



Relationship between Innovation and Socio-economic Performance

INNO-Metrics Thematic Paper

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Executive Summary

One of the underlying rationales for public policies for support of innovation related activities is that they lead to better economic performance and increases in social welfare. This thematic paper investigates the relationship between national innovation performance and measures of socio-economic performance for European countries. Data on innovation performance are gathered from the Innovation Union Scoreboard (2010) and those on economic, social and environmental performance from a number of different databases available from Eurostat. The last two categories include some measures that have been employed as EU2020 targets. The main results to emerge from the analysis are as follows.

Firstly there are major differences in a number of facets of socio-economic performance when countries are grouped according to their overall innovation performance (based on the categorization from IUS 2010 report). Such differences are most stark for economic performance. Taking as an example GDP per capita, *Innovation leaders* have an average level that is around 7 times higher than *Modest innovators* and 2 times higher than *Moderate innovators*. There are large differences amongst these country groups in the two indicators of environmental performance (greenhouse gas emissions and energy intensity of the economy). However in terms of social performance, the differences between country groups are negligible.

Secondly in terms of trends since 1999, the countries that are below average in terms of innovation performance (*Modest* and *Moderate* innovators) have been catching up rapidly, especially in relation to the two measures of environmental performance.

These descriptive results are confirmed by more rigorous statistical analyses (based on correlations and regressions). These show that there is a systematic relationship between innovation performance (as measured by the Summary Innovation Index (SII)) and all indicators of economic and environmental performance but not with those of social performance. However, contrary to expectations, this analysis does not support the notion of a time lag between innovation performance and subsequent economic performance, thus making it difficult to establish causality.

There are large differences in the strength of the relationship between innovation performance and socio-economic performance when the sample is divided according to the income levels of countries. This is most evident in the case of the two environmental indicators, where the amount of variation explained by the SII reduces most drastically when the sample is divided (and is almost non-existent for high income countries).

There are differences in the relationship between different dimensions of innovation performance identified in IUS 2010 and various elements of socio-economic

performance. The strongest relationship is between Research Systems and economic and environmental performance. The implication is that countries with open, excellent and attractive science base have higher per capita GDP and labour productivity, and lower average energy intensity and greenhouse gas emissions. Finally two of the dimensions of innovation are not related to most of the socio-economic performance measures: firm investments and linkages and entrepreneurship. The former result is puzzling as one would expect there to be some relationship between firm expenditures on innovation (R&D and non-R&D) to have a significant impact on the economic performance measures.

1. Introduction: Aims and Limitations

The overall aim of this thematic paper is to investigate the relationship between innovation performance and socio-economic performance at the national level. In relation to the former it uses data from the Innovation Union Scoreboard (2010), henceforth referred to as IUS 2010. Some of the measures of socio-economic performance are based on the EU 2020 targets.

In the past the relationship between innovation and economic performance has been investigated at a number of different levels of aggregation, e.g. at the level of the firm, industrial sector, region or the country. The underlying rationale for these studies is that resources devoted to innovation lead to better economic performance and increases in social welfare. Such studies have also been based on a variety of measures of both innovation and economic performance. In the case of the former these include R&D expenditures, patents, counts of innovations, and sales of new products. In terms of economic performance the measures used have included GDP per capita, labour productivity, import and export competitiveness. However, very few studies have gone beyond these economic measures to include indicators of social or environmental performance. Past analyses have also been based on a variety of methodological approaches ranging from very sophisticated econometrics to investigate causality to simple correlations.

Questions addressed

The analysis in this thematic paper is at the country level using data on innovation indicators from the IUS 2010 and a range of socio-economic and environmental performance indicators assembled from various sources. More specifically the aim is to address 3 sets of questions:

- *Do countries that perform well in terms of innovation also perform well in terms of socio-economic performance?*
- *Which dimensions of innovation performance are related to socio-economic indicators?*
- *Is there a time lag between better innovation performance and better socio-economic performance?*

Limitations

The approach adopted in this paper is mainly descriptive rather than econometric, largely due to the constraints imposed by time and data availability. The implications of this approach can best be illustrated by making some remarks about the relationship between productivity performance and innovation. This has been analysed at many different levels of aggregation from the firm level, to the level of industrial sector and that of the country. The main point to make is that differences in long term productivity performance can be attributed to a number of different factors of which innovation is one. Others are investment in physical capital, level of skills, competition and management capabilities. Thus a rigorous econometric analysis of this relationship would need to include these as explanatory variables. However assembling time series data for these variables for a large set of countries that are included in the IUS 2010 is beyond the scope of this paper (assuming such data are available, which is obviously not the case for some variables such as management capabilities), hence the largely descriptive nature of the analysis below.

2. Data and Methodology

Innovation performance

In this report we use data on innovation performance from the Innovation Union Scoreboard 2010.¹ The main advantage of this approach is that it encompasses a broader definition of innovation compared to other studies examining the relationship between innovation and economic performance. Such studies have been based on R&D, patenting or innovation performance as measured in the CIS. The main disadvantage of our approach is the limited availability of data over time and the fact that the indicators included in the Summary Innovation Index (SII) are measured at different points in time. This imposes a limit on the scope for statistical/econometric analysis especially in relation to the identification of time lags.

As the latest year for which data are available for a majority of the indicators in IUS 2010 is 2008, we take this to be the final year for SII.² This effectively means that all SII reported in IUS 2010 are lagged by 2 years.³

In the analysis below we also relate the socio-economic performance to each of the 8 dimensions of innovation performance identified in IUS 2010:

- Human resources
- Research systems
- Finance and support
- Firm investments
- Linkages & entrepreneurship Intellectual assets
- Intellectual Assets
- Innovators
- Economic effects

The 25 innovation related indicators used in IUS 2010 have been grouped into these 8 dimensions. This analysis is static as the dimensions (and the underlying indicators) are not the same in previous versions of the Innovation scoreboard.

¹ Supplied to us by Hugo Hollanders on 3 December 2010.

² We are aware that the IUS 2010 data have now been revised and include more indicators for 2009.

³ In other words 'SII-2010' in IUS 2010 is designated SII-2008 and 'SII-2009' as SII-2007 etc.

Classifying countries according to innovation performance

In order to examine the differences in socio-economic performance we classify countries according to their innovation performance. The classification used here is that from IUS 2010 which has four categories of countries, based on their average innovation performance across 24 indicators⁴:

- Denmark, Finland, Germany, Sweden, Switzerland and the UK all show a performance well above that of the EU27. These countries are termed **Innovation leaders**.⁵
- Austria, Belgium, Cyprus, Estonia, France, Iceland, Ireland, Luxembourg, Netherlands and Slovenia all show a performance close to that of the EU27 and are labelled **Innovation followers**.
- The performance of Croatia, Czech Republic, Greece, Hungary, Italy, Malta, Norway, Poland, Portugal, Slovakia and Spain is below that of the EU27. These countries are **Moderate innovators**.
- The performance of Bulgaria, Latvia, Lithuania, Romania and Turkey is well below that of the EU27. These countries are described as **Modest innovators**.

