

What National Intellectual Capital Indices Can Tell About the Global Economic Crisis of 2007-2009?

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Abstract: In the past few years, the concept of intellectual capital has been expanded from organizational level to national and regional level. A model of 29 national intellectual capital indices (NICI40) has been constructed and validated by utilizing data of the IMD Competitiveness Yearbook. Research on the 14 years data, spanning from 1995 to 2008, indicates the pattern and progression of national intellectual capital in 40 countries. Trend analyses of this set of panel data disclose very interesting phenomena, such as Iceland shows the most rapid progress in national intellectual capital and is a rising star in economic development with an outstanding 94% GDP per capita (ppp) growth over 14 years. Moreover, it was number one of the OECD countries according to The Global Benchmark Report 2006 and received a consistently high ranking in world standard-of-living surveys. Unfortunately, the recent financial crisis almost crippled its national financial system and wrote off its past economic performance. On the contrary, Norway lags behind its Nordic peers in national intellectual capital development; yet its resilience to the 2007-2009 financial crisis impact is noticeable. Furthermore, Norway generously offers financial support for IMF to assist some ailing neighboring countries. Why the intellectual capital rising star crumbled down and the seemingly static country sustained the crisis? What is the implication of this controversy? The research results of this study have some implications for relevant policy makers.

Keywords: national intellectual capital, financial crisis, national wealth

1. Introduction

Over the past few decades, intangible assets, such as knowledge, patents, and innovation, have been identified as fundamental sources of wealth and progress. These assets represent a major concern for business firms and their stakeholders (Garcia-Ayuso, 2003). Drucker predicts the emergence of a society dominated by knowledge-based resources and a competitive landscape in the allocation of intellectual capital (IC) (Bontis, 2004). In addition to firm level studies, a number of intellectual capital assessments have also taken place at the national level (e.g., Sweden, Denmark, The Nordic Project, and Israel) and at the regional level (e.g., the Arab nations and the Pacific Islands studies) (Bontis, 2004; Bounfour, 2003).

As knowledge assets fuel a country's growth and have significant implications for future national value – innovation, learning, and gross domestic product (GDP), they represent the source of the competencies and capabilities deemed essential for national economic growth, human development, and quality of life (Malhotra, 2003). Consequently, countries rich in intangible assets fare better in terms of national wealth than those whose assets are limited to land, tools, and labor (Malhotra, 2003; World Bank, 1998).

Although the assessment of national intellectual capital can not explain in full or predict an abrupt occurrence such as a sudden stock market plunge, currency depreciation, regional political strife, or global financial crisis, it did reflect a nation's past efforts in terms of human resource development, national economic relationships, infrastructural investment, renewal capability building, and national financial management. This paper briefly introduces the concept of "national intellectual capital", presents its measurement model, national intellectual capital rankings, describes the early signs of 2007-2009 financial crises, and then discusses the lessons learned for regaining competitiveness.

2. National intellectual capital

The recognition that intangibles are one of the most important sources of prosperity and progress has prompted an increasing need for developing more understanding of intellectual capital; as a result, studies of intellectual capital and related topics have proliferated over the years.

However, the intellectual capital of a nation requires the articulation of a comprehensive system of variables that helps uncover and manage that nation's invisible wealth. Past studies either propose

models from a limited perspective (e.g., inputs or intellectual property rights) or models containing too many variables to be easily replicated for trend analysis. This paper presents a moderate set of national intellectual capital indices that are valid and can be easily replicated for follow-up studies.

Intellectual capital is defined as “intellectual material – knowledge, information, intellectual property, experience – that can be put to use to create wealth” (Stewart, 1997) and is the roots for future earning capabilities (Edvinsson & Malone 1997). In the global competition, these features, such as educational system, international trade, infrastructure, and renewal capability affect national competitiveness and constitute the major components of national intellectual capital, namely human capital, market capital, process capital, and renewal capital.

The first type of national intellectual capital, *human capital*, is defined as the competencies of individuals in realizing national goals (Bontis, 2004). According to OECD (2000), human capital consists of knowledge about facts, laws, and principles in addition to knowledge relating to teamwork, and other specialized and communication skills. Education is the foundation of human capital. The variables used in this study include the amount of skilled labor, the degree of employee training, the rate of literacy, the level of enrollment in institutions of higher education, the pupil-teacher ratio, the number of Internet subscribers, and public expenditure on education.

