The impact of internationalisation on the innovation performance of countries

Abstract

The extent to which a country's businesses, institutions and industries are linked with innovation resources and capabilities located outside the country is likely to positively impact on the innovation performance of that country. The paper starts by recalling some theoretical background and empirical evidence to this proposition. It then presents the framework to the research. The paper investigates the association between internationalisation and innovation by developing indices on the internationalisation of countries and linking these – via correlations – to the countries' innovation performance. Three dimensions of internationalisation are considered: the aggregate level (A); the level of technology intensive industries (B); and the firm level (C) based on data derived from two surveys – the Innobarometer survey and the Community Innovation Survey.[1] Innovation is measured via the European Innovation Scorebord (EIS). Data on international embeddedness is collected from 1999 onwards up to the latest available data and is linked to the EIS for which consistent data is available for 2004 to 2008. The results for Levels A and C suggest that outward investments and the inflow of foreign employees and students are strongly correlated with a country's innovation performance; while inward FDI, trade links, outsourcing and cooperation are not.

[1] At the time of submission we have full results for the first and third level (levels A and C), and are currently in the process of completing the data collection for the second level (level B). Relevant results are available by September 2009.

1. Introduction

This paper is a development from – and one of the outcomes of – a project undertaken by the authors for the European Commission. The project links the European Innovation Scoreboard (EIS) to indicators of internationalisation.

The EIS is an annual report managed by the European Commission – Directorate General Enterprises and Industry – carried out since 2001. The EIS measures and compares the innovation performance of countries using a synthetic composite indicator: the Summary Innovation Index (SII). The latter is based on 29 indicators addressing several dimension of a country's system of innovation. The EIS 2008 includes innovation indicators and trend analyses for the EU27 Member States as well as for Croatia, Turkey, Iceland, Norway and Switzerland (European Commission, 2009), and this is also the group of countries that this paper considers.

While considerable progress has been made to reveal cross-country patterns of innovation performance, not least made possible through the coordinated efforts by (European) governments to collect relevant data at a large scale through the Community Innovation Surveys (CISs), little progress has been made towards systematically capturing the global embeddedness of the innovation activities of countries.

The key contribution of this paper resides with the development of derived indicators of the international embeddedness of countries' activities at the general and innovation-specific levels. The paper also provides a systematic analysis of patterns of association with countries' innovation performance. At this stage, neither the project nor this paper empirically tries to establish causality between innovation in European countries and their internationalisation record. There are many factors affecting the

innovation of countries. Our claim is that, a priori, the international context is one of the elements affecting the innovation performance of countries. We therefore establish the level of association – via correlation coefficients – between countries' scores of the SII and their scores of the internationalisation indicators.

The paper is structured in the following way. Section 2 provides the theoretical context against which the study is set. Section 3 develops the specific framework of this study. Section 4 discusses the data and methodology. Section 5 presents the results and the last section concludes.

2. Theoretical background

Innovation is the result of many factors operating at the macro, meso and micro levels. One element overarching all three levels of aggregation is internationalisation. It has been claimed that companies that operate directly in many countries learn from different innovation contexts and are therefore able to benefit from them. The sources of learning and knowledge acquisition can be many. If a country is highly internationalised it is likely to have a higher innovation performance because: (i) its resources (labour, management etc.),its products and its institutions are exposed to alternative innovation contexts, and this allows firms and people to learn from different environments; and (ii) competition forces the firms to innovate.

The transmission mechanisms are via the internal networks of transnational companies (TNCs) as well as via the contacts between each unit of the TNC (be it subsidiary or headquarter) and the local environment in which it operates.

The link between innovation and internationalisation has a strong theoretical underpinning. The evolutionary theory of the firm (Nelson and Winter, 1982; Nelson and Rosenberg, 1993) has led to new developments in the theory of TNCs (Cantwell, 1989; Kogut and Zander, 1993) in which the behaviour and activities of TNCs are linked to innovation development and diffusion.

TNCs operate in foreign countries through several modalities ranging from foreign direct investment (FDI) to trade to licensing and from franchising to sub-contracting and to joint ventures. All modalities, in different ways, give rise to a variety of networks across countries. All these networks give scope for the acquisition of knowledge and innovation from diverse environments. The mechanisms through which the diffusion takes place can be via movements of tangible or intangible products, materials and assets or via the exchanges of personnel.

