

Clusters, KIBS and innovation

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Context

- In recent years, the question of the benefits of geographical clusters on firms' innovation performance has spurred a great deal of academic research, both in management (Folta et al., 2006; Gilbert et al., 2008; McCann and Folta, 2011) and in economic geography (Martin and Sunley, 2003; Simmie, 2004; Wolfe and Gertler, 2004; Giuliani and Bell, 2005; Isaksen, 2009; Wolfe, 2009).
- With respect to the studies on the link between clusters and the capacity to innovate, however, most studies have focused upon manufacturing sectors, particularly high-technology industries.
- Surprisingly, little research has hitherto been conducted on the cluster phenomena and innovation performance in the service sector even that some evidence can be found in the literature about the fact that service firms are highly concentrated into clusters (Nachum and Keeble, 2003; Gordon and McCann, 2005).

Question

- Does innovation in KIBS services vary according to the industrial context within which they are located?
 - does it vary depending on local high-order service profile?
i.e. localisation economies?
 - does it vary depending on local manufacturing?
i.e. inter-sectoral or 'industrial complex' economies?
 - does looking at clusters add anything to a purely geographic (urban size, centre, periphery) classification?

Contributions of the paper

- The first contribution of this article is that we are dealing with an industry, the KIBS, that has not been the subject of any empirical investigation related to clustering and innovation performance.
- The second contribution of this article is that we address not only the causality between firms' performance with respect to its affiliation to a specific cluster but also the heterogeneity between industrial clusters, potentially causing different benefits on firms performance.

Data

- 24 high order services, mainly 3 digit (some aggregations)
 - KIBS (9 - NAICS 54)
 - Information and cultural (6 - NAICS 51)
 - Finance and insurance (7- NAICS 52)
 - Leasing (2 - NAICS 53)
- 26 manufacturing sectors
 - NAICS 31-33, mainly 3 digit (some aggregations)

Data

- 102 regions in Quebec
 - 62 rural (no municipality of over 10 000)
 - 42 urban (municipality of over 10 000, Census Metropolitan Area or Census Agglomeration)
- KIBS innovation survey
 - Oslo manual (2005) inspired survey
 - 1122 observations across 72 of these regions

Methodology

Factor analysis (102 regions)

Variables: Location Quotients

- . for high-order service sectors
- . for manufacturing sectors

- *reduce variables,*
- *identify sectors that tend to co-locate*

Identify regional clusters



Cluster analysis (102 regions)

Variables: Factor scores

- . across 102 Quebec regions
- . major metros kept separate

- *classify each region according to its high-order service OR manufacturing factor profiles*



Logistic regression (1122 KIBS firms)

- . clusters are explanatory variables for KIBS innovation
- . subdivide each cluster into large (*above median employment level in KIBS or manufacturing*) and small (*below median*)
- . 4 types of KIBS innovation

- *does being in a particular cluster increase propensity to innovate?*
- *does being in a larger cluster increase propensity to innovate?*

Effect of clusters on innovation

Methodology

$$I_{ni} = f(Cluster_i) + f'(Controls_i)$$

Logistic regression, I_{ni} is dichotomous

I_{ni} = innovation (first amongst competitors) of type n for company i

n=1 : new product (service).

n=2 : new process for producing service.

n=3 : new marketing strategy or new way of interacting with clients.

n=4 : new management or business strategy.

$Cluster_i$ = dummy variable, 1 for type of cluster in which company i is located, 0 otherwise.

$Controls_i$ = company size (4 classes), R&D (yes|no), sector (9 KIBS sectors) – all dummy variables.

High-order service clusters and KIBS innovation

- 8 factors explain 66% of variance of 24 sectors
- Some evidence that financial services and multi-media sectors cluster together.
- No evidence that technical KIBS cluster in particular Quebec regions
- 7 clusters retained (hierarchical clustering of factor scores)