The idea is to compare these 4 groups of countries according to their socio-economic performance.

Measures of Socio-economic performance

The report is based on a number of different measures of socio-economic performance. Table 1 below lists the specific indicators that have been included in the analysis in Section 3.⁶ The 2 indicators of economic performance are well-known and have been used in previous studies at the country level.⁷ Here we use labour productivity per person rather than the more accurate measure based on per hour worked. The main reason for this choice is that the data for the former are available for more countries

⁴ Here we have also included 5 countries that are not a part of the EU: Switzerland, Norway, Croatia, Iceland, and Turkey.

⁵ We are aware that the final version of the 2010 Scoreboard report now has the UK as Innovation follower due to inclusion of latest data, but this change does not alter the main thrust of our results.

⁶ We also considered the following alternative measures (to the ones included in Table 1): Labour productivity per hour worked, Total Employment Rate; Long-term unemployment rate; Income quintile share ratio; Average gross annual earnings and Environmental Investment by the public sector. These were rejected mainly because of limited data availability. As an example Average gross annual earnings was only available for 17 countries.

⁷ In addition we collected data on total factor productivity from EUKLEMS but these were only available for a small number of countries and only as Index numbers (i.e. could only be used as growth rates and not levels).

and the results obtained are qualitatively similar for both measures. *Employment rate* could equally be regarded as an economic indicator as a social indicator.

Table 1. Indicators of Socio-Economic performance

Indicators	Years	Countries excluded	Source
<i>General Economic Indicators</i>			
GDP per capita in PPS (000s Euros)	1999-2008	Norway & Luxembourg	Eurostat New Cronos, ESDS International, University of Manchester
Labour productivity per person employed divided by Total persons employed (000s Euros)	1999-2009	Cyprus, Iceland, Luxembourg, Norway	Eurostat New Cronos, ESDS International, University of Manchester
<i>Social Indicators</i>			
Employment Rate by age group (20-64) (% of total population aged 20-64 in employment)	1999-2009		EU Labour Force Survey, Eurostat
Income inequality: Gini coefficient	1999-2009	Switzerland	Statistics on Income and Living Conditions (SILC), Euro stat
Early leavers from education and training (% of population aged 18-24 with at most lower secondary education and not in further education or training)	1999-2009	Turkey, Malta, Spain and Portugal	EU Labour Force Survey, Eurostat
<i>Environmental Indicators</i>			
Annual Average Energy intensity of an economy (Gross inland consumption of energy divided by GDP (kilogram of oil equivalent per 1000 Euro))	1999-2008		Eurostat
Greenhouse Gas Emissions per unit of GDP (Greenhouse gas emissions in 1000 tonnes divided by GDP (million euros))	1999-2008	Cyprus	European Environment Agency (EEA), Eurostat

A number of the social and environmental indicators are based on the EU2020 targets: *Employment Rate of population aged between 20-64 years; Early school leavers; Annual average Energy intensity of an economy; and Greenhouse Gas Emissions.*

Issues for statistical analysis

The aim in this report is to investigate how innovation performance is related to socio-economic performance. The underlying rationale is that the current measure of one of the aspects of socio-economic performance (for example labour productivity) is

related to past innovation performance. The exact nature of the time lags involved in such a relationship is an empirical matter. However given the relatively short time period for which the innovation performance indicator is available the scope for experimentation with time lags in the current analysis is rather limited.

An issue raised in previous analyses (for example thematic paper “Innovation and Economic performance” produced by Hugo Hollanders and Anthony Arundel (2006)) is that while there is a strong relationship between innovation and economic performance across a large sample of countries, this does not hold when one controls for the income level of countries. More specifically they argue that such a relationship does not hold for ‘high-income’ countries. We address this issue below in the regression analysis by controlling for differences in per capita GDP.

3. Main Results

This section presents the main results of the analysis of the relationship between innovation and socio-economic performance. More specifically we conduct three types of analyses for each of the measures included in Table 1:

- Descriptive analyses to identify the performance characteristics of countries grouped according to their innovation performance: *Innovation leaders*, *Innovation followers*, *Moderate innovators* and *Modest innovators*.
- Statistical analyses on the basis of aggregate level SII: bi-variate correlations and regressions.
- Regression analysis based on the 8 different dimensions of innovation performance discussed above.

