RELATEDNESS, COMPLEXITY AND LOCAL GROWTH

An Executive Summary of Working Paper 19-01

Benjamin Davies and David C Maré

Motu Economic and Public Policy Research

ben.davies@motu.org.nz, dave.mare@motu.org.nz

SUMMARY HAIKU

Local job networks
promote growth in big cities,
but not in small towns.

INTRODUCTION

Relatedness captures the extent to which the jobs in a region depend on the presence of other local activities. Complexity captures the extent to which workers benefit from the presence of other workers with complementary skills or to which businesses do better when related activities are present locally.

In this paper, we examine the contribution of relatedness and complexity to urban employment growth, using 1981—2013 New Zealand census data. This analysis helps us evaluate the intervention logic of 'smart specialisation' policies used in the European Union.

Current regional development and innovation policy debates in New Zealand discuss the merits of expanding our primary sector relative to diversifying into more complex products and services. Our analysis informs these debates by evaluating whether historical employment dynamics in New Zealand provide evidence of relatedness-driven growth, thereby indicating the capacity for such growth in the future.

METHODOLOGY

We estimate relatedness and complexity using historical New Zealand census data aligned to current industry, occupation and urban area codes. These data provide usual resident employment counts for 50 "cities" (urban areas) and 200 "activities" (industry-occupation pairs) in census years 1981, 1991, 2001 and 2013.

Two activities are related if they require similar knowledge or inputs (Hidalgo et al., 2018). We infer such similarities from employee co-location patterns, which we measure using weighted correlations of local employment shares. Our approach extends previous studies by recognising variation in the extent of local specialisation and by adjusting for differences in data quality between geographic areas of different sizes.

We use our relatedness measure to estimate activity complexity. This captures the knowledge intensity of economic activities (Balland et al., 2018b) by encoding the extent to which they rely on specialised combinations of knowledge. We define activity complexity using the second eigenvector of the row-standardised activity relatedness matrix.

We apply Balland et al.'s (2018a) framework for analysing smart specialisation to identify development opportunities in New Zealand urban areas. We also look back to see if relatedness and complexity predict subsequent growth in local activity employment.

National Science Challenges
BUILDING BETTER HOMES, TOWNS AND CITIES
Ko Ngā wā Kainga hei whakamāhorahora

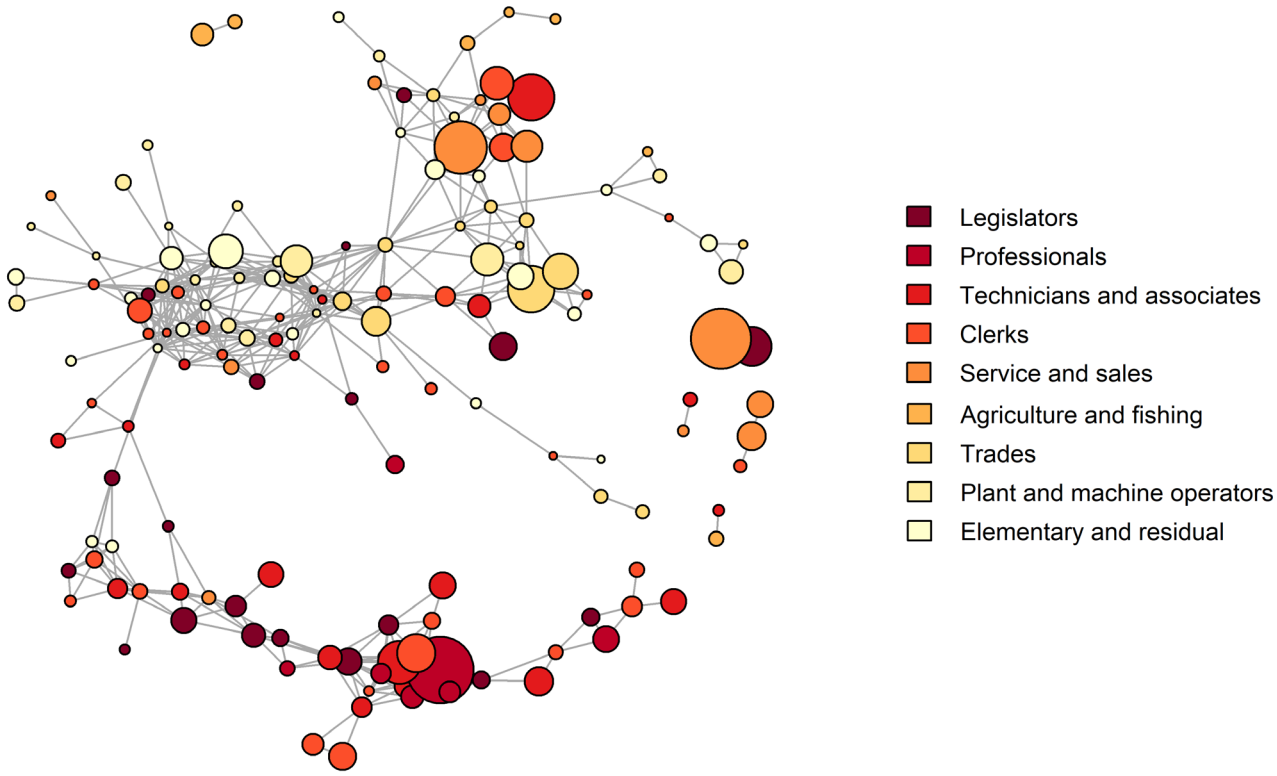
Te Pūnaha Matatini
Data ▪ Knowledge ▪ Insight