The second type of national capital, *market capital*, is similar to external relational networking and social capital in a micro setting in that it represents a country's capabilities and successes in providing an attractive and competitive incentive in order to meet the needs of its international clients, while also sharing knowledge with the rest of world (Bontis, 2004). The present study takes into consideration investment in foreign countries and achievements in foreign relations, as well as exports of goods and services. In this study, the authors focus primarily on each country's corporate tax encouragement, cross-border ventures, openness to foreign cultures, degree of globalization, and transparency of economic information, as well as the image that the country projects abroad, and the country's export and import of commercial services.

The third type of national capital, *process capital*, comprises the non-human sources of knowledge in a nation. Embedded in a country's infrastructure, these sources facilitate the creation, accessibility, and dissemination of information. This type of capital is measured through fair business competition environment, government efficiency, intellectual property rights protection, the availability of capital, the number of computers per capita, the ease with which new firms can be established, and the number of mobile phone subscribers.

The fourth type of national capital, *renewal capital*, is defined as a nation's future intellectual wealth and the capability for innovation that sustains a nation's competitive advantage. Business R&D spending, basic research, R&D spending as a percentage of GDP, the number of R&D researchers, the level of cooperation between universities and enterprises, scientific articles, and USPTO & EPO (patent number recorded in both United States Patent and Trademark Office & European Patent Office) per capita are included in this type of capital.

The fifth type of national capital, *financial capital*, is represented by a single indicator: the logarithm of GDP per capita adjusted by purchasing power parity. This is the most common measurement of the financial wealth of a nation.

3. National intellectual capital measurement model

During the past decade, knowledge assets and intellectual capital have been attracting an increasing amount of attention, not only from academics and CEOs, but also from national policy makers. A World Bank report (1998) points out that the adoption of policies to increase a nation's intellectual wealth can improve people's lives, besides giving them higher incomes.

Yet, a majority of intellectual capital studies have been analyzed particularly from the interest of the business firms to explain the differences between the accounting value and the market value as possible basic source of competitive advantages in companies (Bontis, 2001; Edvinsson, 2002). Nowadays, there are approaches trying to adopt these methodologies to a broader scope with the objective of comparing the intellectual capital indices at national or regional level, that mainly are applications of business models translated to the nations or regions.

For instance, in Europe there is a quest for promoting the competitive investment into intangibles, also called the Lisbon agenda, from the EU summit in Lisbon, Portugal in 2002. The aspiration is to lift the investment of R&D to the level of 3% of GDP for EU-12 countries (<http://www.fm-kp.si/zalozba/ISBN/961-6486-71-3/009-012.pdf>). This highlights the magnitude and the shift of investments into intangibles as well as the need for a systematic intellectual capital report and the outcome of the value creation based on these expenditures. This growing space of intangible investments is among others demanding more strategic intelligence, or knowledge navigation capability on the society.

In the past, researchers from different backgrounds have proposed different models to evaluate national intellectual capital. Since this field of study is still developing, a consensus regarding the set of determinants that should be employed has yet to be reached. Building on past relevant research, we propose a framework and model of IC measurement and then test this model by using the widely accepted International Institute for Management Development (IMD) databases, which contain both quantitative and qualitative indicators.

Indicators we used were selected in two rounds. In the first round, variables that were used at least two times in relevant studies were matched with the IMD World Competitiveness Yearbook. *Market capital* turned out to have the fewest number of variables supported by at least two studies. In the second round, a focus group was formed to obtain feedback regarding the appropriateness of the selected variables. With input from ten Taiwanese professors who also engage in intellectual capital-related research, focal variables were finalized, as shown in Table 1. *Financial capital* is also included as it is a key indicator of national wealth and represents the output dimension of the Input-Process-Output theory. Balance in the number of variables for each of the four types of capital (7 variables each, excluding financial capital) as well as in the number of quantitative and qualitative variables (14 vs. 15) was achieved through the literature review, focus group discussion, and IMD database matching. Consequently, a total of 29 variables were selected—seven each for human capital, market capital, process capital, and renewal capital, and a single variable (GDP per capita adjusted by purchasing power parity) representing financial capital. Herein after, this set of 29 variables is referred as NIC140 (National Intellectual Capital Indices for 40 countries)