For any given country, both domestic and foreign TNCs with subsidiaries are part of networks which are internal to the company and which span several countries. Each company unit operating in a foreign country – whether affiliate, subsidiary or headquarter – has the opportunity to learn from the innovation context and system in the foreign country. The knowledge is absorbed by the unit and then transmitted – wholly or partially – to other parts of the company via its *internal networks* (Zahra, Ireland et al., 2000; Castellani and Zanfei, 2004; Frenz, Girardone et al., 2005; Castellani and Zanfei, 2006; Frenz and Ietto-Gillies, 2007)

Moreover, each company unit develops linkages with local businesses on innovation-related activities leading to *external networks* some of which are contractually formalized and others are more informal. There is therefore a *double network* contributing to knowledge and innovation acquisition and diffusion and thus to the capabilities of a specific country (Hedlund and Rolander, 1990; Castellani and

Zanfei, 2004; 2006). The extent of knowledge diffusion via internal and external networks may partly depend on the internal organizational structure of the company (Hedlund, 1986; Bartlett and Ghoshal, 1989; Gupta and Govindarajan, 1991; Gupta and Govindarajan, 2000).

Empirical support for the link between multinationality and innovation is in (Castellani and Zanfei, 2004; 2006; Frenz and Ietto-Gillies, 2007; Frenz and Ietto-Gillies, 2009). However, the direct activities of TNCs may be only one way in which companies, institutions and people come in contact with the innovation context of other countries. Over and above the acquisition of innovation capabilities via the operations of TNCs, there is also acquisition via the operations of other actors. Trade – most, though not all of which, originates with TNCs – contributes to the acquisition of innovation capabilities by exposing domestic businesses to the needs of foreign clients or to their new products and processes. The international movements of highly skilled labour (Salt 1991 and 1997; OECD, 2002) – some internally to TNCs – are a key mechanism in knowledge and innovation transfer. Moreover, cross-border collaborations between companies, academic institutions and individual researchers contribute to innovation capabilities, so do international academic exchanges and trainings.

3. The framework

There are several dimensions to the international context; we shall concentrate on the following: the level of aggregation; the modality of internationalisation; and the intensity of innovation within the modality.

With respect to the level of aggregation we test variables at the macro/country level, albeit some of the raw data feeding into the country level variables is available at the micro level, in particular data from two major European surveys: the Innobarometer and the Community Innovation Survey.

The modalities of internationalisation considered are: inward and outward foreign direct investment (FDI); trade (both imports and exports); cross-border influx of skilled personnel and of students; and joint cross-border publications. The inclusion of both in- and outflows for FDI and trade respond to the assumption that firms learn from their contacts with other business units in foreign countries in any type of business contact be they as buyer or seller, recipient or initiator of cross-border investment and trade.

We want also to test whether the association between internationalisation and innovation holds for two different levels of internationalisation: for the full aggregate level; and for the level of technology intensity industries. In other words, does it matter – for the association between internationalisation and innovation – that a country may be relatively low on the overall aggregate internationalisation rank if it comes high on the internationalisation ranking for innovation-intensive industries and vice versa? Should therefore countries that are keen to affect positively their innovation performance concentrate on the internationalisation of their high technology industry or should their aim be to support their internationalisation context in general?

The plan for the research is therefore to assess the innovation performance of countries – as measured by the SII – against three sets of variables capturing the degree of internationalisation: the first set of country level variables is derived from general indicators of internationalisation (e.g. FDI flows irrespectively of the

industry); the second set relates to indicators based on data derived from innovation specific industries and resources; the third set refers to country level indicators based on firm level variables derived from the Innobarometer survey and the Community Innovation Survey (CIS). The following figure details the indicators in our three sets.

Figure 1 here

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4. Data and methodology

To assess the extent to which the internationalisation of countries impacts on innovation performance three sets of internationalisation indicators are computed around the three levels introduced above in Figure 1. All indicators are computed at country level. Within the first two levels – (A) general level and (B) innovation-specific industries – foreign direct investment flows, trade and the mobility of employees and students are considered; under (B) we additionally consider cross-border academic publications in science and engineering. Under Level C of the analysis we include all questionnaire items in the Innobarometer survey that have a bearing on the international embeddedness or focus of responding companies. The internationalisation indicators derived from the various variables are linked to an indicator of innovation performance (the SII derived from the EIS).

