Institution: Plymouth University

Unit of Assessment: 19 Business and Management

Title of case study: Regional economic impacts: input-output models and spatial econometrics

1. Summary of the impact (indicative maximum 100 words)

This impact case study is based on research concerning the estimation of regional economic impacts through input-output models and spatial econometrics. The research resulted in the distribution of a free modelling software package to decision-makers throughout the South West region and has had policy impacts in terms of the influence of advice, data, and reports provided to a range of organisations including the South West Regional Development Agency, Plymouth City Council, and several other local councils and private sector decision-makers.

1. **Underpinning research** (indicative maximum 500 words)

The underpinning research has been primarily undertaken by Paul Bishop (currently Professor of Economics, Plymouth University and located at Plymouth for the entire case study period). The genesis of the research was a Ph.D. undertaken by Dr Steven Brand at the University of Plymouth (awarded 1998) Dr Brand is now Associate Professor of Economics, Plymouth University, located in Plymouth for the entire case study period apart from 1996-1998 when at University of Cardiff. The Ph.D. was supervised by Professor Bishop and entitled *A Reassessment of the Hybrid Approach to the Construction of Regional Input-Output Tables*. Theoretical innovations related to this research were associated with novel methods of estimating regional trade [1], the use of locations quotients in IO models [2] and the reappraisal of the use of such models for local impact analysis [3]. Much of the research took place within CEMLEF by the Economics Research Group in co-operation with Professor Peter Gripaios (currently emeritus Professor of Economics, formerly Professor of Economics - located at Plymouth during entire case study period – retired 2009).

Our expertise in regional modelling was recognised by the award of substantial funding (totaling £437,000) in the form of research grants from the South West Regional Development Agency (SWRDA), primarily for the construction of regional accounts, the building of input-output models and further theoretical research on IO models and spatial linkages. The Regional Accounts brought together the best sources of published and unpublished economic data in a structured way. This lowered the costs of regional economic analysis whilst maximising the usefulness of otherwise disparate resources (e.g. facilitating productivity analysis or economic impact analysis). The Accounts quickly became an integral part of economic intelligence and analytical capacity within the region. Software based on the model has been made available as a public good throughout the region since the mid-2000s and has been used by SWRDA, local authorities and other private and public organizations. Insights from the research were utilised and further developed in the construction of Welsh Input-Output tables (in collaboration with University of Cardiff) and for evaluating the impact of foreign manufacturing. The adaptable nature of the modelling techniques can be demonstrated by reports produced for a range of clients during the 2000s including economic assessment of the move of the Met. Office to Exeter, the sinking of HMS SCYLLA as a diving attraction, a proposed Marine Science Park and the case for a New Devon Airport. The development of the IO model was the centre of a wider research program developed within the unit. As a consequence of expertise in regional data, members were the first to publish analyses of new data available from the Government Experimental Accounts, which facilitated a detailed examination of the spatial impact of the public sector, producing new insights into the nature of spatial inequalities [4]. IO also facilitates a detailed examination of industrial structure and inter-industry linkages. This led to an on-going research program examining the impact of industrial structure and the diversity of that structure on sub-regional GDP through the application of spatial econometric models. Members of the group have pioneered the use of spatial econometrics in some regional applications demonstrating that empirical conclusions can be altered by inclusion of spatial effects through spatial lag and error models. The results were amongst the first to highlight the employment dynamics and spillover effects characterising different types of industries and

employ spatial autocorrelation modelling to produce better specified models. [5, 6]

3. References to the research (indicative maximum of six references)

1. Brand S. (1997) On the Appropriate Use of Location Quotients in Generating Regional Input-Output Tables: A Comment, *Regional Studies*, 31, pp791-794 [ABS (2010) ranking 3*]

2. Brand S. (1998) Supply Chains, Material Linkage and Regional Development: A Comment, *Urban Studies*, 35, pp769-773 [ABS (2010) ranking 3*]

3. Bishop, P., Brand, S. & McVittie, E. (2000) The use of input-output in local impact analysis, *Local Economy, 15.3, 238-250.* [ABS (2010) ranking 2*]

4. Gripaios P and Bishop P (2005) Government output and expenditure in UK regions and sub-regions: an analysis of the new experimental accounts data, *Regional Studies*, 39.6. [ABS (2010) ranking 3*]

5. Bishop, P and Gripaios, P. (2007) Explaining spatial patterns of industrial diversity: an analysis of sub-regions in Great Britain, *Urban Studies,* 44.9, 1739-1757. [ABS (2010) ranking 3*]

6. Bishop, P. and Gripaios, P. (2010) Spatial Externalities, Relatedness and Sector Employment Growth in Great Britain, *Regional Studies,* 44.4, 443-454. ISSN 0034-3404 print/ 1360-0591 online. [ABS (2010) ranking 3*]

4. Details of the impact (indicative maximum 750 words)

The major elements of research that underpin its wider impact include new techniques for the development of IO models, the construction of Regional Accounts and the widespread application of these and associated modelling techniques. The suite of techniques is now referred to as the AMORE solution (Advanced Modelling of Regional Economies). A central principle of the IO project was that the modelling resource was a public good. The resource was therefore used by SWRDA, Local Authorities, consultants and academic researchers. SWRDA's use has included informing the Agency's Regional Economic Strategy and regular economic bulletins (e.g. [1], [2]). One example was the use of the Regional Accounts as the basis for the economic evaluation and re-appraisal of the agency's priority sectors [3, 4]. In the SWRDA Legacy Documentation, SWRDA Chief Economist Nigel Jump stated that the Accounts "… *have been crucial to our understanding of the SW economy, investment appraisal and evaluation, and framing our views about the future.*" [5, p.69]. Several Local Authorities have made use of the accounts [6] for impact analysis and investment appraisal (e.g. Somerset Council's 2011 Economic Strategy [7]). The Stockholm Environment Institute at the University of York used the Regional Accounts for carbon foot-printing of key sectors in the region [8, p.6].

