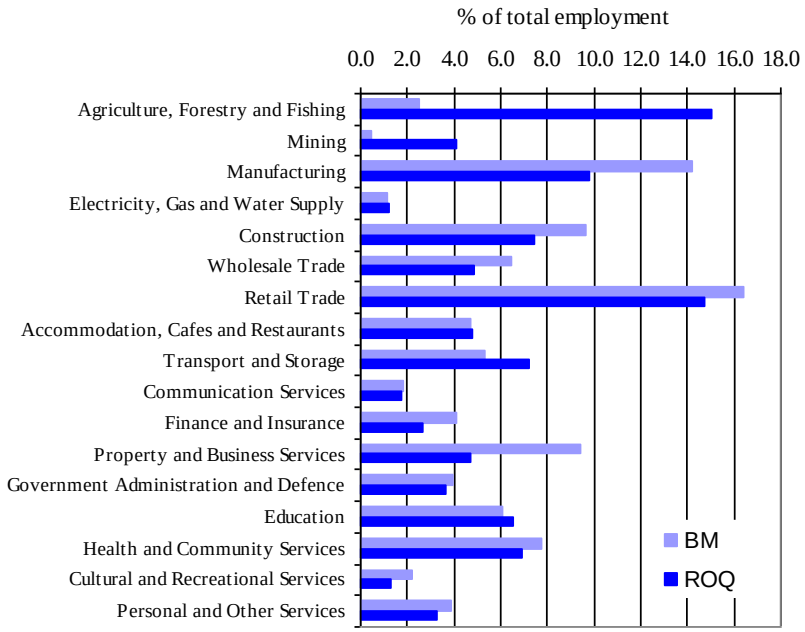

Figure 1. Share of total Employment by Industry 1988-89. Source: AbS Labour Force Survey

Shift-share decomposition provides another perspective of the change which has occurred across these regions. The shift-share technique decomposes employment growth into a number of components in an attempt to explain sources of regional growth. The technique has been extensively used in regional analysis, and though not without its limitations, it remains a popular technique (see Holden, Nairn and Swales 1989, for an evaluation). Table 1 provides a shift-share decomposition of employment growth in the BM and ROQ regions. The decomposition procedure adopted here breaks down regional growth into three components, the National Share (*NS*), Industry Mix (*IM*) and Regional Share (*RS*) components, with these components being defined as;

$$NS_i = E_{ir} e_n \qquad (1)$$

$$IM_i = E_{ir}(e_{in} - e_n)$$

$$RS_i = E_{ir}(e_{ij} - e_{in})$$

$$NS_i = E_{ir} e_n \quad (1)$$
$$TSi = NS_i + IM_i + RS_i$$

Where NS_i, IM_i , RS_i and TS_i refer to the National Share, Industry Mix, Regional Share and Total Shift recorded by the *i*th industry, *E* refers to the employment, *e* the employment growth rate and the subscripts *r,* and *n* refer to the region, and the reference area (Australia).

Table 1 provides a shift-share decomposition of employment growth in our two regions. We can see that total employment growth in BM was 675.9 thousand jobs over the 1988-89 to 2007-08 period, compared to growth of 240.6 thousand jobs in ROQ. For both regions, the largest single contribution to growth was made by the *NS* effect. The *NS* component of the shift-share decomposition measures the regional employment change that would have occurred if regional employment had grown at the same rate as the reference area (Australia in this application). The results indicate that if BM employment grew at the same rate as national employment, an additional 308.2 thousand jobs would have been created over the period, compared to the actual employment growth of 675.9 thousand jobs, while for the ROQ region, growth at the national rate would have seen an additional 188.1 thousand jobs, compared to actual growth of 240.6 thousand jobs.

The *IM* component measures the industrial composition of the region, and reflects the degree to which the local area specialises in industries that are fast or slow growing at the national level. Thus a region containing a relatively large share of industries that are fast growing nationally, will have a positive proportional shift. Thus the negative contribution made by the *IM* component for ROQ, indicates a concentration of industries which have grown relatively slowly at the national level. Chief among these is Agriculture, which had a contribution of -40.6 thousand jobs in ROQ, compared to only -11.1 thousand jobs in BM.

