

Regional Innovation and Growth: the Role of Absorptive Capacity and Knowledge Transfer

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Regional Innovation, Cooperation and Absorptive Capacity

1. Background: Innovation and Competitiveness
2. The Community Innovation Survey: Regional Dimensions
3. Absorptive Capacity, Cooperation and Innovation
4. Simultaneous model of cooperation and innovation
 - Firms' Absorptive Capacity determines cooperation
 - Cooperation (and absorptive capacity) determine innovation
5. Further Analysis

Theory: Innovation and competitiveness

- ◆ Innovation and Competitiveness
Evidence of a link between innovation and competitiveness (income per capita, productivity)

Raises the issue of what determines innovation?

- ⇒ Linear Model
Not so much wrong as incomplete R&D matters but so does the firm's internal and external environment
- ⇒ Management literature
Importance of firms' internal capabilities, human capital and learning
- ⇒ Systems of Innovation
Focuses on relationships between businesses and other organisations e.g. universities, public and private sector research institutes in the context of an economic system

Regional Dimensions I Unweighted Data

- ◆ Note that with weighted data there are significant differences across regions for all variables at the 1% level.

Table 1 Differences across Government Office Regions: Summary of Main Results

Variable	Test	Significance
Product and Process Innovation		
Product innovation	Chi-Square	1%
Product innovation that is new to the market	Chi-Square	1%
Product innovation new to the enterprise	Chi-Square	10%
Process innovation	Chi-Square	Not significant
Process innovation new to the industry	Chi-Square	5%
Share of Turnover from products new to the market	ANOVA	Not significant
Share of Turnover from products new to the enterprise	ANOVA	Not significant
Share of Turnover from significantly improved products	ANOVA	1%
Share of Turnover from all types of new/improved products	ANOVA	10%

Regional Dimensions II

Innovation Activity (binary data, yes/no)		
Intramural R&D	Chi-Square	1%
Acquisition of R&D (extramural)	Chi-Square	5%
Acquisition of machinery and equipment	Chi-Square	1%
Acquisition of external knowledge	Chi-Square	Not significant
Training	Chi-Square	Not significant
All forms of design	Chi-Square	5%
Marketing	Chi-Square	Not significant

Regional Dimensions III

Expenditure on innovation activity		
Intramural R&D	ANOVA	Not significant ¹
Acquisition of R&D (extramural)	ANOVA	Not significant ¹
Acquisition of machinery and equipment	ANOVA	10%
Sum of intra&extra mural R&D & Acquisition of machinery	ANOVA	5%
Acquisition of external knowledge	ANOVA	Not significant
Training	ANOVA	Not significant
All forms of design	ANOVA	10%
Marketing	ANOVA	10%
Cooperation		
Did your enterprise cooperate over innovation?	Chi-Square	1%

Regional Dimensions IV

Policy		
Local or regional policy	Chi-square	1%
Central government policy	Chi-square	1%
Tax credit for R&D	Chi-square	1%
European Union policy	Chi-square	5%
Framework programme	Chi-square	Not Significant ¹
Wider Innovation		
Implementation of new corporate strategy	Chi-square	1%
Implementation of Advanced management techniques	Chi-square	10%
Implementation of major changes to organisational structure	Chi-square	1%
Implementation of changes in marketing strategy	Chi-square	1%
Human capital		
Proportion of employees with science & engineering degree	ANOVA	1%
Proportion of employees with other degree subject	ANOVA	1%

Cooperation, Innovation and Absorptive Capacity

- ◆ Simple bi-variate analysis of innovation & cooperation provides support for the view that cooperation is associated with successful innovation
- ◆ Firms that cooperate over innovation activities with other firms and organizations are more likely to innovate
- ◆ But this raises the question of what determines cooperation for innovation?
- ◆ Research on organizational learning and innovation has used the concept of absorptive capacity – the extent to which firms are able to utilize knowledge generated externally
- ◆ The geography of innovation literature suggests that this has a strong regional dimension as the transfer of complex ‘tacit knowledge’ requires proximity and repeated interaction

Multivariate Analysis

- ◆ Systems approach allows for the combined impact of external factors and internal factors
- ◆ Firms operate within a system of innovation that includes firms' relationship with other firms and organisations such as universities
- ◆ The degree of cooperation with other firms and organizations is one factor that determines the extent to which knowledge is transferred within a national or region
- ◆ Knowledge transfer is not straightforward: firms must have certain internal capabilities or 'absorptive capacity' before they can utilise ideas and knowledge from external sources

A simultaneous model

We model innovation as dependent on firms internal resources and the extent of 'tacit knowledge' transferred by cooperation which we use as a proxy for absorptive capacity

Hence we use the following simultaneous model:

Innovation = f(R&D, human capital, absorptive capacity (cooperation), managerial capability/strategy, size of enterprise, technological opportunity, investment)

where absorptive capacity is proxied by cooperation and is estimated as an endogenous explanatory variable:

cooperation = f (R&D, human capital, managerial capability/strategy, expenditure on training)

Absorptive capacity

- ◆ The positive association between cooperation and innovation raises the question of why the number of collaborative agreements is so low and what might be done to increase them?
- ◆ Absorptive capacity of firms and regions
- ◆ Firms need absorptive capacity to cooperate: joint effects between cooperation and innovation
 - two stage least squares estimation
 - Determinants of cooperation (absorptive capacity)
 - Determinants of innovation

Firms' Absorptive Capacity

Dependent variable: cooperation

<u>Explanatory variables</u>	<u>Regression Coefficient</u>
Size of Firm	***
Sector	**
Scientists & Engineers as % of workforce	***
Other Graduates as % of workforce	**
Advanced management techniques	***
Internal R&D	***
Expenditure on training	***

** denotes significance at the 5% level

*** 1% denotes significance at the 1% level

Regional Results

- ◆ The cooperation/absorptive capacity equation has been estimated using:
 - CIS3 and CIS4
 - The whole sample combined
 - The 12 Government Office Regions

We found that:

- ◆ the results obtained are fairly stable over the two CIS time periods (samples) 1998-2000, 2002-2004.
- ◆ there are significant differences across regions on the coefficient size and significance of the variables

Innovation and Co-operation (Simultaneous model)

Dependent variable: Share of Turnover from New and Significantly Improved Products, Cooperation Instrumented

<u>Explanatory variables</u>	<u>Std Beta Coefficient</u>
Co-operation with universities	***
Size of enterprise	***
Sector	***
Scientists & Engineers as % of workforce	**
Other graduates as % of workforce	***
Expenditure on training	not significant
Internal R&D	**
Extra mural R&D	**
Changes to Organisational Structure	***

** denotes significance at the 5% level
*** denotes significance at the 1% level

Further Analysis

- ◆ Different Estimation techniques and further testing
- ◆ Sub-regional analysis
- ◆ Growth Accounting Model