High order service clusters

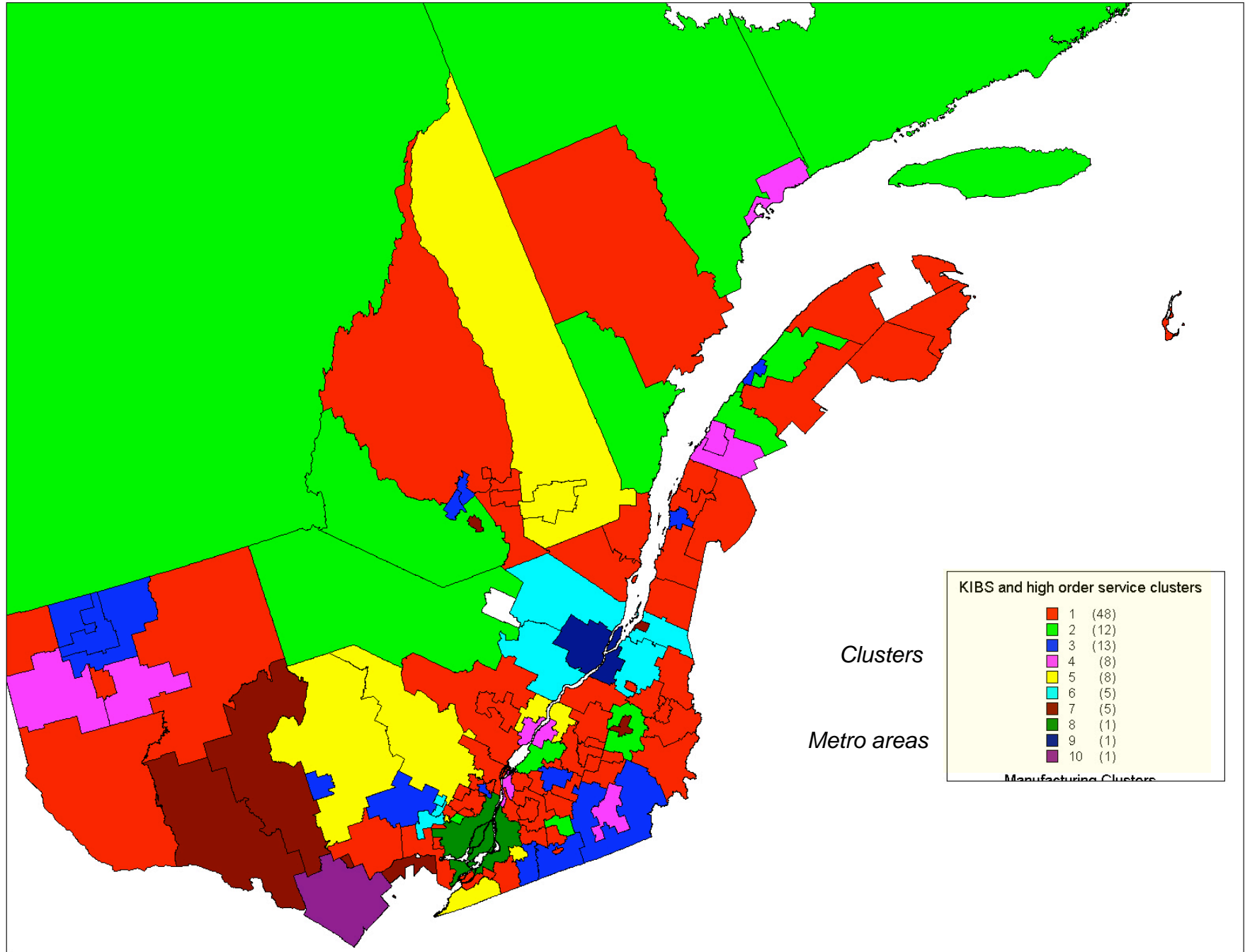
| | number of regions in each cluster | management consultants, sound, marketing | telecom, archi., TV (+ R&D, editing & information services) | accounting, legal (+ design) | monetary authorities, financial brokers | insurance, (+ financial instruments) | rental services, not financial intermediaries | data services, (not film and video) | insurance agents | median number of high-order service jobs | Name given to each cluster |
|----|-----------------------------------|--|---|------------------------------|---|--------------------------------------|---|-------------------------------------|------------------|---|----------------------------|
| n | fact.1 | fact.2 | fact.3 | fact.4 | fact.5 | fact.6 | fact.7 | fact.8 | HO serv | | |
| 48 | -0.41 | -0.36 | 0.26 | -0.18 | 0.08 | -0.20 | -0.20 | -0.19 | 540 | average | |
| 12 | 0.38 | 0.26 | -1.34 | -0.44 | -0.48 | 0.04 | -0.09 | -1.30 | 338 | NOT accounting, legal, NOT insurance agents | |
| 13 | 0.62 | -0.30 | 0.19 | -0.41 | -0.72 | 0.47 | 0.00 | 1.29 | 810 | insurance agents, some general m-KIBS | |
| 8 | -0.58 | 2.11 | 0.03 | -0.37 | -0.01 | 0.50 | -0.46 | 0.60 | 1753 | multi-media | |
| 8 | -0.03 | 0.25 | 0.20 | 0.24 | -0.29 | -0.19 | 2.38 | 0.06 | 748 | data services | |
| 6 | 1.81 | -0.13 | -0.22 | -0.22 | 2.12 | -0.09 | -0.57 | 0.65 | 2008 | M-KIBS, insurance | |
| 7 | 0.14 | -0.06 | 0.08 | 3.08 | 0.09 | 0.19 | -0.19 | -0.18 | 955 | brokers, monetary authorities | |