The *RS* component of the shift-share decomposition, measures the change in a particular industry in the region due to the difference between the industry's regional growth rate, and the growth rate for the reference area (Australia in this application). This component indicates growth or decline in industries due to differences in growth rates of the same industry between the region and the state. Overall, the results presented in table 1 indicate that BM experienced strong economic growth relative to ROQ, with the largest contribution to regional growth being made by the *RS* effect (323.4 thousand jobs.) In contrast, the *RS* effect was weaker in ROQ, contributing only 70.3 thousand jobs.

Table 1. Shift Share Decomposition of Total Employment in Qld, 1988-89 to 2007-08. Source: the Author.

	Brisbane-Moreton				Rest of Queensland			
	NS	IM	RS	TS	NS	IM	RS	TS
Agriculture, Forestry and Fishing	7.7	-11.1	-0.7	-4.0	28.3	-40.6	7.0	-5.3
Mining	1.5	0.3	5.8	7.6	7.7	1.7	-1.6	7.8
Manufacturing	43.8	-53.4	39.3	29.6	18.4	-22.5	17.8	13.8
Electricity, Gas and Water Supply	3.5	-5.6	4.7	2.6	2.3	-3.8	3.8	2.3
Construction	29.7	20.8	32.4	82.9	14.1	9.9	17.7	41.6
Wholesale Trade	19.9	-22.9	11.5	8.5	9.1	-10.5	3.3	1.9
Retail Trade	50.5	8.1	44.7	103.4	27.7	4.4	4.6	36.7
Accommodation, Cafes and Restaurants	14.4	13.3	8.1	35.8	8.9	8.2	-1.7	15.5
Transport and Storage	16.4	-3.0	21.2	34.6	13.6	-2.5	-7.1	4.1
Communication Services	5.6	-2.1	4.8	8.4	3.3	-1.2	-0.8	1.4
Finance and Insurance	12.7	-7.6	7.2	12.2	5.1	-3.0	-2.5	-0.5
Property and Business Services	29.1	64.1	28.8	122.0	8.8	19.4	6.8	35.1
Government Administration and Defence	12.1	2.4	20.3	34.8	6.9	1.4	7.5	15.8
Education	18.7	8.2	26.4	53.3	12.3	5.4	7.9	25.6
Health and Community Services	23.8	18.6	49.8	92.2	13.0	10.1	7.3	30.4
Cultural and Recreational Services	6.8	9.4	10.2	26.5	2.4	3.3	4.0	9.6
Personal and Other Services	11.9	4.9	9.0	25.8	6.1	2.5	-3.6	4.9
Total employment	**308.2**	**44.3**	**323.4**	**675.9**	**188.1**	**-17.8**	**70.3**	**240.6**

This disparity in economic performance, particularly labour market performance, is highlighted by the regional difference in the *RS* effect. Regional characteristics of BM have according to this decomposition

technique, been driving employment growth, resulting in growth above what would be expected given the performance experienced at the national level. There is strong evidence that regional employment growth drives population growth, though there may be a two way causation (see Carlino and Mills 1987 and Clark and Murphy 1996), with some evidence of this found in regional Queensland (see Trendle 2009). Thus the strong performance of the BM labour market has caused problems, particularly bottlenecks in infrastructure, and recent policy provides incentives for new arrivals to settle outside the BM region.

Another perspective of the differences in performance between the two regions is shown by figure 2, which provides details of regional (quarterly) growth for BM and ROQ. Overall, employment growth exhibits more variation in the ROQ region. The variance for the employment growth rate over 1987(4) and 2008 (3) is 1.7% in BM and 3.2% in ROQ.