3.1 Socio-Economic Performance characteristics of countries.

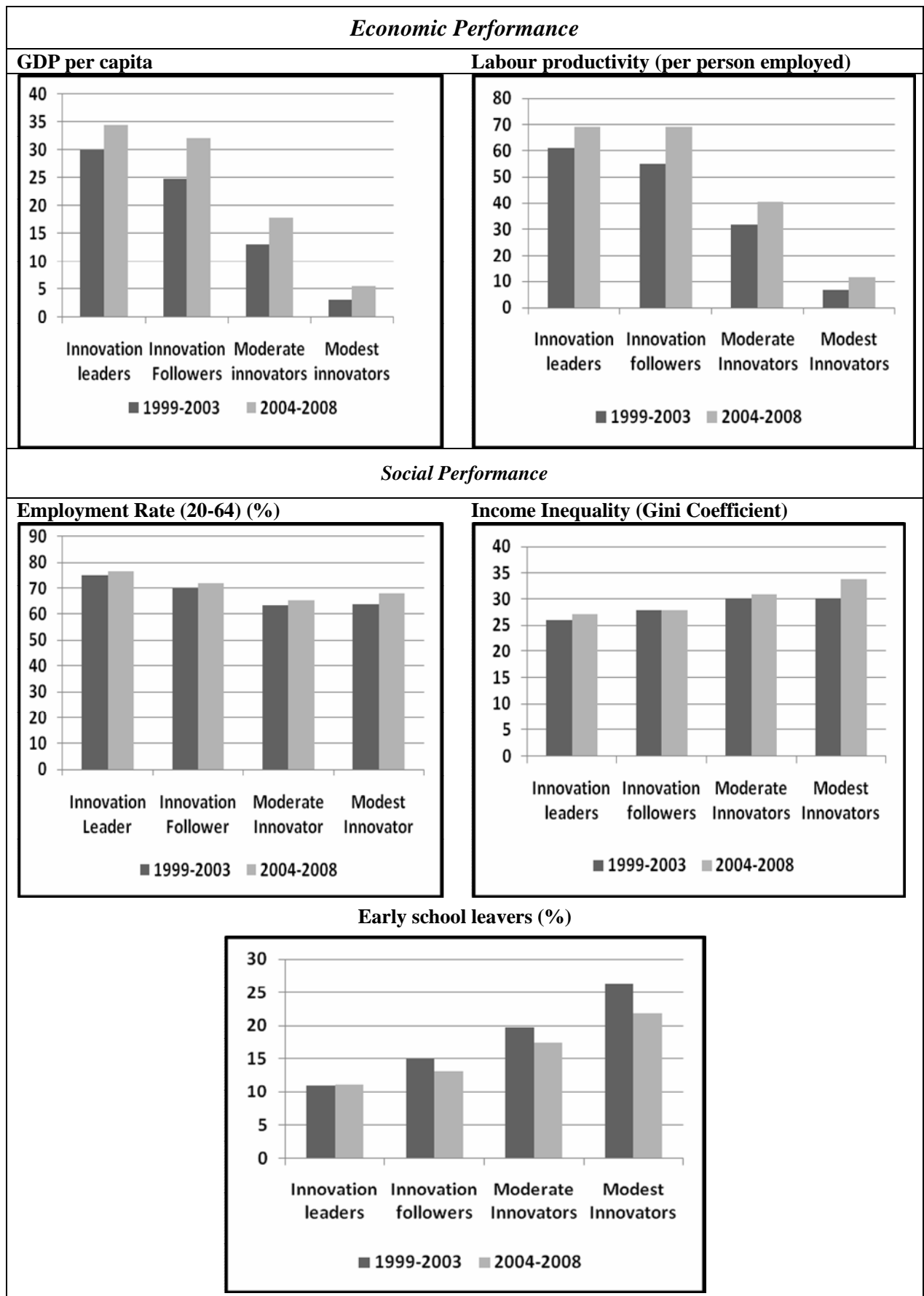
Economic Performance

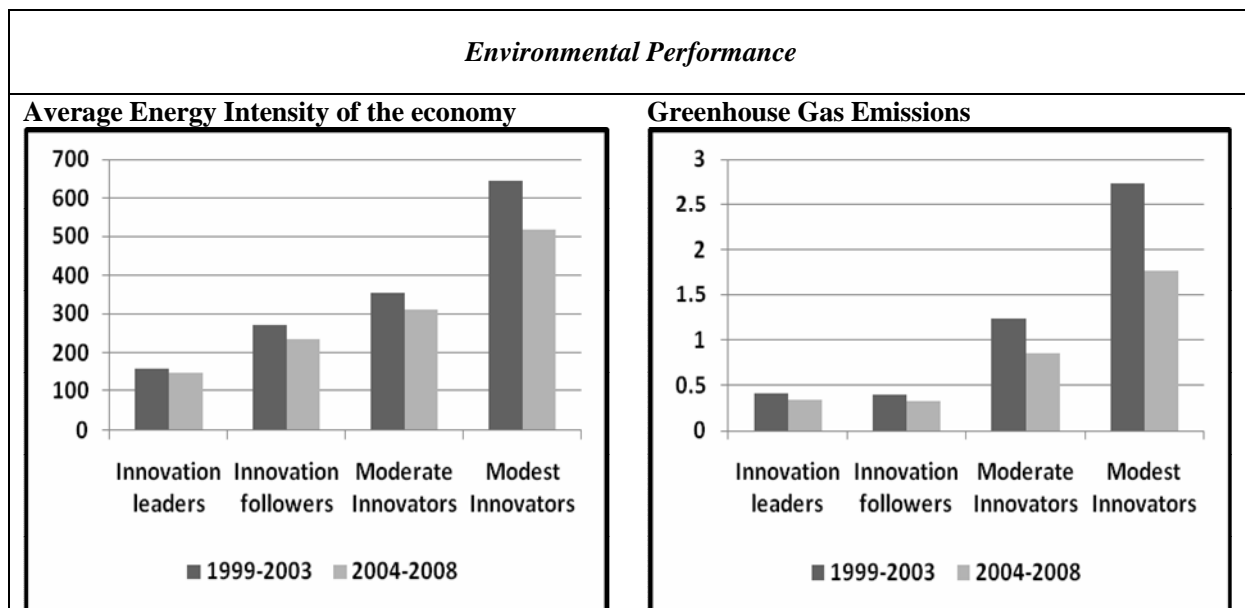
The first indication of the positive relationship between innovation and economic performance is given in Fig. 1. *Innovation leaders* have an average level of per capita GDP that is around 7 times higher than *Modest innovators* and 2 times higher than *Moderate innovators*. *Innovation followers* also have a better performance than either *Moderate* or *Modest innovators*. The same differences are evident when we consider labour productivity. With respect to trends over time the largest proportionate increases in per capita GDP from 1999 to 2008 have been for *Modest innovators* and the lowest for *Innovation leaders*, thus signifying some level of catch-up.

Social Performance

Figure 1 also shows that for two out of the three indicators of social performance, the differences between groups of countries aggregated according to their innovation performance are very small: *employment rate of population aged 20-64* and *income inequality*. In terms of the third indicator *Innovation leaders* and *followers* have a much smaller proportion of *early school leavers* amongst the population aged 18-24 than either *Moderate* or *Modest innovators*. However for *Innovation leaders* this proportion has not changed over the 10 years since 1999, but for modest innovators there has been a decline from 26.4% to 21.8%.

Figure 1 Socio-Economic performance by Country groups





Environmental performance

The two indicators of environmental performance also show stark differences between *Innovation leaders* and *Modest innovators*. Average *energy intensity* of the latter group of countries is around 4 times higher than that of the former. The differences in terms of *greenhouse gas emissions* as a proportion of GDP are even larger, with *Modest innovators* between 5 and 6 times higher than *Innovation leaders* and *Moderate innovators* around 3 times higher. However considering the trends from 1999 to 2008, the largest decreases in both the *energy intensity* of the economy and *greenhouse gases* have been for *Modest innovators*.

3.2 Aggregate Innovation Performance and Socio-Economic Performance

In this section we consider three sets of issues. The first is whether there is a systematic relationship between innovation performance and socio-economic performance. The above descriptive analysis has hinted that this is likely to be the case and we use correlations and regressions to analyse this at the level of individual countries.

The second issue addressed is whether there is a time lag between innovation performance on the one hand, and socio-economic performance on the other. The underlying rationale is that it takes some time before innovation has an effect on a

performance variable such as GDP per capita. The identification of the time lag is not an easy matter and here we use year-wise correlations to address this issue. The idea is that any increase in the size of the correlation coefficient over time, when innovation performance is correlated with one of the indicators of socio-economic performance (e.g. GDP per capita), is an indication of the time lags involved.

The third issue addresses the concerns raised in a previous EIS Thematic Paper (Arundel and Hollanders (2006)) that the relationship between innovation and economic performance is strongly conditioned by the level of income of a country. More precisely they argued that for high income countries this relationship is much weaker (or non-existent) than for low income countries. This issue is addressed by conducting separate regressions for each of these set of countries.

Table 2 presents the year-wise correlations between SII and each of the 7 indicators of socio-economic performance.⁸ All the correlations except for those with *early school leavers* are significantly different from zero. This analysis confirms that there is a systematic relationship between innovation performance and most of the indicators of socio-economic performance, including *income inequality* where the differences between the average performance of countries grouped according to their innovation performance were minimal. Table 2 also shows that the strongest correlations are between SII and the economic performance variables and the weakest with social performance.