Note this table shows the mean factor scores for each cluster. The factor analysis is not shown, but the name of each factor describes it

KIBS innovation: do high-order service clusters play a role?

| <i>Radical innovation (first amongst competitors)</i> | Product | | Process | | Marketing and client | | Managt. & strategy | |
|---|---------|----------|---------|---------|----------------------|----------|--------------------|--------|
| pseudo r2 | 0 | 0.202 | 0.021 | 0.189 | 0.006 | 0.124 | 0 | 0.1286 |
| -2 logL nul | | 1472.016 | 1081.8 | 1081.8 | 1421.3 | 1421.3 | 1479.6 | 1479.6 |
| -2 logL model | | 1292.671 | 1067.1 | 942.1 | 1416.5 | 1317.0 | | 1368.6 |
| p (chi2=0) | | <.0001 | 0.000 | <.0001 | 0.0312 | <.0001 | | <.0001 |
| n=1 | 409 | 409 | 210 | 210 | 369 | 369 | 416 | 416 |
| n=0 | 713 | 713 | 912 | 912 | 753 | 753 | 706 | 706 |
| Clusters | | | | | | | | |
| average presence of KIBS | - | 0.48** | 0.73*** | 1.09*** | - | - | - | - |
| NOT accounting, NOT legal, NOT insurance agents | - | - | 1.57** | 2.26*** | - | - | - | - |
| insurance agents, some general M-KIBS | - | - | - | - | - | - | - | - |
| multi-media | - | - | - | - | - | - | - | - |
| data services | - | - | - | 0.49* | - | - | - | - |
| M-KIBS, insurance | - | - | - | 1.03** | - | - | - | - |
| brokers, monetary authorities | - | -1.33* | - | - | - | - | - | - |
| Quebec City | - | - | - | - | -0.33** | -0.48*** | - | -0.28* |
| Ottawa | - | - | - | - | - | - | - | - |
| Montreal (reference) | X | X | X | X | X | X | X | X |
| Controls | | | | | | | | |
| Research and development (yes/ no) | X | *** | X | *** | X | *** | X | *** |
| Sector controls (9 sectors, 8DF) | X | *** | X | ** | X | ** | X | ** |
| Size controls (4 sizes, 3 DF) | X | *** | X | *** | X | *** | X | *** |

note: The significance level of the most highly significant sector / size variable is included for information



KIBS and high order service clusters

| | |
|----|------|
| 1 | (48) |
| 2 | (12) |
| 3 | (13) |
| 4 | (8) |
| 5 | (8) |
| 6 | (5) |
| 7 | (5) |
| 8 | (1) |
| 9 | (1) |
| 10 | (1) |

Clusters

Metro areas

Manufacturing Clusters

Manufacturing clusters and KIBS innovation

- 8 factors explain 68% of variance of 26 manufacturing sectors.
- Manufacturing factors (and clusters) are more intuitive than high-order service factors (or clusters)
- e.g.
 - High-tech cluster,
 - medical cluster,
 - urban oriented low value added,
 - paper and aluminium,
 - metals etc...