Table 1: Variables in each type of capital proposed by this study

Human Capital index	Market capital index
Skilled labor*	1. Corporate tax*
Employee training*	2. Cross-border venture*
Literacy rate	3. Culture openness*
Higher education enrollment	4. Globalization*
Pupil-teacher ratio	5. Transparency*
Internet subscribers	6. Image of country*
Public expenditure on education	7. Exports of goods
Process capital index	Renewal capital index
Business competition environment*	Business R&D spending
Government efficiency*	Basic research*
Intellectual property rights protection*	R&D spending/GDP
Capital availability*	R&D researchers
Computers in use per capita	Cooperation between universities and enterprises*
Convenience of establishing new firms*	Scientific articles
Mobile phone subscribers	Patents per capita (USPTO + EPO)

Remark:

Financial capital is the logarithm of GDP per capita adjusted by purchasing power parity. Variables marked with an asterisk are rated qualitatively using a scale of 1–10.

Using the variables listed in Table 1, we collected data for 40 countries from the IMD World Competitiveness Yearbook. The data analyzed in this book, therefore, describes 40 countries over a period of 14 years, from 1995 to 2008. To differentiate from other National IC Models and for easier reference, "NICI40" is named to represent the 29-indicator national intellectual capital model for 40 countries developed by the authors.

In this study, there are two different types of data: data with an absolute value, such as "patents per capita"; and data with a qualitative rating based on a scale of 1 to 10, such as "image of country." Although subjective, qualitative rating on the degree or magnitude of certain variables is unavoidable, as evaluating intangible assets cannot be fully represented by merely adding up absolute numbers. For a meaningful integration of the quantitative score and qualitative rating, the ratio of the absolute value relative to the highest value of each quantitative variable was calculated and multiplied by 10 to transform the number into a 1-to-10 score. The data transformation procedures have been repeated for all numerical indicators of human capital, market capital, process capital, and renewal capital. Financial capital is represented by the logarithm of GDP per capita adjusted by the purchasing power parity of each country, calculated its ratio to the highest value and then transformed it into a 1-to-10 score. The Overall National Intellectual Capital Ranking as shown in Table 2 includes the mean scores of the five types of capital and the total score of national intellectual capital of each country.

4. National intellectual capital rankings for 40 countries

Based on the data analysis described in the preceding section, Table 2 displays the score and ranking of the five types of national intellectual capital. The overall and individual indices provide valuable information for policy makers. With 14 years of data, the top 10 countries in the overall ranking list are, in order, Finland, Sweden, Switzerland, Denmark, the USA, Singapore, Iceland (2007 and 2008 data are missing, very likely due to the 2008 financial crisis), the Netherlands, Norway, and Canada. The overall results of NICI40 confirm the general perception that the Nordic countries have the highest degree of national intellectual capital; as a result, all five Nordic countries are in the top ten NICI40. For an easier reference of the NICI40 ranking, Table 2 is prepared according to the country sequence.

Table 2: NICI40 - national intellectual capital score and ranking based on country sequence

1995~2008	Human capital		Market capital		Process capital		Renewal capital		Financial capital		Overall NICI40	
Mean	6.13		5.64		5.32		3.76		9.14		29.99	
SD	1.16		0.94		1.51		2.01		0.73		5.67	
Country	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking
Argentina	5.12	31	4.01	40	2.78	40	1.43	38	8.65	32	22.00	38
Australia	7.01	10	6.16	14	7.03	7	4.49	18	9.65	11	34.34	11
Austria	6.89	12	6.25	13	6.52	13	4.60	16	9.70	8	33.96	12
Belgium	7.01	9	5.86	18	5.79	18	4.66	15	9.64	12	32.97	16
Brazil	4.43	37	4.81	33	3.11	38	1.63	35	8.43	35	22.41	37
Canada	7.84	3	6.31	9	6.57	12	4.84	12	9.71	6	35.26	10
Chile	4.96	33	6.60	6	4.91	25	1.80	33	8.70	30	26.97	28
China	4.18	39	5.27	25	3.49	33	2.12	27	7.49	38	22.55	36
Czech Republic	5.34	29	5.56	22	4.51	28	2.57	24	9.16	26	27.15	27
Denmark	8.15	1	6.62	4	7.42	2	5.81	7	9.69	9	37.69	4
Finland	7.79	4	6.61	5	7.71	1	7.36	3	9.56	18	39.03	1
France	6.50	15	4.67	35	5.51	20	4.96	10	9.60	17	31.24	20