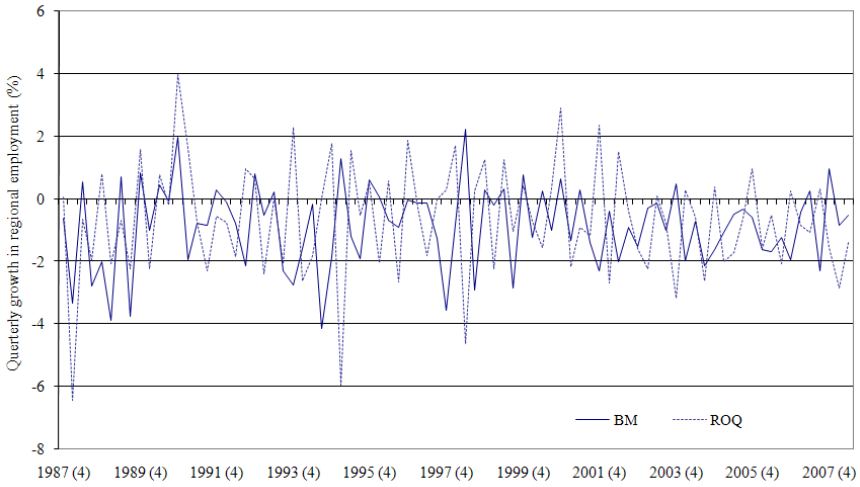

Figure 2. Variance of quarterly regional employment growth. Source: ABS Labour Force Survey

3. THE ANALYSIS OF REGIONAL INSTABILITY - A REVIEW

The causes and effects of regional economic instability have been the concern of regional economists for a considerable time. Unlike macroeconomics, where instability and stabilisation policy is concerned with macro type monetary and fiscal policy and instability is concerned with a wide range of macroeconomic aggregates, for the regional

economist instability is concerned with economic behaviour at a regional level. The analysis of instability is generally directed at the study of the most easily observable regional variable, being employment, or if data allows, employment by industry. Jackson (1984) and Attaran and Zwick (1989) note that interest in regional instability goes back at least 60 years.

A recurrent theme in the regional economics literature dealing with regional economic instability, is the relationship between the sectoral composition of regional employment and regional economic growth and instability. Implicit in the literature is the assumption that a diverse regional economy will have more stable employment growth, while shielding the economy from fluctuations in the market for specific products produced by the region. If industrial diversity is to play a role in policy formation, the nature of the relationship between regional diversity and growth needs clarification. Complicating the issue, is the existence of a variety of measures of industrial diversity, with the literature having defined and measured diversity a number of ways. These measures include; the percentage of employment in durable goods production, the national average, the ogive and entropy measures of diversity and the portfolio theoretic approach.

Jackson (1984) notes that the percentage of employment in durable goods manufacturing was used in many early studies of economic diversity. This measure is assumed to be a proxy of a region's reliance on export income, hence, its supposed sensitivity to national economic fluctuations. Durable goods are characterised by a high income elasticity of demand, and during an economic downturn, consumers are less likely to purchase such goods. This results in lower levels of production and possible layoffs, not only in the specific industry, but in those industries with forward and backward linkages to that industry.

Jackson (1984) notes that the ogive, and national average measures are logical inclusions in the explanation of regional employment instability, in that they serve as proxies for a region's dependence on imports. The assumption required to make the link between these measures of regional diversity, is that the lower the short-run elasticity of demand for imported goods, and the greater the ratio of imported consumption to regional income, the greater will be that region's sensitivity to cyclical fluctuations. Implicitly, a diverse regional economy is expected to have both a high income elasticity of demand for imported goods, and a low ratio of import consumption to regional income, since all industrial activities would be sufficiently represented in the region.

The national average (*NA*) measure, refers to the sum of regional deviations from the national percentages in industrial categories. The

greater the sum of these deviations, the greater is the industrial specialisation, or the lower the industrial diversity. The computational formulae for this measure is;

$$NA = \sum_{i}^{N} (e_i / e_t - E_i / E_t) \tag{2}$$

Where ;

N = the number of industrial sectors in the region.

e_i and e_t = the employment in the industry and the total employment in the region;

E_i and E_t = the national employment in industry i and total national employment respectively.