RESULTS – MAPPING RELATEDNESS

Following Hidalgo et al. (2007), we use our estimates to map the network structure of economic activities.

At the centre of our map is a tightly connected, nest-shaped cluster of low-skill occupations in the distributive service industries. To the right of this cluster is a group of medium- to low-skill occupations in the construction sector, which provide links to retail industries and healthcare. These activities are ubiquitous, appearing together in many urban areas across New Zealand. In contrast, the lower wing of our network map comprises a cluster of high-skill occupations in the professional and information service sectors, which tend to concentrate in large cities and to obtain higher levels of complexity.

Figure 1: Network map with nodes coloured by occupation



RESULTS – SMART SPECIALISATION OPPORTUNITIES

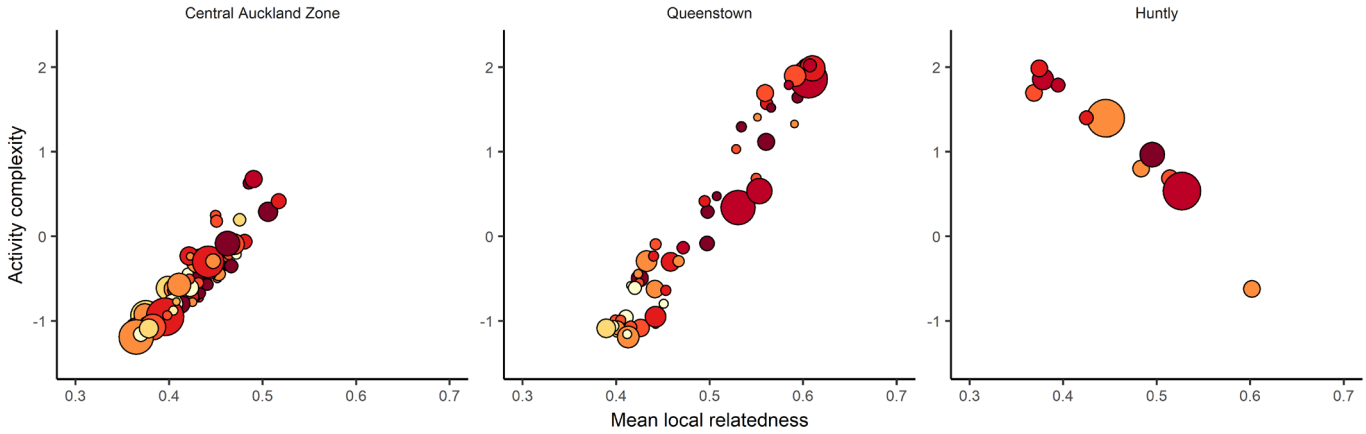
Balland et al. (2018a) characterise smart specialisation as a way to "leverage existing strengths" in order to "generate novel platforms on which regions can build competitive advantage in high value-added activities," arguing that such activities are those with high complexity. On the one hand, expanding into related activities carries low risk because the knowledge and resources necessary for those activities to prosper are already available locally. On the other hand, the highest returns to regional growth are obtained through expanding into complex activities because such activities "form the basis for long-run competitive advantage." This risk-return trade-off is captured by comparing the mean local relatedness of an activity with its estimated level of complexity.