1995~2008	Human capital		Market capital		Process capital		Renewal capital		Financial capital		Overall NICI40	
Mean	6.13		5.64		5.32		3.76		9.14		29.99	
SD	1.16		0.94		1.51		2.01		0.73		5.67	
Country	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking
Germany	6.31	20	5.55	23	6.12	16	5.88	6	9.62	14	33.48	15
Greece	5.43	28	4.82	32	4.32	29	1.96	29	9.36	23	25.87	29
Hungary	6.33	19	5.68	19	4.71	27	2.34	26	8.94	27	27.99	23
Iceland	7.58	7	6.55	7	6.86	9	5.14	9	9.67	10	35.80	7
India	3.79	40	4.91	30	3.22	36	1.78	34	6.96	40	20.67	40
Ireland	6.42	17	7.21	2	6.58	11	3.87	20	9.70	7	33.77	13
Italy	6.07	23	4.60	36	5.07	23	2.62	23	9.54	19	27.90	24
Japan	6.82	13	4.60	37	5.68	19	7.03	5	9.60	16	33.73	14
Korea	6.15	22	4.79	34	4.87	26	4.23	19	9.24	24	29.28	21
Malaysia	5.53	27	6.50	8	5.11	22	2.01	28	8.66	31	27.80	25
Mexico	4.75	35	4.95	28	3.19	37	1.24	40	8.75	29	22.88	35
Netherlands	6.89	11	6.95	3	6.79	10	5.21	8	9.73	5	35.56	8
New Zealand	6.80	14	6.26	11	6.27	14	3.50	21	9.36	22	32.18	18
Norway	7.72	5	5.96	15	7.06	5	4.71	14	10.00	1	35.45	9
Philippines	4.85	34	4.93	29	3.25	34	1.47	37	7.38	39	21.88	39
Poland	5.61	26	4.04	39	3.23	35	1.95	30	8.77	28	23.59	33
Portugal	5.94	25	5.26	26	4.95	24	1.91	31	9.22	25	27.28	26
Russia	5.30	30	4.07	38	2.85	39	2.87	22	8.57	34	23.65	32
Singapore	6.39	18	8.39	1	7.25	3	4.77	13	9.85	3	36.65	6
South Africa	4.71	36	4.84	31	4.02	30	1.84	32	8.37	36	23.79	31
Spain	5.98	24	5.39	24	5.16	21	2.50	25	9.47	20	28.51	22
Sweden	7.98	2	6.31	10	7.18	4	7.78	2	9.63	13	38.89	2
Switzerland	7.17	8	6.26	12	7.04	6	7.99	1	9.78	4	38.24	3
Taiwan	6.47	16	5.94	16	5.92	17	4.84	11	9.38	21	32.55	17
Thailand	5.02	32	5.68	20	3.96	31	1.36	39	8.15	37	24.16	30
Turkey	4.33	38	4.98	27	3.61	32	1.51	36	8.57	33	22.99	34
UK	6.18	21	5.62	21	6.13	15	4.57	17	9.61	15	32.11	19
USA	7.60	6	5.91	17	6.97	8	7.16	4	9.88	2	37.53	5

A quick review of Table 2 shows that although the ranking is for the intangible national intellectual capital, the result agrees with the general perception that the top ten countries are well developed countries with relatively better economic and social status, and the bottom ten countries are developing countries somewhat ailed by either economic, social, or political problems in the past decade. To further explore the relationship between national intellectual capital and financial performance, we correlated the sum of the human capital, market capital, process capital, and renewal capital scores with GDP per capita (ppp) in real dollars for the 40 countries, **and a strong correlation of .88 was found**. This result indicates that the national intellectual capital model proposed in this book carries very valuable information in explaining national economic development and competitiveness. That is, the results presented in this paper support to a significant degree the issues policy makers are concerned about: bottom-line financial performance. Therefore, NICI40 can serve as an extension of GDP or other commonly used economic indicators, particularly for the intangibles. While GDP reflects the present economic situation, NICI40 is not only an indicator of future wealth creation capabilities but also has good explaining power for current financial performance.

However, a reminder is that this set of data reflects the past national intellectual capital performance of the 40 countries, spanning 1995 to 2008 rather than their current status. For Iceland particularly, the reported statistics is its past performance before the 2008 global financial crisis (from 1995 to 2006, with 2007 and 2008 IMD data missing Iceland only). Irrespective to the recent financial crisis, the 14 years panel data provides valuable clues for what they are today and what they may become in the future.