The other main result to emerge from Table 2 is that there is very little evidence of a time lag between innovation performance and subsequent socio-economic performance. Taking labour productivity as an example, in order to detect the possibility of a lag, we would expect that productivity in 2008 would have a substantially higher level of correlation with past years SII (for example 2003 than with 2008). However the results show no such pattern: the year to year variation in the correlation coefficient is very low signifying a lack of any distinct lag pattern. One issue to consider is that the time period available may be too small to detect any lags in the relationship.

⁸ Here “SII-2003” refers to “SII-2005” from EIS 2007 report, and the remaining SII (2004-2008) are from IUS 2010.

Table 2 Yearly Correlations between Innovation Performance and Socio-Economic Performance

Correlation between SII and GDP per capita PPS

	<i>SII 2003</i>	<i>SII 2004</i>	<i>SII 2005</i>	<i>SII 2006</i>	<i>SII 2007</i>	<i>SII 2008</i>
GDP per capita 2003	0.89	0.91	0.92	0.92	0.91	0.90
GDP per capita 2004	0.88	0.91	0.92	0.91	0.91	0.89
GDP per capita 2005	0.87	0.89	0.89	0.89	0.88	0.86
GDP per capita 2006	0.87	0.90	0.90	0.90	0.89	0.87
GDP per capita 2007	0.87	0.89	0.89	0.89	0.88	0.86
GDP per capita 2008	0.89	0.93	0.93	0.92	0.92	0.91

Correlation between SII and Labour productivity per person employed

	<i>SII 2003</i>	<i>SII 2004</i>	<i>SII 2005</i>	<i>SII 2006</i>	<i>SII 2007</i>	<i>SII 2008</i>
Labour productivity 2003	0.86	0.89	0.89	0.89	0.88	0.88
Labour productivity 2004	0.86	0.89	0.89	0.89	0.88	0.88
Labour productivity 2005	0.86	0.89	0.89	0.89	0.88	0.87
Labour productivity 2006	0.85	0.89	0.89	0.88	0.88	0.87
Labour productivity 2007	0.85	0.89	0.89	0.88	0.87	0.87
Labour productivity 2008	0.85	0.88	0.89	0.88	0.87	0.87

Correlation between SII and Employment rate (20-64)

	<i>SII 2003</i>	<i>SII 2004</i>	<i>SII 2005</i>	<i>SII 2006</i>	<i>SII 2007</i>	<i>SII 2008</i>
Employment rate 2003	0.63	0.64	0.64	0.65	0.65	0.64
Employment rate 2004	0.64	0.65	0.65	0.67	0.66	0.65
Employment rate 2005	0.64	0.65	0.65	0.66	0.66	0.64
Employment rate 2006	0.65	0.63	0.63	0.65	0.64	0.63
Employment rate 2007	0.65	0.61	0.61	0.63	0.62	0.61
Employment rate 2008	0.64	0.61	0.60	0.62	0.62	0.61

Correlation between SII and Income Inequality

	<i>SII 2003</i>	<i>SII 2004</i>	<i>SII 2005</i>	<i>SII 2006</i>	<i>SII 2007</i>	<i>SII 2008</i>
Gini Coefficient 2005	-0.51	-0.45	-0.46	-0.47	-0.47	-0.45
Gini Coefficient 2006	-0.64	-0.62	-0.63	-0.62	-0.63	-0.62
Gini Coefficient 2007	-0.50	-0.50	-0.50	-0.49	-0.49	-0.48
Gini Coefficient 2008	-0.47	-0.50	-0.51	-0.50	-0.51	-0.49

Correlation between SII and Early school leavers

	<i>SII 2003</i>	<i>SII 2004</i>	<i>SII 2005</i>	<i>SII 2006</i>	<i>SII 2007</i>	<i>SII 2008</i>
Early school leavers 2003	-0.19	-0.25	-0.24	-0.20	-0.21	-0.22
Early school leavers 2004	-0.15	-0.19	-0.18	-0.13	-0.15	-0.17
Early school leavers 2005	-0.04	-0.10	-0.09	-0.04	-0.05	-0.08
Early school leavers 2006	0.01	-0.04	-0.04	0.02	0.00	-0.04
Early school leavers 2007	0.08	0.04	0.04	0.07	0.06	0.03
Early school leavers 2008	0.08	0.04	0.04	0.08	0.07	0.03

Correlation between SII and Energy Intensity of the economy

	<i>SII 2003</i>	<i>SII 2004</i>	<i>SII 2005</i>	<i>SII 2006</i>	<i>SII 2007</i>	<i>SII 2008</i>
Energy Intensity 2003	-0.52	-0.60	-0.61	-0.61	-0.60	-0.60
Energy Intensity 2004	-0.51	-0.60	-0.61	-0.61	-0.60	-0.60
Energy Intensity 2005	-0.52	-0.61	-0.61	-0.61	-0.61	-0.61
Energy Intensity 2006	-0.51	-0.60	-0.60	-0.60	-0.60	-0.60
Energy Intensity 2007	-0.53	-0.61	-0.62	-0.62	-0.61	-0.61
Energy Intensity 2008	-0.54	-0.62	-0.63	-0.62	-0.62	-0.61

Correlation between SII and Greenhouse Gas emissions

	<i>SII 2003</i>	<i>SII 2004</i>	<i>SII 2005</i>	<i>SII 2006</i>	<i>SII 2007</i>	<i>SII 2008</i>
Greenhouse gas emissions 2003	-0.58	-0.62	-0.63	-0.63	-0.62	-0.61
Greenhouse gas emissions 2004	-0.58	-0.63	-0.63	-0.63	-0.63	-0.61
Greenhouse gas emissions 2005	-0.61	-0.65	-0.65	-0.66	-0.65	-0.64
Greenhouse gas emissions 2006	-0.60	-0.64	-0.65	-0.65	-0.65	-0.63
Greenhouse gas emissions 2007	-0.58	-0.63	-0.64	-0.64	-0.63	-0.61
Greenhouse gas emissions 2008	-0.59	-0.63	-0.64	-0.64	-0.64	-0.61

Bold indicates that the correlation coefficient is different from zero at the 5% level.

Table 3 presents the summary of the results of panel data estimations of the relationship between each of the 7 measures of socio-economic performance (dependent variable) and SII (explanatory variable). For each measure the sample has been divided into low income and high income countries to detect any differences in the relationship.

Table 3. Ordinary Least Squares Regression of Innovation performance and Socio-economic performance.

	All Ctrys			Low Income ¹			High Income ²		
	<i>Coeff</i>	<i>R</i> ²	<i>N</i>	<i>Coeff</i>	<i>R</i> ²	<i>N</i>	<i>Coeff</i>	<i>R</i> ²	<i>N</i>
<i>GDP per capita</i>	32.3	0.80	179	28.1	0.58	96	41.1	0.34	83
<i>Labour Productivity</i>	55.8	0.77	165	52.1	0.35	87	60.4	0.28	78
<i>Employment rate</i>	23.1	0.40	188	21.4	0.26	93	25.5	0.20	95
<i>Income Inequality</i>	-11.0	0.14	158	-18.6	0.02	75	-0.6	0.27	83
<i>Early school leavers</i>	-5.5	0.00	168	-11.0	0.06	90	0.4	0.27	78
<i>Energy Intensity</i>	-322.6	0.35	190	-450.1	0.10	96	-130.9	0.05	94
<i>Greenhouse Gas emissions</i>	-2.3	0.38	186	-3.6	0.11	90	-0.8	0.03	96

Panel data estimations with SII as the independent variable.