In this section we next discuss the sources of the raw data feeding into the analysis. We explain the country selection, the relevant time dimensions to the data,

and the method used to construct the different indicators. This is followed by a discussion of the methodology – a combination of correlations and regressions – used to examine the relationship between internationalisation and innovation. Table 1 provides an overview of the underlying variables on which the individual indicators and the summary globalisation indices (SGIs) are based, and gives the relevant source of the raw data.

Table 1 here

The indicators are calculated for the EU27 countries and for Croatia, Turkey, Iceland, Norway and Switzerland, as this is the largest group of countries for which relevant data are available. For levels A and B of the analysis, different data sources are used, including the United Nations Conference on Trade and Development for FDI data, the World Development Indicators produced by the World Bank for data on trade, the EU Labour Force Survey for the number of total and foreign employees and the Education Statistics from the Organisation of Economic Cooperation and Development for students and GDP. We collected the raw data from these different sources for the years 1999 up to 2007 – the latest available year.

Level C of the analysis is based on two innovation surveys – Innobarometer (European Commission, 2009) and CIS – for which the indicators are based on the latest available surveys. Thus, with respect to Level C, the data refers to one year only. This is because the relevant questions of the Innobarometer survey are only available for the latest – 2009 – survey.

In what follows we first discuss how the indicators and summary indices for Levels A and B data are derived. This is followed by the discussion on Level C. When computing the individual indicators for Levels A and B, we smoothened the data by using five year moving averages; we cumulated both the nominators and denominators of the internationalisation indicators over five years. For example, we summed the values for FDI inflows for 1999 up to 2003 and expressed the total over the five years as a percentage of GDP cumulated over the same period. Thus, between 1999 and 2007, there are five consecutive indicators the first referring to the period 1999 to 2003 (our first time period T1) and the last to the period 2003 to 2007 (T5). This smoothing is done for two reasons. Firstly, because flow data – such as the data on FDI – is subject to some degree of volatility, and this is flattened through the use of moving averages. Secondly, to capture in the indicators a cumulative process of learning by which a country's innovation performance is not only affected by the level of international embeddedness in the same or previous years, but depends on the cumulative impact of international linkages and learning over a period of time.

The six variables in A1 to A3 are expressed in relative terms, i.e. as a percentage of GDP, total number of employees or total number of students. The variables differ considerably in terms of their average values; moreover, their patterns differ across countries according to the size of the country and the structure of its economy. We normalized the variables and turn them into indicators that range from 0 to 1, partly to offset the problems of scale just mentioned but also to provide a reliable comparison between our indices and the SII we use to capture innovation. The normalisation was done as follows:

$$G_{it} = \frac{G_{it} - \min G_t}{\max G_t - \min G_t} \qquad (1)$$

with i denoting the 32 countries and t the five time periods.

Before computing the indicators, the raw data is inspected and adjusted for outliers using the interquartile range (IQR). IQR is equal to the distance between the first and third quartiles (or between the 75^{th} and 25^{th} percentiles): $IQR=Q_3-Q_1$, where this distance spans the middle 50% of the data. Outliers are identified as follows: negative outliers are values $< Q_1 - 3\times IQR$, while positive outliers $> Q_3 + 3\times IQR$. Outliers are not included in determining the maximum and minimum scores in the normalisation process. For outliers where the value of the relative score is above the maximum score or below the minimum score the re-scaled score is set to 1 and 0 respectively.

Turning now to level C of the analysis, the Innobarometer survey used in this paper was conducted by the European Commission in April 2009. This is the first wave of the Innobarometer survey which contained a range of questions specifically aimed at measuring internationalisation. Questionnaires were completed by companies in 29 European countries, with a total of 5,234 observations, with each of the 29 countries achieving a sample size of 200 with the exceptions of Norway and Switzerland for which there are 100 observations, and Cyprus, Luxembourg and Malta for which there are 70 observations. The survey contains seven questionnaire items which relate to aspects of international embeddedness of firms' activities since 2006: whether or not a company operated in international markets; outsourced activities abroad; invested into companies abroad; cooperated with international partners; recruited employees from other countries; engaged in market-testing of new products abroad; and considered international markets as the lead markets. All items provide binary data indicating whether or not the company engaged in the relevant international activities.