5. Early signs of financial crisis from this set of data

The above 40-country national intellectual capital study has led us to look into the intangible assets development of the eleven country clusters, namely Nordic European, larger European, smaller European, Southern European, Eastern European, Canada and USA, Latin American, Australia and New Zealand, East Asian, Southeast Asian, and BRIC (Brazil, Russia, India, and China) countries (please refer to the authors' coming book published by Springer). When interpreting this set of data, we have detected the early signs of financial crisis in some countries. Our observation sequence and findings are presented hereunder.

5.1 Step #1

When checking the background information of the 40 countries, we have been able to obtain the GDP growth rate of some countries for the last three years, namely 2006, 2007, and 2008 as shown in Table 3. Judging from the magnitude of the growth rate decline between 2007 and 2008, we identified Iceland, Ireland and Singapore as the three countries that have been strongly impacted by the financial crisis. Iceland's GDP growth rate dropped from +4.9% in 2007 to -3.5% in 2008 with a difference of 8.4%; Ireland dropped from +6.0% in 2007 to -1.7% in 2008 with a difference of 7.7%; and Singapore dropped from +7.7% in 2007 to +1.2% in 2008 with a difference of 6.5%. Although most of the other countries listed in Table 3 are also influenced by the financial crisis, the magnitude is not as large as that of the above three countries. Brazil has only -0.2% GDP drop between 2007 and 2008, which shows almost no impact by the financial crisis. Why Brazil was not influenced by the global financial crisis poses an interesting topic for further pursuit.

5.2 Step #2

Our second step is to investigate the problems of the identified three countries – Iceland, Ireland and Singapore. The thread of thinking comes from our 40 countries research findings. That is, human capital and renewal capital are better predictors for national long term intellectual capital development; whereas market capital and process capital are better predictors for national short term intellectual capital development. In other words, short term or more efficient national intellectual capital development may lie in the increase of market capital and process capital. On the other hand, a rapid decline in national intellectual capital may be caused by the decrease of market capital or process capital as well. Based on this clue, indeed we found that Iceland, Ireland and Singapore have a down-ward trend in market capital and process capital.

For Iceland, an early sign might be detected in the first decline of market capital/process capital in 2001, and then a second one in 2006 as shown in Figure 1 (IMD 2007 and 2008 data of Iceland are missing). For Ireland, with respect to the value-creating capability of market capital and process capital, a peak is reached in 2000, then a decline sets in until 2003, with a short upturn to 2005, and then a decline to a low level in 2008 as shown in Figure 2. However, the negative correlation between market capital and

process capital from year 2000 onward up to 2008 is a strong watershed signal. Most notably, the big slide from 2007 to 2008 reflects the 2008 financial crisis and shows that economic activity in Ireland dropped sharply in 2008-09 as it entered into a recession for the first time in more than a decade (http://www.theodora.com/wfbcurrent/ireland/ireland_economy.html).

Table 3: GDP growth rate of the last three years and the impact of financial crisis

GDP growth	2006	2007	2008	2008- 2007#	Affected by 2008 Financial Crisis
Australia	2.9%	4.0%	2.2%	-1.8%	Some Impact
Austria	3.4%	3.1%	1.6%	-1.5%	Some Impact
Belgium	3.0%	2.6%	1.3%	-1.3%	Some Impact
Brazil	4.0%	5.4%	5.2%	-0.2%	Almost No Impact
Canada	3.1%	2.7%	0.6%	-1.9%	Some Impact
Denmark	3.3%	1.6%	0.6%	-1.0%	Some Impact
Finland	4.9%	4.2%	1.5%	-2.7%	Significant Impact
France	2.4%	2.1%	0.7%	-1.4%	Some Impact
Germany	3.0%	2.5%	1.3%	-1.2%	Some Impact
Greece	4.2%	4.0%	2.8%	-1.2%	Some Impact
Iceland	4.4%	4.9%	-3.5%	-8.4%	Very Strong Impact
India	9.6%	9.0%	6.6%	-2.4%	Significant Impact
Ireland	5.7%	6.0%	-1.7%	-7.7%	Very Strong Impact
Italy	1.9%	1.4%	-0.7%	-2.1%	Significant Impact
Japan	2.0%	2.4%	-0.4%	-2.8%	Significant Impact
Korea	5.1%	5.0%	2.5%	-2.5%	Significant Impact
Netherlands	3.4%	3.5%	1.8%	-1.7%	Some Impact
New Zealand	2.0%	3.1%	0.2%	-2.9%	Significant Impact
Norway	2.5%	3.7%	1.8%	-1.9%	Some Impact
Portugal	1.4%	1.9%	0.2%	-1.7%	Some Impact
Russia	7.7%	8.1%	6.0%	-2.1%	Significant Impact
Singapore	8.2%	7.7%	1.2%	-6.5%	Very Strong Impact
Spain	3.9%	3.7%	1.1%	-2.6%	Significant Impact
Sweden	4.6%	2.7%	0.7%	-2.0%	Some Impact
Switzerland	3.4%	3.3%	1.9%	-1.4%	Some Impact
Taiwan	4.8%	5.7%	1.9%	-3.8%	Significant Impact
United Kingdom	2.8%	3.0%	0.7%	-2.3%	Significant Impact
USA	2.8%	2.0%	1.3%	-0.7%	A little Impact