Bold indicates statistical significance at the 5% level.

¹ Low income countries are: Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, and Turkey

² High income countries are: Austria, Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Spain, Sweden, Switzerland, and UK

The first point to make from Table 3 is that most of the results discussed in the previous sections (based on different types of analyses (descriptive and correlations)) are confirmed for the sample as whole. There is a very strong positive relationship between the economic performance measures and innovation, the relationship with two of the three social performance measures is weak (or non-existent), and that with environmental measures is somewhere in-between.

The results show that there are differences both in the amount of variation in a particular variable explained by innovation performance (R^2) and the size of the coefficient when the sample is divided between high and low income countries. Taking *GDP per capita* as an example, for the whole sample a very high level of variance is explained by SII (80%), however in the case of high income countries this reduces to 34%. At the same time the impact of SII is higher for high income

countries (41.1) than either low income countries (28.1) or the sample as a whole (32.3).

In general the relationship between socio-economic performance and innovation performance is much stronger for the full sample of countries compared to when the sample is divided between high and low income countries. This is most evident in the case of the two environmental indicators, where the amount of variation explained by SII reduces most drastically when the sample is divided (and is almost non-existent for high income countries).

3.3 Dimensions of Innovation and Socio-Economic Performance.

The aim of this sub-section is to analyse the impact of each of the 8 dimensions of innovation identified in EIS 2010 on the different measures of socio-economic performance. These dimensions represent different aspects of the innovation system: *Human Resources* (including skills); *Open, excellent and attractive Research Systems* (related to the Science base); *Finance and Public Support for innovation*; *Firm-level investments*; *Linkages* (i.e. collaborations) and *Entrepreneurship*; *Intellectual Assets* (Patents, Trademarks and Copyright); *Innovators* (innovating SMEs); and *Economic Effects of innovation*. Each of these dimensions is measured by a number of different indicators and here we use a summary index which combines these together.

Each dimension is regressed on each of the different measures of socio-economic performance using a panel dataset. The resulting 56 regressions are summarized in Table 4. For 2 measures of social performance, *income inequality* and *early school leavers*, none of the innovation dimensions have an impact. Of the remaining 5 performance measures, the strongest relationship is with *Research Systems*. In other words countries with open, excellent and attractive science base have higher per capita GDP, labour productivity, employment rate, and lower average energy intensity and greenhouse gas emissions. *Intellectual assets* also have a relatively strong relationship with these same five socio-economic performance measures. Amongst the other dimensions, *linkages and entrepreneurship* has a relatively explanatory power in most cases (i.e. high R^2) but the effect (coefficient) is not statistically significant.

Table 4 Ordinary Least Squares Regression of Innovation Dimensions and Socio-economic performance.

Dependent variable →	<i>Per capita GDP</i>		<i>Labour productivity</i>		<i>Employment rate</i>		<i>Income Inequality</i>		<i>Early school leavers</i>		<i>Energy Intensity</i>		<i>Greenhouse Gas emissions</i>	
	<i>Coeff</i>	<i>R²</i>	<i>Coeff</i>	<i>R²</i>	<i>Coeff</i>	<i>R²</i>	<i>Coeff</i>	<i>R²</i>	<i>Coeff</i>	<i>R²</i>	<i>Coeff</i>	<i>R²</i>	<i>Coeff</i>	<i>R²</i>
Human Resources	29.1	0.30	53.2	0.37	27.0	0.31	1.94	0.01	-3.4	0.17	-426.3	0.08	-2.58	0.09
Research Systems	32.4	0.86	51.2	0.79	16.2	0.41	1.10	0.12	1.6	0.01	-192.0	0.38	-1.20	0.41
Finance and Support	5.9	0.49	8.1	0.42	8.5	0.44	-0.39	0.07	-3.2	0.01	-181.8	0.19	-1.57	0.32
Firm Investments	-4.5	0.38	8.3	0.28	0.0	0.33	1.37	0.03	1.0	0.01	73.0	0.06	0.11	0.11
Linkages & Entrepreneurship	0.5	0.67	1.0	0.58	1.5	0.49	1.96	0.15	-0.8	0.00	-1.3	0.29	-0.09	0.34
Intellectual Assets	29.5	0.75	40.1	0.70	17.5	0.34	3.40	0.13	-5.8	0.00	-222.2	0.32	-1.36	0.36
Innovators	7.8	0.40	11.4	0.50	5.3	0.08	1.13	0.04	-0.5	0.01	-74.3	0.23	-0.46	0.20
Economic Effects	18.6	0.43	27.2	0.55	12.3	0.04	1.92	0.10	-12.7	0.02	-233.2	0.25	-1.68	0.24

Panel data estimations with SII for each dimension of innovation as the independent variable.
 Bold indicates statistical significance at the 5% level.

Finally two of the dimensions of innovation are not related to majority of the socio-economic performance measures: *firm investments* and *linkages and entrepreneurship*. The former result is a little puzzling as one would expect there to be some relationship between firm expenditures on innovation (R&D and non-R&D) to have a significant impact on the economic performance measures. In the case of *per capita GDP* the effect of such expenditures is statistically insignificant with a relatively low R^2 and in that of labour productivity, while the effect is statistically significant, the R^2 is low. In order to understand why this may be the case one would need to look in more detail at the behaviour of the individual indicators that make up *firm investments*.

4. Summary and Conclusions

This thematic paper has investigated the relationship between innovation performance and socio-economic performance at the national level for European countries. Data on innovation performance were gathered from the Innovation Union Scoreboard (2010) and those on economic, social and environmental performance from a number of different databases available from Eurostat. The last two categories include some measures that have been employed as EU2020 targets. The main results to emerge from the analysis are as follows:

1. There are major differences in a number of facets of socio-economic performance when countries are grouped according to their overall innovation performance (based on the categorization from IUS 2010 report). Such differences are most stark for economic performance. Taking as an example GDP per capita, *Innovation leaders* have an average level that is around 7 times higher than *Modest innovators* and 2 times higher than *Moderate innovators*. There are large differences amongst these country groups in the two indicators environmental performance (greenhouse gas emissions and energy intensity of the economy). However in terms of social performance, the differences between country groups are negligible.
2. With regards to trends since 1999, there are strong indications that for both economic and environmental performance, countries below average in terms of innovation performance (*Modest* and *Moderate* innovators) are catching up rapidly. This is most apparent in the two measures of environmental performance.