For both the ogive (*OG*) and entropy (*EN*) measure, it is assumed that for a region to be diverse, an equal percentage of regional employment should be found in each industrial category. Deviations from this condition are summed, and the interpretation is similar to the national average or coefficient of specialisation. The computational formulae for these two measures are;

$$OG = \sum_{i}^{n} (e_i / e_t - 1/N) \tag{3}$$

$$EN = -\sum_{i=1}^{n} p_i \log_2 p_i \tag{4}$$

In the entropy measure of diversification, p refers to the proportion of employment in each industrial sector.

Jackson (1984) notes that each of these measures is normative and assumes that every region, regardless of resource advantage, infrastructure development, agglomeration economies, or factor endowment should conform to that norm. For example, he notes that implicit in analysis using the national average measure, is the assumption

that the national economy is optimally diversified, and an industrially diversified region's employment percentages should then replicate the national economic structure. The norm in the entropy and ogive measures is that of an equal concentration of employment in each of that region's industrial sectors (see Attaran and Zwick 1989). In contrast, the percentage of durable goods production in a region as a measure of diversity, implies that there exists a consistent optimal concentration of employment in durable goods production for every region.

Another measure of industrial diversity is provided by the portfolio theoretic approach. Rather than attempting to measure the diversity of a regional economic base in isolation, the portfolio selection framework explicitly considers the link between regional diversity and the consequences for regional growth or decline and stability or instability. This is done by using the observed relationships between the various components of the regional economy. Portfolio selection models attempt to measure the portfolio of assets that yield the greatest return to the investor for a given level of risk. These models have their origin in the financial literature, particularly Markowitz (1952). Conroy (1974) introduced this methodology to regional economic analysis where it was applied to the problem of minimising employment instability, subject to some rate of employment growth. In a regional setting, the portfolio becomes employment or income by industry sector, and the return to be maximised is the region's economic growth subject to some level of employment or income instability. Data limitations here, and for regional Australia in general, limit analysis to employment data.

In order to construct a portfolio selection model, a time series of employment data, disaggregated by industry sector is required. The Australian Bureau of Statistics (ABS) provides industry data, classified according to the Australian and New Zealand Standard Industrial Classification (ANZSIC). The data used in this application spans the period 1988(Q3) to 2008(Q3). At the sub-state level, this data is available only at the first division level of disaggregation, with seventeen industries. For this reason, the model is limited to this level of disaggregation. With the existing data it would be possible to develop models for each ABS Labour Force Region of Queensland, however, only a two-region model comprising BM and ROQ is considered. The justification for this level of regional disaggregation is that the discussion of regional decentralisation has focussed on encouraging settlement outside of the south-east corner (the BM region in our model) of the state.

The first stage in the creation of a portfolio selection model, is the construction of an industry variance-covariance matrix. The approach

taken by Conroy (1974 and 1975), Barth *et al* (1975), Board and Sutcliffe (1991) and Lande (1992), and used here, is to fit a quadratic time trend to the time series for each industry using ordinary least squares. An estimate of the variance-covariance matrix used in portfolio analysis is constructed from the estimated residuals of this equation. This approach has been criticised by some authors (see, for example, Hunt and Sheesley 1994), who suggest that econometric rigor dictates the use of a stationary time series. These authors use statistical techniques to choose autoregressive, integrated moving average (ARIMA) models, which are used to generate the residuals from which the variance-covariance matrix is derived. However, other authors such as Wagner (2000), argue that the use of a stationary series implies that the correlation matrix only captures unanticipated fluctuations. Because stabilisation policy is concerned with both anticipated, and unanticipated fluctuations in the regional economy, the simpler methodology is used in the current analysis.

The portfolio selection model is derived from the variances and covariances of employment in the individual sectors of the Queensland economy. The variance of returns, measures the risk involved in the stochastic process of the individual industries. In the analysis, it is assumed that investors and regions are averse to risk. Following Lande (1992), the portfolio selection model can be specified as:

Minimise:
$$\sigma_p^2 = \sum_j \omega_j^2 \sigma_j^2 + \sum_{i \neq j} \sum_{i \neq j} \omega_i \omega_j \sigma_{ij} \tag{5}$$

subject to:
$$\sum_i \omega_i = 1 \tag{6}$$

and:
$$\sum_i \omega_i g_i = G \tag{7}$$

Where:

σ^2_p = the portfolio variance for the industrial mix of a region

$\sigma^2_{i,\,ij}$ = covariance of regional employment for industry(i) and industry between industries (ij)

$\omega_i\ \omega_j$ = proportions of regional employment associated with industries i and j

g_i = the growth rate of sector I, i = 1,...I.