The research has made an important contribution to the development of Plymouth's Low Carbon Action Plan. In 2010 Plymouth City Council (PCC) received funding for a government Low Carbon Framework pilot scheme. The report *The Low Carbon and Environmental Goods and Service Sector* (2011) [9] was the first detailed study of the nature and extent of the local LCE and was based on an adapted form of the IO model with a low carbon sector [10]. Hence it built upon and extended previous research conducted by the group.

The final report *"…. provided the baseline detail against which low carbon economic targets could be considered."* [11 p14], the definition of the Low Carbon Economy adopted by the PCC for future policy [11, p13] and underpinned recommendations in the Action Plan including that the Low Carbon sector should be a priority sector in the Local Economic Strategy [11, p19]. An evaluation of the Plymouth pilot for the Department of Energy and Climate Change by CAG consultants concluded that the project *"…demonstrates the benefits gained from working with local academic institutions."* In particular: *"The research …..could be a useful comparator for other councils. It also suggests actions for policy makers that may be transferable."* [12, p.134] During 2013 Bishop and

Brand undertook a project for South West Water (SWW) comprising two elements: a report on the *Economic Drivers of Bad Debt in the Water Sector* and *The Economic Impact of South West Water on the Devon and Cornwall Economy* [13]. The bad debt report built upon recent academic papers on consumer insolvency by Bishop. The project involved developing a bespoke input-output model of the SWW company area, constructed using the same accounting principles as the South West Regional Accounts, hence directly building on prior research. In addition, a modelling tool was developed to enable the company to update the impact assessment and conduct scenario planning. Evidence of impact comes from a statement by Iain McGuffog [14]. The RED Group's expertise in regional modelling is evidenced by its recent appointment (2012) as the Department for Business Innovation and Skills, Business and Economic Intelligence Expert in the South West [15]. This involves the group in providing regular monthly briefings on the South West economy to The National Institute of Economic and Social Research (NIESR).

5. Sources to corroborate the impact (indicative maximum of 10 references)

1. SWRDA (2009a) 'South West Regional Accounts', *Economics Review* Issue 16 pp32-33

2. SWRDA (2011) *South West Regional Accounts: 11 Years of Data* http://www.southwestrda.org.uk/idoc.ashx?docid=2f045bb7-4dbb-4656-bdb0-b89a93ce4c25&version=-1

3. SWRDA (2010) *SW Priority Sectors* http://www.southwestrda.org.uk/idoc.ashx?docid=f27312d2-ec33-49bd-b390-3b1085b183e8&version=-1

4. SWRDA (2008), An Evaluation of the SWO's BEM and SLIM, Jacob Glanville Economic Consultants.

5. SWRDA (2011) *The Economics Story* http://www.southwestrda.org.uk/idoc.ashx?docid=4d33c47f-b95e-4833-affe-6640946a871f&version=-1

6. Text of an e-mail statement from Stephen Bashford 27/03/2013 – available on request.

7. Somerset Economic Strategy 2011 http://www.somerset.gov.uk/irj/go/km/docs/CouncilDocuments/SCC/Documents/Community/Economy%20and%20Europe/Chapter%204_Economy%20Business%20and%20Enterprise.pdf

8. Frey, S. and Wiedman, T. (2008) Identifying resource productivity for five key economic sectors in the South West region http://www.censa.org.uk/docs/SEI_SW-Sectors_BL3-CF.pdf

9. *The Low Carbon and Environmental Goods and Service Sector (2011)* – electronic copy available on request or via web-address in [10].

10. Details of the climate framework policy and consultation process plus all key documents can be found at: http://www.plymouth.gov.uk/homepage/environmentandplanning/sustainableplymouth/susclimatechange/localcarbonframework.htm

11. *Climate Wealth and the City*, Plymouth's Local Carbon Framework. November 2012 (Ed. Jackie Young) Report for the Plymouth Climate Change Commission. http://www.plymouth.gov.uk/lcfprospectus.pdf

12. Evaluation of the Local Low Carbon Framework Pilots CAG Consultants http://www.cagconsultants.co.uk/news/local-carbon-framework-pilots.html

13. *The Economic Drivers of Bad Debt in the Water Sector* and *The Economic Impact of South West Water on the Devon and Cornwall Economy*, Reports for South West Water by RED (2013) (Electronic copies available on request).

14. Text of an e-mail from Iain McGuffog 4/03/2013 – available on request.

15. *BIS English Business and Economic Intelligence Experts' Role* Electronic (Document defining expert role available on request).