3. The more rigorous statistical analyses (based on correlations and regressions) confirm that there is a systematic relationship between innovation performance (as measured by the Summary Innovation Index (SII)) and indicators of economic and environmental performance but not with those of social performance.
4. However contrary to expectations, this analysis does not support the notion of a time lag between innovation performance and subsequent economic performance, making it difficult to establish causality.
5. In general the relationship is much stronger for the full sample of countries compared to when the sample is divided between high and low income countries. This is most evident in the case of the two environmental indicators, where the amount of variation explained by the SII reduces most drastically when the sample is divided (and is almost non-existent for high income countries).
6. There are differences in the relationship between different dimensions of innovation performance identified in IUS 2010 and various elements of socio-economic performance. The strongest relationship is between *Research Systems* and economic and environmental performance. The implication is that countries with open, excellent and attractive science base have higher per capita GDP and labour productivity, and lower average energy intensity and greenhouse gas emissions. Finally two of the dimensions of innovation are not related to most of the socio-economic performance measures: *firm investments* and *linkages and entrepreneurship*. The former result is puzzling as one would expect there to be some relationship between firm expenditures on innovation (R&D and non-R&D) to have a significant impact on the economic performance measures.

Data Annex

Data Definitions

Indicators	Definition	Unit	Source
General Economic Indicators			
GDP per capita in PPS	Gross domestic product (GDP) is a measure for the economic activity. It is defined as the value of all goods and services produced less the value of any goods or services used in their creation. Basic figures are expressed in PPS, i.e. a common currency that eliminates the differences in price levels between countries allowing meaningful volume comparisons of GDP between countries.	Euro Per inhabitant	Economic and Social Data Service, (ESDS), Euro stat
Labour productivity per person employed ((GDP (million Euros) divided by Total persons employed (in '000s))	Labour productivity is the value of goods and services produced by number of workforce employed. It is calculated by dividing Total GDP divided by Total Employment in '000s.	Million Euro/person employed in 1000s.	ESDS, Euro stat
Social Indicators			
Employment Rate by age group (20-64) (% of total population aged 20-64 in employment)	The employment rate is calculated by dividing the number of persons aged 20 to 64 in employment by the total population of the same age group. The indicator is based on the EU Labour Force Survey. The survey covers the entire population living in private households and excludes those in collective households such as boarding houses, halls of residence and hospitals. Employed population consists of those persons who during the reference week did any work for pay or profit for at least one hour, or were not working but had jobs from which they were temporarily absent.	In Percentages	EU Labour Force Survey, Eurostat
Income inequality: Gini coefficient	The Gini coefficient is defined as the relationship of cumulative shares of the population arranged according to the level of equivalised disposable income, to the cumulative share of the equivalised total disposable income received by them.		Statistics on Income and Living Conditions Euro stat
Early leavers from education and training (% of population aged 18-24 with at most lower secondary education and not in further education or training).	Early leavers from education and training refers to persons aged 18 to 24 fulfilling the following two conditions: first, the highest level of education or training attained is ISCED 0, 1, 2 or 3c short, second, respondents declared not having received any education or training in the four weeks preceding the survey (numerator). The denominator consists of the total population of the same age group, excluding no answers to the questions "highest level of education or training attained" and "participation to education and training".	%	EU Labour Force Survey, Eurostat

<i>Environmental Indicators</i>			
<p>Annual Average Energy intensity of an economy (Gross inland consumption of energy divided by GDP (kilogram of oil equivalent per 1000 Euro))</p>	<p>This indicator is the ratio between the gross inland consumption of energy and the gross domestic product (GDP) for a given calendar year. It measures the energy consumption of an economy and its overall energy efficiency. The gross inland consumption of energy is calculated as the sum of the gross inland consumption of five energy types: coal, electricity, oil, natural gas and renewable energy sources. The GDP figures are taken at chain linked volumes with reference year 2000. The energy intensity ratio is determined by dividing the gross inland consumption by the GDP. Since gross inland consumption is measured in kgoe (kilogram of oil equivalent) and GDP in 1 000 EUR, this ratio is measured in kgoe per 1 000 EUR.</p>	<p>Kgoe/1000 Euros</p>	<p>Eurostat</p>
<p>Greenhouse Gas Emissions per unit of GDP (Greenhouse gas emissions in 1000 tonnes divided by GDP (million Euros))</p>	<p>This is calculated as Greenhouse gas emissions in 1000 tonnes divided by GDP (million Euros)). The annual greenhouse gas (GHG) emissions are estimated and reported under the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and the Decision 280/2004/EC. The so called Kyoto basket includes six gases: carbon dioxide (CO₂), methane nitrous oxide, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride . GDP is in total volumes in million euros.</p>	<p>1000 tonnes/million Euros</p>	<p>European Environment Agency, Eurostat</p>

Regressions between SII and Socio Economic and Environmental Indicators

SII and GDP Per capita: All countries

GDP	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	33061.81	4193.436	7.88	0	24775.06	41348.55	0.79	179
_cons	5912.525	1814.438	3.26	0.001	2326.974	9498.075		

SII and GDP Per capita: Low income countries

GDP	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	28132.76	3864.214	7.28	0	20441.23	35824.28	0.57	96
_cons	1489.366	1159.477	1.28	0.203	-818.515	3797.247		

SII and GDP Per capita: High income countries

GDP	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	41167.87	8433.977	4.88	0	24338.13	57997.61	0.33	83
_cons	7977.327	4947.579	1.61	0.112	-1895.41	17850.07		

SII and Labour productivity: All countries

Labour Productivity	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	55.8062	5.896774	9.46	0	44.14497	67.46743	0.76	165
_cons	18.09596	2.569343	7.04	0	13.01493	23.17699		

SII and Labour productivity: Low Income countries

Labour Productivity	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	52.09565	7.371627	7.07	0	37.39705	66.79426	0.34	87
_cons	6.192912	2.178095	2.84	0.006	1.849914	10.53591		

SII and Labour productivity: High income countries

Labour Productivity	Coef.	Std. Err.	t	P> t	[95% Conf. Intervals		r2	N
SII	60.3584	9.486559	6.36	0	41.40682	79.30998	0.28	78
_cons	29.89402	5.621061	5.32	0	18.66466	41.12338		

SII and Employment rate 20-64 :All countries

Employment Rate 20-64	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	23.08787	3.407506	6.78	0	16.35673	29.81901	0.40	188
_cons	59.94985	1.503713	39.87	0	56.97943	62.92026		

SII and Employment rate 20-64: Low Income countries

Employment Rate 20-64	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	21.36022	5.571781	3.83	0	10.26305	32.45738	0.26	93
_cons	60.09287	1.69755	35.4	0	56.71191	63.47384		

SII and Employment rate 20-64 : High Income countries

Employment Rate 20-64	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	25.456	3.621259	7.03	0	18.24663	32.66537	0.20	95
_cons	58.9606	2.083888	28.29	0	54.8119	63.1093		

SII and Income Inequality: All countries

Gini Coefficient	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	-10.96284	8.239574	-1.33	0.186	-27.26872	5.343031	0.14	158
_cons	33.96176	3.646871	9.31	0	26.74471	41.17881		