For the purpose of this paper we first compute the proportion of companies which, for example, operated in international markets (compared with all companies that responded to the Innobarometer). We then follow the same data transformation to derive at seven indicators ranging from 0 to 1 (see, Eq. 1). Finally, we derive a Level C1 globalisation index which is the simple average of the seven indicators. The reference period for the Innobarometer indicators is 2006 to 2008, and EIS is based on 2006 and 2007 data.

Additionally to the Innobarometer indicators, we use the fourth European Community Innovation Survey, conducted by the individual member states and compiled by Eurostat for 15 countries. Here, the unit of measurement is not the company, but the enterprise, and the reference period is 2002-2004. While one of the variables used – enterprise operates in international markets – is also captured by the Innobarometer survey, the other variable – foreign-ownership, is not. Moreover, the number of observations that the EU CIS are based on are much larger – just under 70,000 – compared with the Innobarometer survey, so the results for international markets and cooperation act as a robustness check for the Innobarometer results.

The European Innovation Scoreboard Summary Index (SII) is compiled and published by European Commission – DG Enterprise and Industry on an annual basis and since 2001. Changes in the methodology applied to different waves of the EIS mean that comparable data on SII is available from 2004 onwards (European Commission, 2009). The SII is an aggregate index and is based on 29 individual variables. It captures innovation performances of countries, such as the share of innovators in a country or the average turnover from innovations, but the EIS also covers wider framework conditions, such as finance and support for innovation, human resources and ICT infrastructures. A detailed description of the methodology

and variables feeding into the SII are available through the European Innovation Scoreboard (2009).

The SGI/A and SGI/B and their underlying indicators of internationalisation are linked with a time lag of one year to the SII; the SGI/A and B based on 1999 to 2003 data are associated with the SII for the year 2004, the SGIs based on 2000 to 2004 data to SII for 2005 and so forth up to SII for 2008. The rationale is that international embeddedness in the earlier time period feeds into the innovation performance of a country in the later period. In the case of level C the SGI/C is available for the reference period of the surveys (2006 onwards in the case of the Innobarometer and 2002-2004 in the case of CIS) and the indicators are correlated with the latest SII (2008).

At each level of analysis the correlation coefficients between SII and the internationalisation indicators are calculated for the 27 countries and for the following: (i) The single indicators that compose each sets at the three levels (A, B and C); (ii) single sub-periods; (iii) the pooled data for all the periods; and (iv) the aggregate Summary Globalization Index (SGI) for each specific level.

5. Results

In Tables 2 and 3 we compare the degree of internationalisation across countries for level A and C respectively.

Table 2 here

Countries with high internationalisation indicators are small countries, namely Luxembourg, Belgium, Netherlands and Switzerland, as well as Malta and Estonia. While Turkey exhibits the lowest degree of internationalisation.

Table 3 here

Based on the level C indicators firms in Luxembourg, Slovenia, Lithuania, Belgium and Sweden are more likely to be engaged in activities abroad, while companies in Germany are the least likely to do so based on the GSI/C scores.

Table 4 provides the correlations between the six internationalisation indicators of level A, SGI/A and SII across the five different time periods, as well as for the pooled dataset.

Table 4 here

The associations between SII and SGI/A range between 0.31 and 0.41, with the pooled data suggesting a correlation of 0.35. With respect to the individual internationalisation indicators, shares of outward FDI and foreign students have the largest positive correlations with SII followed by the share of foreign employees, while imports have the strongest negative correlations. The results for inward FDI are mixed with positive correlations in the earlier time periods and negative correlations in the later ones; however, none of the coefficients is significant.

In Table 3 we present the correlations between internationalisation indicators based on the two surveys – Innobarometer and CIS – and SII, which corresponds to level C.