Manufacturing clusters

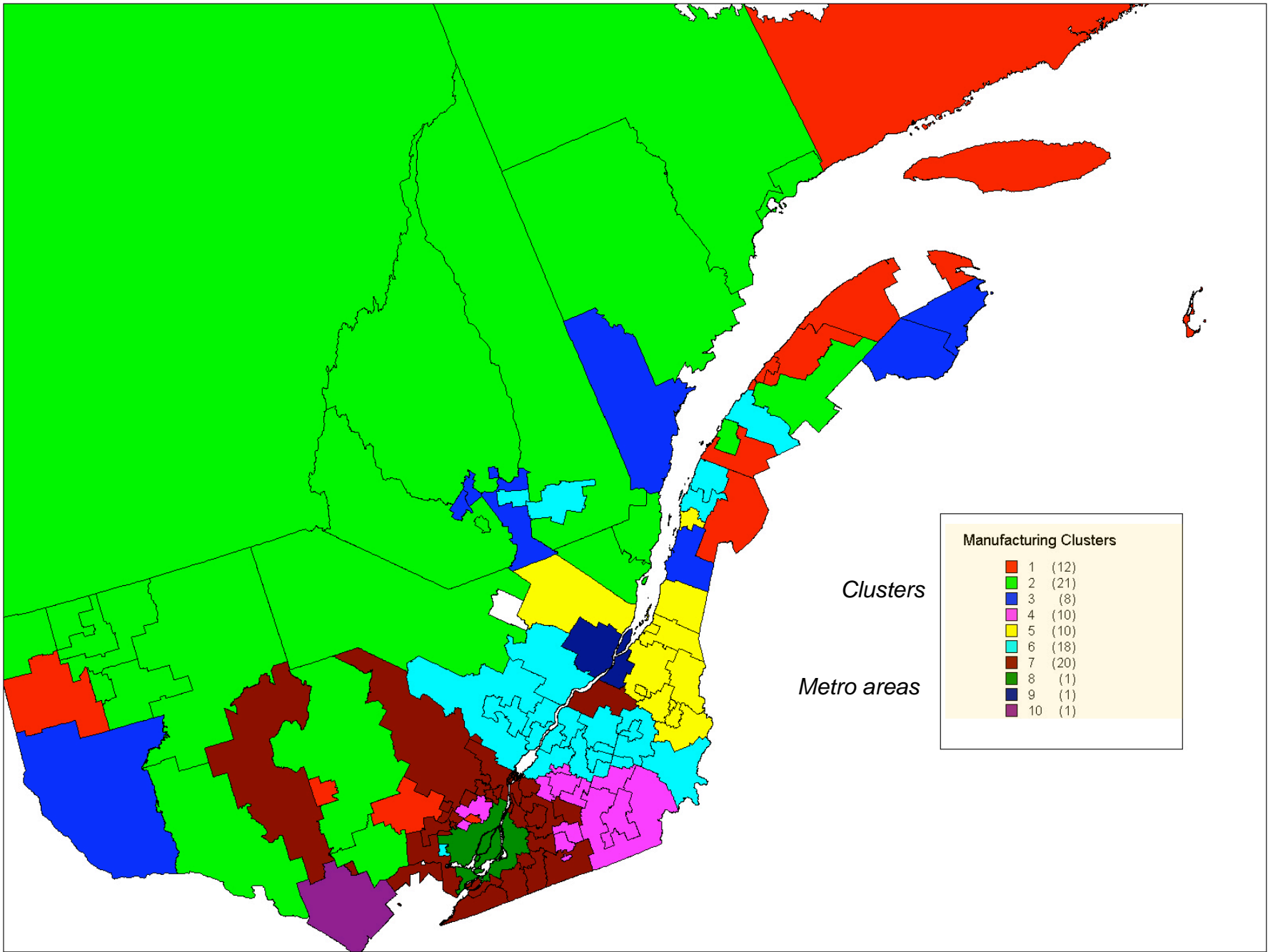
| n | number of regions in each cluster | fact.1 | fact.2 | fact.3 | fact.4 | fact.5 | fact.6 | fact.7 | Manuf | name of cluster |
|----|-----------------------------------|--------|--------|--------|--------|--------|--------|--------|-------|--|
| 12 | Basse et moyenne valeur ajoutée | -0.70 | -0.39 | 0.66 | -0.38 | -0.90 | -0.88 | -0.56 | 695 | Low manufacturing presence (except food and minerals) |
| 21 | High-tech | -0.79 | -0.35 | -0.98 | 0.00 | -0.05 | 0.28 | -0.52 | 840 | Low manufacturing presence (esp. food and minerals) |
| 8 | Aliments et minerais | -0.87 | -0.26 | 0.20 | -0.83 | -0.76 | 0.55 | 1.83 | 860 | Oil and coal products, some aluminium and paper |
| 10 | Pharmaceuti que | 1.35 | 1.13 | -0.17 | -0.40 | -0.49 | 0.82 | -0.37 | 2518 | High-tech and low and medium tech (clothing, plastics etc..) |
| 10 | Métaux | 1.41 | -0.98 | -0.67 | 0.30 | -0.24 | -0.48 | 0.97 | 2470 | Low and medium tech, oil and coal products |
| 18 | Papier et alu | 0.28 | -0.34 | 0.25 | -0.54 | 1.24 | 0.31 | -0.22 | 2738 | Metals |
| 23 | Produits du pétrole et du charbon | -0.03 | 0.81 | 0.65 | 0.95 | 0.13 | -0.38 | 0.04 | 3120 | High-tech, pharmaceuticals, some food and minerals |