SII and Income Inequality: Low Income countries

Gini Coefficient	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	-18.64173	15.49577	-1.2	0.234	-49.65988	12.37643	0.02	75
_cons	36.23553	4.797352	7.55	0	26.63259	45.83847		

SII and Income Inequality: High Income countries

Gini Coefficient	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	-0.59826	4.080185	-0.15	0.884	-8.74234	7.545824	0.26	83
_cons	28.21237	2.297718	12.28	0	23.62611	32.79863		

SII and Early school leavers: All countries

Early school leavers	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	-5.523309	4.632498	-1.19	0.235	-14.68258	3.635964	0.00	168
_cons	14.73867	2.118125	6.96	0	10.55076	18.92658		

SII and Early school leavers: Low Income countries

Early school leavers	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	-10.9678	5.362908	-2.05	0.045	-21.68144	-0.2541611	0.06	78.0 0
_cons	14.55167	1.632433	8.91	0	11.29051	17.81283		

SII and Early school leavers: High Income countries

Early school leavers	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	0.3845434	7.493553	0.05	0.959	-14.54669	15.31577	0.27	90
_cons	12.84675	4.421396	2.91	0.005	4.036928	21.65658		

SII and Energy Intensity: All countries

Energy Intensity	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	-322.562	77.84272	-4.14	0	-476.3161	-168.8079	0.35	190
_cons	442.8579	34.03648	13.01	0	375.6294	510.0864		

SII and Energy Intensity: Low Income countries

Energy Intensity	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	-450.1411	137.5273	-3.27	0.002	-723.8824	-176.3998	0.10	96
_cons	570.5289	41.26576	13.83	0	488.3914	652.6663		

SII and Energy Intensity: High Income countries

Energy Intensity	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	-130.8849	31.11825	-4.21	0	-192.8492	-68.92053	0.05	94
_cons	240.6583	17.98159	13.38	0	204.8523	276.4642		

SII and Greenhouse Gas Emissions: All countries

Greenhouse gases	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	-2.346342	0.4761579	-4.93	0	-3.286986	-1.405698	0.38	186
_cons	1.883197	0.2086328	9.03	0	1.471046	2.295349		

SII and Greenhouse Gas Emissions: Low Income countries

Greenhouse gases	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	-3.644153	0.8950874	-4.07	0	-5.427653	-1.860652	0.11	90
_cons	2.432995	0.260341	9.35	0	1.914254	2.951735		

SII and Greenhouse Gas Emissions: High Income countries

Greenhouse gases	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
SII	0.7960731	0.1325546	-6.01	0	-1.059916	-0.5322298	0.03	96
_cons	0.8264209	0.0764381	10.81	0	0.6742747	0.978567		

Regressions between Innovation Dimensions and Socio-Economic and Environmental Indicators.

Innovation Dimension and GDP Per capita :

	Coef.	Std. Err.	t	P> t	[95% Conf. Intervals		r2	N
Human Resources	29146.83	4627.395	6.3	0	19983.33	38310.33	0.30	149
_cons	5856.249	2355.219	2.49	0.014	1192.273	10520.22		
Research systems	32425.24	3974.075	8.16	0	24555.49	40294.99	0.86	149
_cons	6090.896	1791.146	3.4	0.001	2543.94	9637.852		
Finance and support	5862.727	3796.537	1.54	0.125	-1655.45	13380.9	0.49	149
_cons	18068.69	1687.303	10.71	0	14727.38	21410.01		
Firm investments	-4452.039	3215.156	-1.38	0.169	-10818.92	1914.845	0.38	149
_cons	22551.86	1376.9	16.38	0	19825.23	25278.5		
Linkages and entrepreneurship	465.7953	4130.468	0.11	0.91	-7713.656	8645.247	0.67	149
_cons	20470.83	1690.937	12.11	0	17122.31	23819.34		
Intellectual assets	29497.64	2836.777	10.4	0	23880.05	35115.23	0.75	149
_cons	10075	1025.83	9.82	0	8043.574	12106.42		
Innovators	7849.211	2679.938	2.93	0.004	2542.203	13156.22	0.40	149
_cons	18055.5	905.3388	19.94	0	16262.69	19848.32		
Economic effects	18643.84	4872.452	3.83	0	8995.061	28292.63	0.43	149
_cons	11575.06	2380.157	4.86	0	6861.701	16288.42		

Innovation Dimension and Labour productivity per person employed:

	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
Human Resources	53.2068	5.130711	10.37	0	43.0379	63.37571		
_cons	15.24975	2.681419	5.69	0	9.935261	20.56423	0.37	138
Research systems	51.24737	4.497301	11.4	0	42.33387	60.16088		
_cons	20.10419	2.015806	9.97	0	16.10893	24.09945	0.79	138
Finance and support	8.129908	4.96123	1.64	0.104	-1.703089	17.96291		
_cons	39.46206	2.172927	18.16	0	35.15539	43.76873	0.42	138
Firm investments	-8.303321	4.155841	-2	0.048	-16.54006	-0.066578		
_cons	46.48529	1.758797	26.43	0	42.99941	49.97117	0.28	138
Linkages and entrepreneurship	0.9553122	5.618995	0.17	0.865	-10.18135	12.09198		
_cons	42.6267	2.220765	19.19	0	38.22521	47.02818	0.58	138
Intellectual assets	40.07637	4.924097	8.14	0	30.31697	49.83577		
_cons	28.45555	1.797039	15.83	0	24.89387	32.01722	0.70	138
Innovators	11.43001	3.54087	3.23	0.002	4.41212	18.4479		
_cons	38.92043	1.284537	30.3	0	36.37452	41.46634	0.50	138
Economic effects	27.21207	6.610724	4.12	0	14.10983	40.31431		
_cons	29.46706	3.295491	8.94	0	22.9355	35.99862	0.55	138

Innovation Dimension and Employment rate (20-64):

	Coef.	Std. Err.	t	P> t	95% Conf. Intervals		r2	N
Human Resources	27.00231	3.199271	8.44	0	20.67006	33.33457		
_cons	56.37384	1.657246	34.02	0	53.09368	59.65399	0.31	157
Research systems	16.19553	2.741798	5.91	0	10.76875	21.62232		
_cons	62.88873	1.265666	49.69	0	60.38362	65.39384	0.41	157
Finance and support	8.534884	2.897066	2.95	0.004	2.800778	14.26899		
_cons	66.46624	1.318661	50.4	0	63.85624	69.07624	0.44	157
Firm investments	0.0375007	2.43864	0.02	0.988	-4.789251	4.864252		
_cons	70.31652	1.046572	67.19	0	68.24506	72.38798	0.33	157
Linkages and entrepreneurship	1.521128	3.179241	0.48	0.633	-4.77148	7.813736		
_cons	69.70126	1.325985	52.57	0	67.07677	72.32576	0.69	157
Intellectual assets	17.45515	2.436765	7.16	0	12.63211	22.27819		
_cons	63.96747	0.8956062	71.42	0	62.19481	65.74013	0.34	157
Innovators	5.256161	1.52233	3.45	0.001	2.243045	8.269278		
_cons	68.54238	0.5338614	128.39	0	67.48572	69.59904	0.08	157
Economic effects	12.273	3.805866	3.22	0.002	4.740128	19.80588		
_cons	64.27181	1.883773	34.12	0	60.54329	68.00032	0.04	157