Table 5 here

The summary indices SGI/C1 and SII2008 have a correlation of 0.39, similar to the correlation coefficients for SGI/A. The strongest associations with the innovation score among the individual indicators at level C are found with the share of companies recruiting employees from other countries. This finding is similar to the level A indicator on share of foreign employees. The next strongest correlation is with investment abroad. Part of this investment is likely to take the form of outward FDI, which under level A was positive and significant. The next two indicators in terms of strength of association are cooperation and market-testing abroad, neither of which are significant, while the remaining three indicators are close to zero.

The correlation between the indicators derived from CIS4 and SII2008 are somewhat larger which might be the case because some of the variables feeding into the SII index are derived from different sections of CIS.

6. Conclusions

The paper makes a contribution through the design of new indicators of the international embeddedness of countries, and by exploring their associations with innovation. Three levels of analysis are considered: level A is the general level, level B captures internationalisation in sectors with a stronger contribution to the innovation system (high-tech and KIBS), and level C is based on European survey

data (Innobarometer and CIS). The indicators are linked to countries innovation performances using correlations.

While the findings of the correlation analyses are preliminary, they warrant further investigation into the issue, encouraged by the following. The results for Levels A and C suggest that outward investments and the inflow of foreign employees and students are strongly correlated with a country's innovation performance; while inward FDI, trade links, outsourcing and cooperation are not. Findings for inward FDI are mixed, with positive correlations in the earlier two time periods, and increasingly negative correlations thereafter. Countries who are net importers may be less innovative (as indicated by the negative correlations between imports and SII). A comparatively high level of imports is compatible with low competitiveness due to low level of innovation activity. We shall reconsider this issue in the context of analysing the results for level B.

Further work needs to be carried out to establish the extent to which the strength of the innovation system of countries may, for example, attract foreign students and employees, rather than vice versa, the presence of foreign students and employees leading to increased innovation performance.

Outcomes of this line of work are relevant in terms from a policy perspective, and are likely to lead to a better understanding of what modalities of internationalisation should be encouraged if the aim is increased innovation performance of national economies.

Figure 1 Overview of the different level of internationalisation indicators and innovation indicator