G = the value of total employment

From equation (5), it is clear how portfolio theory affects the choice of industries chosen in developing a diversification strategy to reduce employment instability. If policy makers have the choice of adding one of two industries, one of which has a large variance, and the other a low variance, the better choice might be the high variance industry. This is because total portfolio variance depends not only on industry variance, but on the weighted sum of all covariances with other industries in the portfolio. If employment in the industry with the greater variance is uncorrelated with employment in the other industries in the portfolio, or if it has large negative covariances with some or all of them, it might make a greater contribution to reducing total portfolio variance than the industry with the lower variance.

Computation of the portfolio variance, makes possible an analysis of the effect of changes in the industrial structure on the stability of the regional economy. These effects can be derived by changing the weights of particular sectors. In this framework, the rate of growth of employment is the weighted average of the actual employment growth rates in the various sectors of the regional economy.

The minimisation of the nonlinear objective function σ^2_p, in (5), provides the optimal set of weights for the region under consideration. The constraints of this objective function, ensure that the optimal solution will be within meaningful bounds. The first constraint (6) requires that sector weights sum to one. This prevents a solution which uses more or less than 100% of the regional employment. The second constraint (7)

makes possible the imposition of a growth constraint on the region. The value of total employment growth G, can be varied so as to make possible the estimation of the relationship between employment growth and instability.

In order to solve the two-region model, the variance-covariance matrix comprises four block matrices as shown in (8). The first block matrix (σ^{BM}_{ij}), is a matrix of industry by industry correlations for the Brisbane-Moreton region. The block matrix adjacent to this along the top row i.e., $\sigma_{BMiROQj}$, is a correlation matrix for residuals from industry employment i in BM and industry j in ROQ[1]. The same matrix follows in the first block of the second row. The final matrix i.e., σ^{ROQ}_{ij} is a matrix of industry by industry correlations for the Rest of Queensland region. Each of these matrices comprises 17 rows and columns.

$$\begin{bmatrix} \sigma^{BM}_{ij} & \sigma_{BMiROQj} \\ \sigma_{BMiROQj} & \sigma^{ROQ}_{ij} \end{bmatrix} \tag{8}$$

4. SOLUTION TO THE TWO-REGION MODEL

In the current analysis, the model was solved using standard spread-sheeting software, capable of dealing with quadratic programming problems. The models have been solved using the constraint set shown in equations (6) and (7), along with an additional constraint, restricting movements in employment shares to be less than 10% of their initial value respectively. This additional constraint was introduced to provide some realism to the model solution. With no restriction on the amount of adjustment allowed by any industry, the solution may see several industries disappear from the regional portfolio. It is unlikely that a State Government would undertake a policy that would see an entire industry disappear, even one responsible for instability in the regional portfolio. Furthermore, State Governments, as a rule, do not have unlimited resources. Thus limiting movement in employment shares recognises the financial constraints faced by policy makers[2].

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[1] Thus, in the two region model, it is not trade flows that link the two regions, but observed relationships between movements in employment, i.e., their correlations as shown in the two off-diagonal block matrices shown in equation 11.

[2] This aside, the author acknowledges that this restriction is somewhat arbitrary, though is a frequently used convention in the literature, see, Board and