Innovation Dimension and Income Inequality:

Gini Coefficient	Coef.	Std. Err.	t	P> t	[95% Conf. Intervals		r2	N
Human Resources	1.938039	4.905914	0.4	0.694	-7.788412	11.66449	0.06	138
_cons	28.10977	2.556767	10.99	0	23.04074	33.17881		
Research systems	1.104874	3.414598	0.32	0.747	-5.664899	7.874648	0.12	138
_cons	28.61011	1.576908	18.14	0	25.48374	31.73649		
Finance and support	-0.3942374	3.548068	-0.11	0.912	-7.428627	6.640152	0.07	138
_cons	29.29989	1.64263	17.84	0	26.04322	32.55657		
Firm investments	1.371359	2.801847	0.49	0.626	-4.183574	6.926293	0.03	138
_cons	28.54324	1.183785	24.11	0	26.19627	30.89021		
Linkages and entrepreneurship	1.95992	3.563218	0.55	0.583	-5.104506	9.024346	0.15	138
_cons	28.29197	1.509208	18.75	0	25.29982	31.28412		
Intellectual assets	3.39883	3.431305	0.99	0.324	-3.404067	10.20173	0.13	138
_cons	27.87779	1.260791	22.11	0	25.37815	30.37743		
Innovators	1.13217	1.737302	0.65	0.516	-2.312201	4.57654	0.04	138
_cons	28.7308	0.6123652	46.92	0	27.51673	29.94487		
Economic effects	1.918671	4.794508	0.4	0.69	-7.586908	11.42425	0.10	138
_cons	28.17435	2.362962	11.92	0	23.48955	32.85915		

Innovation Dimension and Early school leavers:

	Coef.	Std. Err.	t	P> t	[95% Conf. Intervals		r2	N
Human Resources	-3.433357	4.903992	-0.7	0.485	-13.15094	6.28423	0.18	140
_cons	14.03379	2.700695	5.2	0	8.682186	19.3854		
Research systems	1.56549	3.725522	0.42	0.675	-5.816881	8.947861	0.01	140
_cons	11.40304	1.776571	6.42	0	7.88265	14.92344		
Finance and support	-3.160491	3.507595	-0.9	0.37	-10.11102	3.790043	0.01	140
_cons	13.63931	1.664777	8.19	0	10.34044	16.93818		
Firm investments	0.9570778	2.872958	0.33	0.74	-4.735881	6.650036	0.01	140
_cons	11.71882	1.293893	9.06	0	9.154885	14.28275		
Linkages and entrepreneurship	-0.7921674	3.713037	-0.21	0.831	-8.149798	6.565463	0.00	140
_cons	12.49736	1.652927	7.56	0	9.221973	15.77274		
Intellectual assets	-5.839528	3.568534	-1.64	0.105	-12.91082	1.23176	0.00	140
_cons	14.37921	1.373926	10.47	0	11.65669	17.10174		
Innovators	-0.485995	1.946419	-0.25	0.803	-4.342954	3.370964	0.01	140
_cons	12.31837	0.7076298	17.41	0	10.91615	13.72058		
Economic effects	-12.65014	4.916398	-2.57	0.011	-22.39231	-2.907968	0.02	140
_cons	18.43445	2.448924	7.53	0	13.58174	23.28716		

Innovation Dimension and Energy Intensity:

	Coef.	Std. Err.	t	P> t	[95% Conf. Intervals		r2	N
Human Resources	-426.3208	67.09131	-6.35	0	-559.1029	-293.5388		
_cons	514.3696	34.53306	14.89	0	446.0243	582.7148	0.08	158
Research systems	-192.0139	56.33077	-3.41	0.001	-303.4995	-80.52826		
_cons	382.9052	25.79078	14.85	0	331.8621	433.9484	0.38	158
Finance and support	-181.7588	53.98362	-3.37	0.001	-288.5991	-74.91853		
_cons	376.2061	24.1277	15.59	0	328.4544	423.9578	0.20	158
Firm investments	73.04267	45.93573	1.59	0.114	-17.86984	163.9552		
_cons	264.8325	19.37439	13.67	0	226.4881	303.1768	0.06	158
Linkages and entrepreneurship	-1.273875	60.08509	-0.02	0.983	-120.1897	117.642		
_cons	295.9031	24.75705	11.95	0	246.9058	344.9004	0.29	158
Intellectual assets	-222.1627	56.15727	-3.96	0	-333.3049	-111.0205		
_cons	375.8095	20.46995	18.36	0	335.2969	416.322	0.32	
Innovators	-74.32733	29.77015	-2.5	0.014	-133.2462	-15.4085		
_cons	320.958	10.53804	30.46	0	300.1019	341.8141	0.23	158
Economic effects	-233.2109	72.5774	-3.21	0.002	-376.8506	-89.57119		
_cons	410.4808	35.9027	11.43	0	339.425	481.5367	0.25	158

Innovation Dimension and Green house Gas emissions:

	Coef.	Std. Err.	t	P> t	[95% Conf. Intervals		r2	N
Human Resources	-2.579757	0.4255021	-6.06	0	-3.422012	-1.737502		
_cons	2.136155	0.217263	9.83	0	1.706096	2.566214	0.09	155
Research systems	-1.197412	0.3563601	-3.36	0.001	-1.902805	-0.4920195		
_cons	1.374617	0.1652724	8.32	0	1.04747	1.701763	0.40	155
Finance and support	-1.56947	0.3230086	-4.86	0	-2.208846	-0.9300943		
_cons	1.545727	0.1497326	10.32	0	1.24934	1.842113	0.31	155
Firm investments	0.1145099	0.2886254	0.4	0.692	-0.4568064	0.6858262		
_cons	0.7736755	0.1219473	6.34	0	0.5322882	1.015063	0.10	155
Linkages and entrepreneurship	-0.0905958	0.3956396	-0.23	0.819	-0.8737402	0.6925486		
_cons	0.8588409	0.1632191	5.26	0	0.5357588	1.181923	0.33	155
Intellectual assets	-1.355203	0.3414653	-3.97	0	-2.031112	-0.679293		
_cons	1.317298	0.1257836	10.47	0	1.068318	1.566279	0.35	155
Innovators	-0.463603	0.1876111	-2.47	0.015	-0.8349677	-0.0922383		
_cons	0.9830975	0.0671576	14.64	0	0.8501632	1.116032	0.20	155
Economic effects	-1.681042	0.4681967	-3.59	0	-2.607808	-0.7542751		
_cons	1.649367	0.2310305	7.14	0	1.192057	2.106678	0.24	155