Note this table shows the mean factor scores for each cluster. The factor analysis is not shown, but the name of each factor describes it

KIBS innovation: do manufacturing clusters play a role?

| <i>Radical innovation (first amongst competitors)</i> | Product | | Process | | Marketing and client | | Managt. & strategy | |
|--|---------|--------|---------|---------|----------------------|---------|--------------------|---------|
| pseudo r2 | 0 | 0.191 | 0.015 | 0.181 | 0.014 | 0.133 | 0.015 | 0.134 |
| -2 log L nul | 1472.0 | 1472.0 | 1081.8 | 1081.8 | 1421.3 | 1421.3 | 1479.6 | 1479.6 |
| -2 log L model | | 1303.7 | 1071.3 | 948.6 | 1409.6 | 1308.6 | 1466.9 | 1364.1 |
| p (chi2=0) | | <.0001 | 0.004 | <.0001 | 0.010 | <.0001 | 0.003 | <.0001 |
| n=1 | 409 | 409 | 210 | 210 | 369 | 369 | 416 | 416 |
| n=0 | 713 | 713 | 912 | 912 | 753 | 753 | 706 | 706 |
| Clusters | | | | | | | | |
| Low manufacturing presence (except food and minerals) | - | - | - | - | - | 0.83** | - | - |
| Low manufacturing presence (esp. food and minerals) | - | - | - | 0.71* | - | - | - | - |
| Oil and coal products, some aluminium and paper | - | - | - | - | - | - | 1.30*** | 1.40*** |
| High-tech and low and medium tech (clothing, plastics etc. | - | - | - | 0.77** | - | - | - | - |
| Low and medium tech, oil and coal products | - | - | 0.65** | 1.12*** | - | - | - | - |
| Metals | - | - | 0.71*** | 0.98*** | 0.39* | 0.52** | - | - |
| High-tech, pharmaceuticals, some food and minerals | - | - | - | - | -0.63* | - | -0.76** | - |
| Quebec City | - | - | - | - | -0.31** | -0.39** | - | - |
| Ottawa | - | - | - | - | - | - | - | - |
| Montreal (reference) | X | | X | | X | | X | |
| Controls | | | | | | | | |
| Research and development (yes/ no) | X | *** | X | *** | X | *** | X | *** |
| Sector controls (9 sectors, 8DF) | X | *** | X | ** | X | ** | X | ** |
| Size controls (4 sizes, 3 DF) | X | *** | X | *** | X | *** | X | *** |

note: The significance level of the most highly significant sector / size variable is included for information



Do clusters add anything to 'geography'?

- It is well known that economic growth in Canada varies across certain geographic dimensions (Shearmur & Polèse, 2007).
 - city size
 - location of city (close to or far from a large metro area)
 - urban (agglomeration of over 10 000 people)/ rural
- Do our results for innovation and clusters merely pick up these general patterns of economic development?

KIBS innovation: does 'geography' play a role?