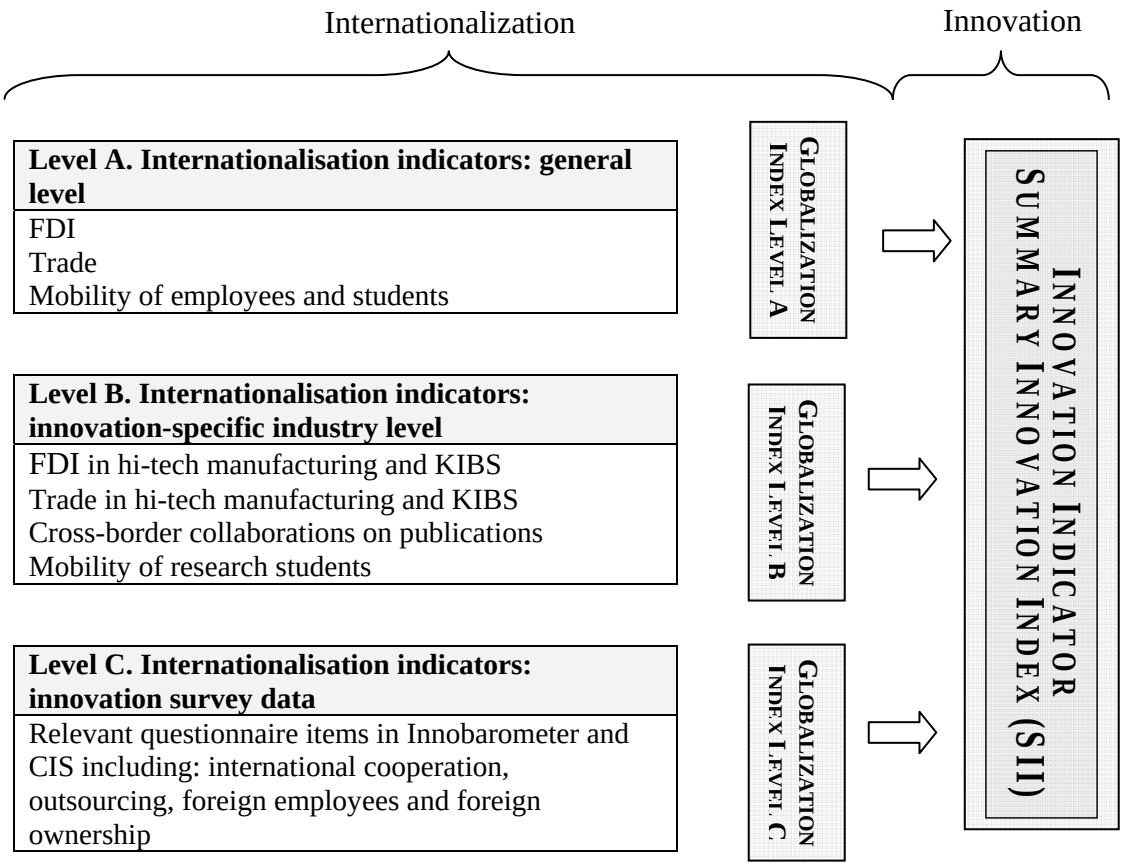

Table 1 Levels A to C internationalisation indicators and data sources

Variables for levels A, B, C	Data source
A. Internationalisation indicators: general level	
A.1 FDI	
Inward FDI flows for all industries as % of GDP	United Nations Conference on Trade and Development Database
Outward FDI for all industries as % of GDP	
A.2 Trade flows	
Imports as % of GDP	World Development Indicator produced by the World Bank
Exports as % of GDP	
A.3 Mobility of employees and students	
Foreign students in tertiary education as % total students in tertiary education	Education Statistics produced by the Organisation of Economic Cooperation and Development
Foreign employees as % of total employees	EU Labour Force Survey collected by Eurostat
Summary Globalisation Index at Level A (SGI/A)	
B. Internationalisation indicators: innovation-specific industry level	
B.1 FDI	
Inward FDI in high-tech manufacturing as % total inward FDI	OECD (International Direct Investment Statistics)
Outward FDI in high-tech manufacturing as % total outward FDI	
Inward FDI in KIBS as % total inward FDI	OECD (Globalisation Statistics)
Outward FDI in KIBS as % total FDI	
B.2 Trade	
Imports in high-tech manufacturing as % of total imports	OECD (International Trade by Commodity Statistics)
Exports in high-tech manufacturing as % of total exports	
Imports of KIBS as % of total imports	OECD (Statistics on International Trade in Services)
Exports of KIBS as % of total exports	
B.3 Collaborations	
Joint cross-border publications in Science and Engineering as % total Science and Engineering publications	National Science Foundation: Science and Engineering Indicators
B.4 Mobility of students	
Foreign research students as % total research students	OECD (Education Statistics)
Summary Globalisation Index at Level B (SGI/B)	
C. Internationalisation indicators: innovation survey data	
C.1 Companies operating in international markets as % of all companies	European Commission (Innobarometer)
C.2 Companies that outsource to companies located abroad as % of all companies	
C.3 Companies investing abroad as % of all companies	

C.4 Companies that engaging in international cooperation as % of all companies	
C.5 Companies that recruit employees from abroad as % of all companies	
C.6 Companies that engage in market-testing abroad as % of all companies	
C.7 Companies that consider lead markets to be abroad as % of all companies	
Summary Globalisation Index at Level C1 (SGI/C1)	
C.8 Enterprises that are foreign-owned as a % of all enterprises	
C.9 Enterprises that operate in international markets as % of all enterprises	
Summary Globalisation at Index Level C2 (SGI/C2)	