Figure 2 examines three urban areas with different relatedness and complexity profiles. It shows limited scope for the Central Auckland Zone to develop new low-risk, high-return specialisations because it is already specialised in such activities.

In contrast, Queenstown appears poised for employment growth in activities typically reserved for large cities because such activities are locally under-represented but also highly related to Queenstown's existing activity portfolio. These growth opportunities arise because Queenstown boasts many activities often found in areas with large populations but, due to its transient tourist population, Queenstown is relatively specialised in few of the complex activities derived through divisions of labour.

Smaller areas in our data tend to have worse smart specialisation opportunities. For example, the negative relationship between mean local relatedness and complexity suggests that Huntly's local activity portfolio does not contain the knowledge and skills necessary for sustainable expansion into complex activities. Huntly's small size makes it appear relatively specialised in all but the nationally largest activities, because even a few local employees in an activity will make it appear over-represented relative to its share of national employment.

Figure 2: Smart specialisation opportunities



RESULTS – PREDICTING EMPLOYMENT GROWTH

More complex activities grew faster during our period of study. On average, and holding local share and relatedness density constant at their weighted mean value, a one standard deviation increase in activity complexity is associated with a 0.89 percentage point increase in local employment growth per year. This effect increases to 0.98 percentage points when we control for city complexity. More locally-related activities experienced slower growth, especially in complex cities.

Our estimates suggest that cities diversified their local activity portfolios during our period of study, and that this diversification occurred more quickly into more complex activities and within more complex cities.

Balland et al.'s (2018a) framework suggests complex activities with high local relatedness offer the strongest prospects for future growth. If this were true, then we would expect a strong positive coefficient on the interaction of relatedness density and activity complexity. Our estimates show only a weak and insignificant interaction.

We conduct several subsample analyses in order to investigate which activities benefit from relatedness and complexity, and which cities gain those kinds of benefits. Our analyses suggest that smart specialisation does not explain employment dynamics within our data and that being relatedness-dense promotes growth only for activities in the most complex cities.

CONCLUSION

Our network map reveals a cluster of activities associated with high-skill occupations in the person-centred and information services sectors. It also shows a grouping of activities associated with low-skill occupations in the goods-producing and distributed services sectors. These clusters reflect co-location patterns among activities of high and low levels of complexity, respectively.

Complex activities experienced faster employment growth during our period of study, especially in more complex cities. However, this growth was not significantly stronger in cities more dense with related activities. Relatedness and complexity appear to be relevant for analysing how large, complex cities grow, but offer less information about growth trajectories for small cities. This result is consistent with the idea from the urban economics literature that cities are dense networks of interacting activities. In our New Zealand data, the benefits of such interaction are more apparent in larger cities where activity networks are more dense.

On average, across New Zealand towns and cities, relatedness and complexity do not strongly influence growth. It is an open question whether these effects do not operate or that New Zealand cities lack the scale for such operation.

REFERENCES

Balland et al. 2018a. Smart specialisation policy in the European Union: Relatedness, knowledge complexity and regional diversification. Regional Studies, https://doi.org/10.1080/00343404.2018.1437900.

Balland et al. 2018b. Complex economic activities concentrate in large cities. Papers in Evolutionary Economic Geography 18.29, Utrecht University.

Hidalgo et al. 2007. The product space conditions the development of nations. Science, 317(5837):482–487.

Hidalgo et al. 2018. The principle of relatedness. In Morales et al. Unifying Themes in Complex Systems IX, pages 451–457, Cham. Springer International Publishing.

READ THE FULL VERSION OF THE WORKING PAPER AT

WWW.MOTU.ORG.NZ OR CALL US ON 04 939 4250