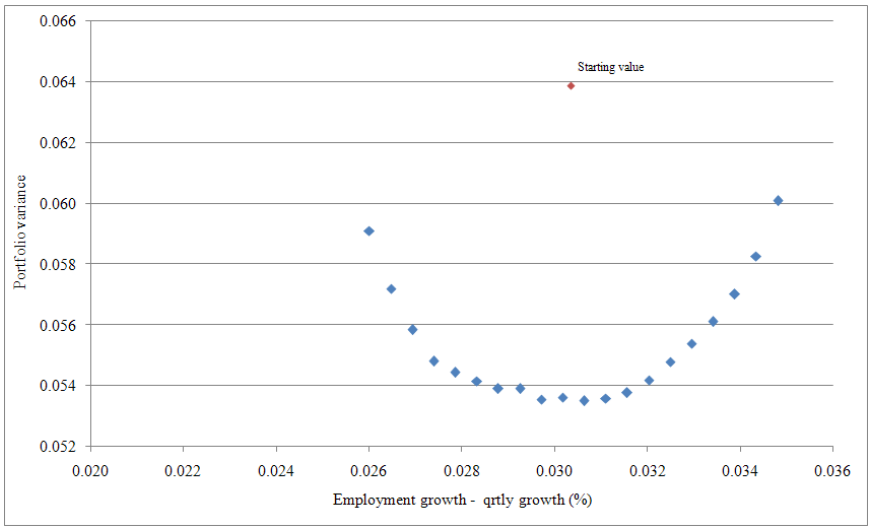

Figure 3. Queensland Regional Efficiency Frontier from a Two-Region Portfolio Selection Model. Source: the Author.

Figure 3 provides the regional efficiency frontier of the model under the constraint setting. The figure shows the efficiency frontier, along with the position implied by the starting values used in the model solution. These starting values have been derived from average employment shares for the five years to September 2008, while G_i is taken as the annual average employment growth by industry over this period. This five year average was chosen on the basis that five years is a long enough period to derive an average growth rate, while being a short enough period to incorporate information about recent changes to the structure of the economy. The regional efficiency frontiers have been generated by solving the model for different levels of employment growth (G) at twenty equally spaced points, after the maximum and minimum values of G were found, given the constraint set imposed on the model.

A point to notice when looking at the solutions derived from the model, is that all boundary point solutions provide a lower measure of employment instability, in terms of lower portfolio variance, than that yielded using the model's starting values based on industry structure and growth over the five years to September 2008.

A summary of the details of this model's results are presented in figure

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Sutcliffe (1991), Hunt and Sheesley (1994) and Lande (1992).

4. The first panel, (4a) provides details of the relationship between employment instability and employment diversity. Again, in this figure it can be seen that all boundary point solutions imply less instability than the starting point values. The results also indicate that thirteen of the twenty boundary point solutions imply greater employment diversity than at the starting point. It is also worth noting that the solutions on the efficiency frontier implying less employment diversification than given by the shares of average employment for the five years to September 2008, are all at points where employment growth is higher than that experienced in the five years to September 2008. Here, employment diversity is represented by the entropy index, derived from the employment by industry by region shares, implicit in the model solution. The entropy index was chosen, only because its interpretation is widely understood: the closer the measure moves to unity (1), the more equal the distribution of employment. If the shares of employment in each industry are identical, the measure sums to unity.

This point is made clear by the information presented in the diagram (4b). Here it is seen that all points below the starting point on the horizontal axis (index of diversity), lie above the starting point on the vertical axis (employment growth). If we confine policy discussion to points on the regional efficiency frontier where employment growth is no lower than the average for the five years to September 2008, the results from the model solution provide no clear direction for debate on the appropriateness of industrial diversification strategies. Overall, eleven of the twenty points on the regional efficiency frontier have an employment growth rate above that implied by the starting value. Of these eleven boundary point solutions, six have measured diversity lower than at the starting value, i.e., a less equal distribution of employment. A further issue is that these points will be on that area of the efficiency frontier where employment growth is rising slowly, while instability is rising sharply.