Table 2 Level A indicators and SGI/A

Country	*Inward FDI*	*Outward FDI*	*Imports*	*Exports*	*Foreign students*	*Foreign empl.*	*SGI/A*
Austria	0.16	0.28	0.36	0.44	0.75	0.43	**0.40**
Belgium	0.60	0.73	0.90	0.94	0.58	0.33	**0.68**
Bulgaria	0.92	0.01	0.71	0.53	.	0.01	**0.43**
Croatia	0.45	0.08	0.51	0.39	.	.	**0.36**
Cyprus	0.64	0.36	.	.	.	.	**0.50**
Czech Rep.	0.53	0.04	0.69	0.69	0.22	0.04	**0.37**
Denmark	0.30	0.32	0.28	0.39	0.42	0.13	**0.31**
Estonia	0.76	0.29	0.94	0.82	0.06	0.92	**0.70**
Finland	0.23	0.29	0.13	0.29	0.12	0.05	**0.19**
France	0.21	0.47	0.02	0.07	0.33	0.23	**0.22**
Germany	0.13	0.16	0.14	0.24	0.58	0.38	**0.27**
Greece	0.01	0.06	0.12	0.00	0.04	0.26	**0.08**
Hungary	0.37	0.14	0.71	0.68	0.16	0.02	**0.35**
Iceland	0.53	0.82	0.26	0.19	0.20	0.13	**0.36**
Ireland	0.44	0.62	0.81	1.00	0.16	0.23	**0.45**
Italy	0.05	0.14	0.01	0.07	0.08	0.26	**0.09**
Latvia	0.29	0.05	0.52	0.33	.	0.04	**0.26**
Lithuania	0.25	0.06	0.58	0.48	.	0.03	**0.28**
Luxemburg	0.72	0.94	1.00	1.00	0.66	1.00	**0.91**
Malta	0.81	0.21	1.00	0.93	.	0.13	**0.66**
Netherlands	0.51	0.95	0.58	0.69	0.21	0.15	**0.52**
Norway	0.09	0.33	0.06	0.33	0.23	0.16	**0.20**
Poland	0.25	0.05	0.18	0.18	0.00	0.00	**0.12**
Portugal	0.23	0.31	0.20	0.11	0.13	0.11	**0.18**
Romania	0.38	0.00	0.29	0.19	.	0.00	**0.18**
Slovak Rep.	0.63	0.02	0.89	0.81	0.04	0.00	**0.40**
Slovenia	0.16	0.13	0.55	0.55	.	0.01	**0.28**
Spain	0.26	0.50	0.09	0.08	0.12	0.35	**0.23**
Sweden	0.39	0.62	0.22	0.36	0.40	0.19	**0.36**
Switzerland	0.24	0.83	0.23	0.33	1.00	0.95	**0.67**
Turkey	0.05	0.02	0.00	0.02	0.03	.	**0.03**
UK	0.28	0.48	0.08	0.07	0.74	0.23	**0.31**

* Indicators are computed as averages across a five year period (e.g. 1999-2003, 2000-2004, etc.). The values in this table are the averages of our indicators which refer to different time periods starting with 1999-2003 and ending with 2003-2007. Where there are missing values, i.e. a lower number of indicators, the SGI/A is the average of the indicators for which we have information.

Table 3 Level C indicators and SGI/C1 and C2

Country	*Operates in int. markets*	*Out-sourcing*	*Invest in firms abroad*	*Int. co-operation*	*Foreign empl.*	*Market-testing abroad*	*Int. lead markets*	*GSI/C*
Austria	0.53	0.25	0.70	0.39	0.51	0.64	0.78	**0.54**
Belgium	0.43	0.71	1.00	0.67	0.50	0.89	0.21	**0.63**
Bulgaria	0.38	0.13	0.08	0.15	0.11	0.00	0.42	**0.18**
Cyrpus	0.00	0.28	0.20	0.16	0.85	0.26	0.59	**0.34**
Czech Rep.	0.63	0.38	0.74	0.30	0.44	0.52	0.26	**0.47**
Denmark	0.61	0.49	0.57	0.69	0.39	0.60	0.51	**0.55**
Estonia	0.51	0.38	0.19	0.95	0.13	0.59	1.00	**0.53**
Finland	0.43	0.46	0.33	0.86	0.32	0.40	0.46	**0.47**
France	0.44	0.42	0.24	0.28	0.25	0.26	0.57	**0.35**
Germany	0.11	0.00	0.13	0.00	0.15	0.11	0.00	**0.07**
Greece	0.55	0.43	0.40	0.46	0.33	0.59	0.94	**0.53**
Hungary	0.28	0.05	0.08	0.31	0.03	0.13	0.59	**0.21**
Ireland	0.30	0.44	0.23	0.37	1.00	0.39	0.38	**0.44**
Italy	0.47	0.19	0.48	0.16	0.15	0.32	0.84	**0.37**
Latvia	0.37	0.55	0.00	0.26	0.00	0.24	0.21	**0.23**
Lithuania	0.41	1.00	0.51	0.98	0.18	0.54	0.82	**0.63**
Luxemburg	1.00	0.56	0.82	0.52	0.81	0.44	0.47	**0.66**
Malta	0.27	0.27	0.19	0.11	0.63	0.19	0.18	**0.26**
Netherlands	0.59	0.51	0.83	0.70	0.53	0.69	0.46	**0.61**
Norway	0.40	0.53	0.94	0.58	0.76	0.53	0.05	**0.54**
Poland	0.49	0.20	0.09	0.46	0.13	0.25	0.15	**0.25**
Portugal	0.41	0.42	0.59	0.32	0.33	0.61	0.50	**0.45**
Romania	0.40	0.18	0.07	0.35	0.05	0.40	0.32	**0.25**
Slovak Rep	0.42	0.52	0.47	0.46	0.18	0.58	0.30	**0.42**
Slovenia	0.86	0.35	0.55	0.62	0.61	1.00	0.57	**0.65**
Spain	0.21	0.40	0.49	0.15	0.53	0.45	0.42	**0.38**
Sweden	0.33	0.43	0.79	1.00	0.61	0.65	0.60	**0.63**
Switzerland	0.43	0.23	0.57	0.40	0.92	0.50	0.37	**0.49**
UK	0.21	0.28	0.27	0.32	0.52	0.24	0.47	**0.33**