| <i>Radical innovation (first amongst competitors)</i> | Product | | Process | | Marketing and client | | Managt. & strategy | |
|--|---------|--------|---------|---------|----------------------|----------|--------------------|--------|
| pseudo r2 | 0 | 0.191 | 0.023 | 0.191 | 0.014 | 0.133 | 0.019 | 0.134 |
| -2 log L nul | | 1472.0 | 1081.8 | 1081.8 | 1421.3 | 1421.3 | 1479.6 | 1479.6 |
| -2 log L model | | 1303.7 | 1066.0 | 940.6 | 1410.2 | 1309.0 | 1464.2 | 1364.0 |
| p (chi2=0) | | <.0001 | 0.001 | <.0001 | 0.0052 | <.0001 | 0.006 | <.0001 |
| n=1 | 409 | 409 | 210 | 210 | 369 | 369 | 416 | 416 |
| n=0 | 713 | 713 | 912 | 912 | 753 | 753 | 706 | 706 |
| Regional classification (urban, central, peripheral) | | | | | | | | |
| Central, 100-500K | - | - | - | 0.66* | - | - | - | - |
| Central 50-100K | - | - | - | - | - | - | -0.82* | - |
| Central 25-50 K | - | - | 0.76** | 1.13*** | - | 0.69* | - | 0.63* |
| Central 10-25K | - | - | - | - | - | - | - | - |
| Central, rural | - | - | 0.82*** | 1.20*** | -0.76** | -0.62* | -0.73** | -0.54* |
| Peripheral, 100-500K | - | - | 1.18** | 1.75*** | - | - | - | - |
| Peripheral, 50-100K | - | - | - | - | - | - | - | - |
| Peripheral, 25-50K | - | - | - | - | - | - | - | - |
| Peripheral, 10-25K | - | - | - | 0.88* | - | - | 0.74* | 0.79* |
| Peripheral, rural | - | - | - | - | - | - | - | - |
| Quebec City | - | - | - | - | -0.38** | -0.49*** | -0.25* | -0.28* |
| Ottawa | - | - | - | - | - | - | - | - |
| Montreal (reference) | X | X | X | X | X | X | X | X |
| Controls | | | | | | | | |
| Research and development (yes / no) | X | *** | X | *** | X | *** | X | *** |
| Sector controls (9 sectors, 8DF) | X | *** | X | ** | X | ** | X | - |
| Size controls (4 sizes, 3 DF) | X | *** | X | *** | X | *** | X | *** |
| note: The significance level of the most highly significant sector / size variable is included for information | | | | | | | | |

Which models perform best?

- If the 'cluster' models perform better than the 'geography' models, then this is *prima facie* evidence that clusters may indeed play a role in KIBS innovation.
 - χ^2 = absolute explanatory power
 - pseudo r^2 = explanatory power adjusted for degrees of freedom (number of variables in the model)
- If not, then our cluster models are merely telling us something we already know: then economic development carries across certain geographic dimensions

| | <i>Product</i> | | <i>Process</i> | | <i>Marketing and client</i> | | <i>Managt. & strategy</i> | |
|--------------------------------|----------------|-----------|----------------|--------------|-----------------------------|--------------|-------------------------------|--------------|
| | Chi2 | pseudo r2 | Chi2 | pseudo r2 | Chi2 | pseudo r2 | Chi2 | pseudo r2 |
| <i>Without controls</i> | | | | | | | | |
| Manufacturing clusters | 0 | 0 | 10.5 | 0.015 | 11.7 | 0.014 | 12.7 | 0.015 |
| High-order service clusters | 0 | 0 | 14.7 | 0.021 | 4.8 | 0.006 | 0 | 0 |
| Regional classification | 0 | 0 | 15.8 | 0.023 | 11.2 | 0.014 | 15.4 | 0.019 |

With controls

| | | | | | | | | |
|-----------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Manufacturing clusters | 168.3 | 0.191 | 133.2 | 0.181 | 112.7 | 0.133 | 115.5 | 0.134 |
| High-order service clusters | 179.3 | 0.202 | 139.7 | 0.189 | 104.3 | 0.124 | 111.0 | 0.129 |
| Regional classification | 168.3 | 0.191 | 141.2 | 0.191 | 112.3 | 0.133 | 115.6 | 0.134 |

Conclusions

- No evidence that metro areas (Montreal, Quebec, Ottawa) are any more innovative than other regions.
- Indeed, Quebec – dominated by provincial government – depresses KIBS marketing and management innovation.
 - No evidence of urbanisation economies
- There is some evidence that innovation varies across smaller cities, and across the urban/rural and centre/periphery dimensions.
 - .
- ONLY FOR PRODUCT INNOVATION are rates of innovation affected by clusters (high-order service) more than by geography.

Conclusions

- Thus **urbanisation economies** (and diseconomies) seem to play a role.
- **Industrial complex economies** (Parr, 2002: externalities that cross between sectors, in this case manufacturing and KIBS) do not play any role that can be distinguished from urbanisation economies/diseconomies.
- **Localisation economies** (sector specific local externalities) do not play a role

Conclusions

- These results are suggestive
- Of the three hypotheses...
 - KIBS innovation is connected with high-order service clusters
 - KIBS innovation is connected with manufacturing clusters
 - KIBS innovation is connected with ‘geography’
- ... the last one has found most support.
- note also that in all models Quebec’s three major metro areas are singled out, and have no positive effect on the probability of KIBS innovation.

Conclusions

In short, and given our observations, there are three possibilities:

- i. There are indeed links between industrial clusters and KIBS innovation.
- ii. There are no links between industrial clusters and KIBS innovation.
- iii. KIBS innovation is not associated with any local factors ***at this scale***.