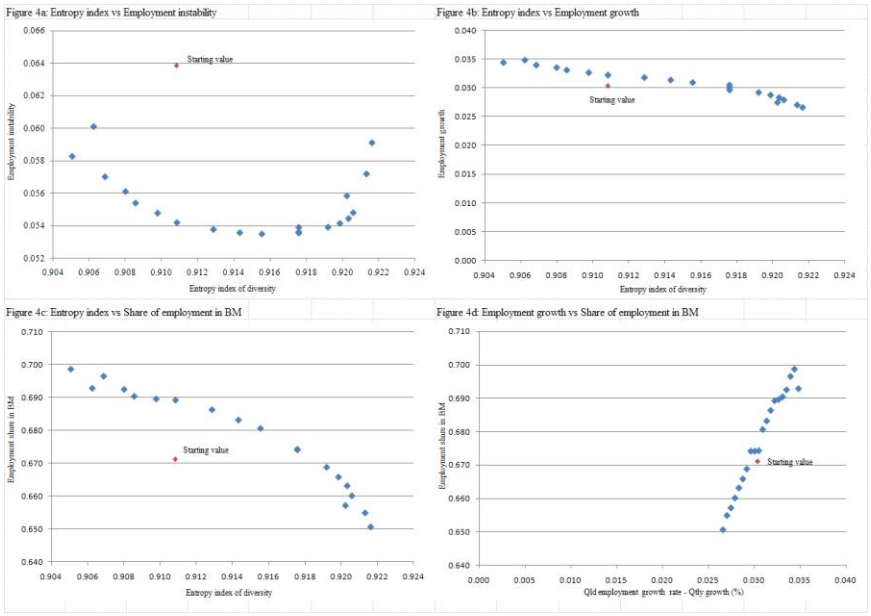

Figure 4: Summary Results from the Two-Region, Portfolio Selection Model. Source: the Author.

Figure 4c presents the relationship between the share of employment in Brisbane-Moreton and the entropy index of diversity. The results presented in this figure suggest that higher measures of employment diversity are associated with a lower proportion of total employment in the south-east of the State. However, given the relationship shown in figure 4b implies lower measured employment diversity is associated with higher growth, it is unsurprising that figure 4d indicates there is a strong positive relationship between the proportion of total Queensland employment in the south-east of the state, and total employment growth for Queensland. These results suggest that policies aimed at encouraging the geographic distribution of economic activity face a trade off, in that they can only be achieved at the expense of lower rates of employment growth for Queensland.

5. CONCLUSION

Economics approaches the issue of diversification from two perspectives.

Traditionally, economic theory suggests that growth should be derived from economic specialisation based on comparative advantage. Alternately, regional development theory and practice is often predicated on the idea that diverse regional economies enjoy higher rates of economic growth and lower levels of instability. On the surface then, it appears that policy makers are being forced to choose between two polar goals of growth and stability, a point often overlooked in the regional science literature and policy circles, but reflected here in the findings of the model.

The policy implications of the two-region model presented in this work, are far from clear. All points on the efficiency frontier, imply a lower portfolio variance than that given using the model's starting values. However, a number of interesting points arise in the solution set for this model. Firstly, the solution set implies that policy makers can only promote a greater proportion of economic activity outside the south-east corner of Queensland, if they are prepared to accept a lower level of employment growth for the state. Thus, the boundary point solutions imply a greater geographic concentration of activity in Queensland. This is especially relevant, given the recent and ongoing focus of policy aimed at encouraging population growth outside the south-east corner of Queensland (see, for example DIP 2010).

Furthermore, in terms of the efficacy of regional diversification strategies, the results from the model are somewhat ambiguous. With discussion again confined to the boundary point solutions, where employment growth is above the annual average for the five years to September 2008, the results for five of the eleven boundary point solutions imply a greater level of industrial diversification, while the remaining six points imply a lower measure of regional diversity. The policy choice is found to imply a trade-off between employment growth and stability, with the choice of diversification strategy depending on policy makers' preferences for risk. For example, less risk averse policy makers may favour positions towards the right hand end of the regional efficiency frontier, with associated high levels of both employment growth and volatility in employment growth.

When confronted with a similar finding in the US setting, Wagner and Deller (1998), suggest that rather than being contradictory, the simultaneous pursuit of growth and stability can be viewed as short and long-run goals respectively. In the short-run, policy is focussed on growth, while long-run policy promotes growth and stability. As stability and diversity increase, so should the potential for growth. However, taken at face value, the results presented in the current study argue for a more cautious appraisal of diversification strategies. The model results suggest

that such policies are no magic bullet, instead, the potential for trade-offs must be recognised. These trade-offs between growth and stability are found to be affected, not only by the portfolio of industries a region possesses, but at the state level, by the eventual location of economic activity.

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