Table 4 Level A results – correlations between six internationalisation indicators, SGI/A and SII

Innovation index		*SII 2004*	*SII 2005*	*SII 2006*	*SII 2007*	*SII 2008*	*SII pooled**
Internationalisation indicators and index		1999-2003	2000-2004	2001-2005	2002-2006	2003-2007	1999-2007
SGI/A	Correlation	**0.41**	**0.37**	**0.31**	**0.31**	**0.35**	**0.35**
	p-value	0.02	0.03	0.08	0.08	0.05	0.00
	N	32	32	32	32	32	160
Inward FDI flows	Correlation	**0.21**	**0.02**	**-0.16**	**-0.21**	**-0.25**	**-0.10**
	p-value	0.26	0.90	0.38	0.24	0.17	0.22
	N	32	32	32	32	32	160
Outward FDI flows	Correlation	**0.77**	**0.70**	**0.57**	**0.57**	**0.63**	**0.64**
	p-value	0.00	0.00	0.00	0.00	0.00	0.00
	N	32	32	32	32	32	160
Imports	Correlation	**-0.09**	**-0.12**	**-0.13**	**-0.16**	**-0.14**	**-0.12**
	p-value	0.65	0.53	0.50	0.40	0.46	0.14
	N	31	31	31	29	29	151
Exports	Correlation	**0.14**	**0.12**	**0.12**	**0.06**	**0.08**	**0.11**
	p-value	0.45	0.50	0.51	0.75	0.69	0.16
	N	31	31	31	29	29	151
Foreign students	Correlation	**0.74**	**0.75**	**0.76**	**0.74**	**0.71**	**0.72**
	p-value	0.00	0.00	0.00	0.00	0.00	0.00
	N	23	23	22	22	24	115
Foreign employees	Correlation	**0.41**	**0.48**	**0.51**	**0.50**	**0.52**	**0.49**
	p-value	0.05	0.01	0.00	0.01	0.00	0.00
	N	24	27	29	28	28	136

Table 5 Level C results – correlations between seven internationalisation indicators, SGI/C and SII2008

Innovation index	*SII 2008*	
Internationalisation indicators and index Innobarometer	*Correlation*	*p-value*
SGI/C1	**0.39**	**0.04**
Company operated in international markets	0.06	0.77
Outsourced activities to companies located abroad	-0.01	0.96
Investment into companies located abroad	0.38	0.04
Cooperated with partners which were located abroad	0.29	0.12
Recruited employees from other countries	0.57	0.00
Market-testing in foreign countries	0.28	0.14
Company considered international markets as lead markets	0.05	0.81
Internationalisation indicators and index CIS4	*Correlation*	*p-value*
SGI/C2	**0.67**	**0.00**
Enterprise is foreign ownership	0.62	0.00
Enterprise operates in international markets	0.62	0.00

Correlations are based on 29 countries included in the Innobarometer; and 22 countries for which the Eurostat CIS4 data is available.

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