#Remark: between -1.0% and -2.0%: some impact; between - 2.1% and -5.0%: significant impact; and between -5.1% and -9.0%: very strong impact

For Singapore, Figure 3 indicates that the first sign of market capital decline appears in 2002 with a short upturn in 2003, 2004 marks another drop in both market capital and process capital and then follows a relatively strong upsurge. Unfortunately, the sharp market capital/process capital plunge from 2007 to 2008 discloses the strong impact of the 2008 financial crisis, which agrees with the finding of Table 3.

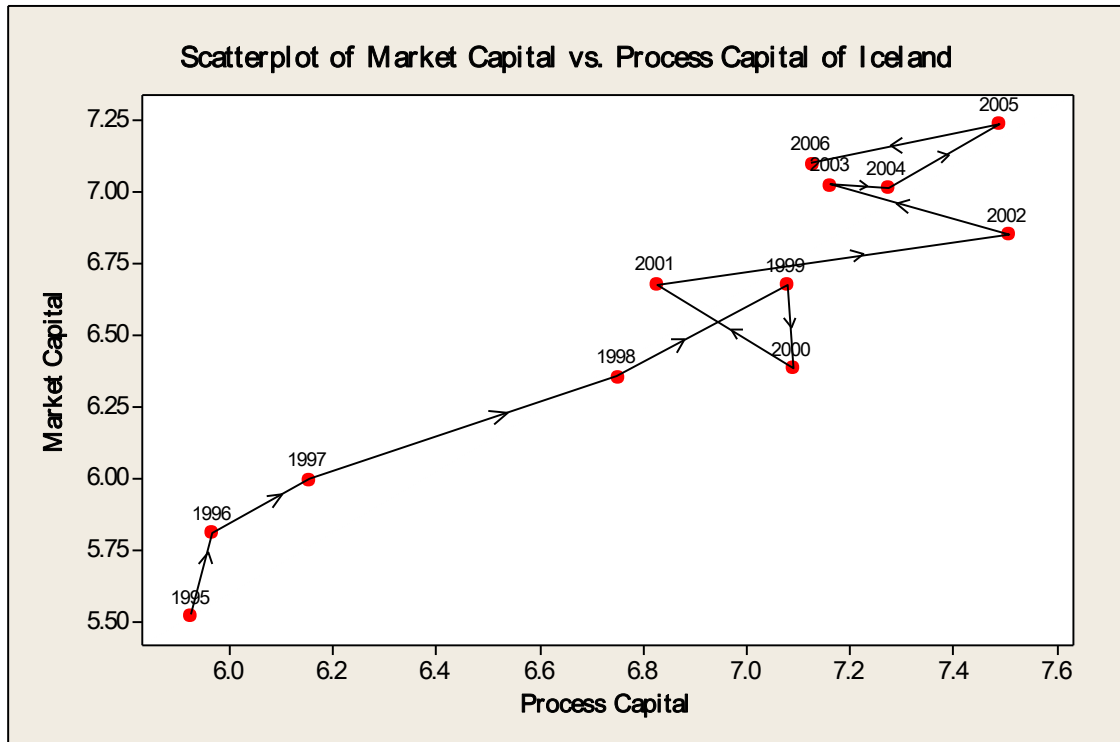


Figure 1: Scatter plot of market capital vs. process capital of Iceland

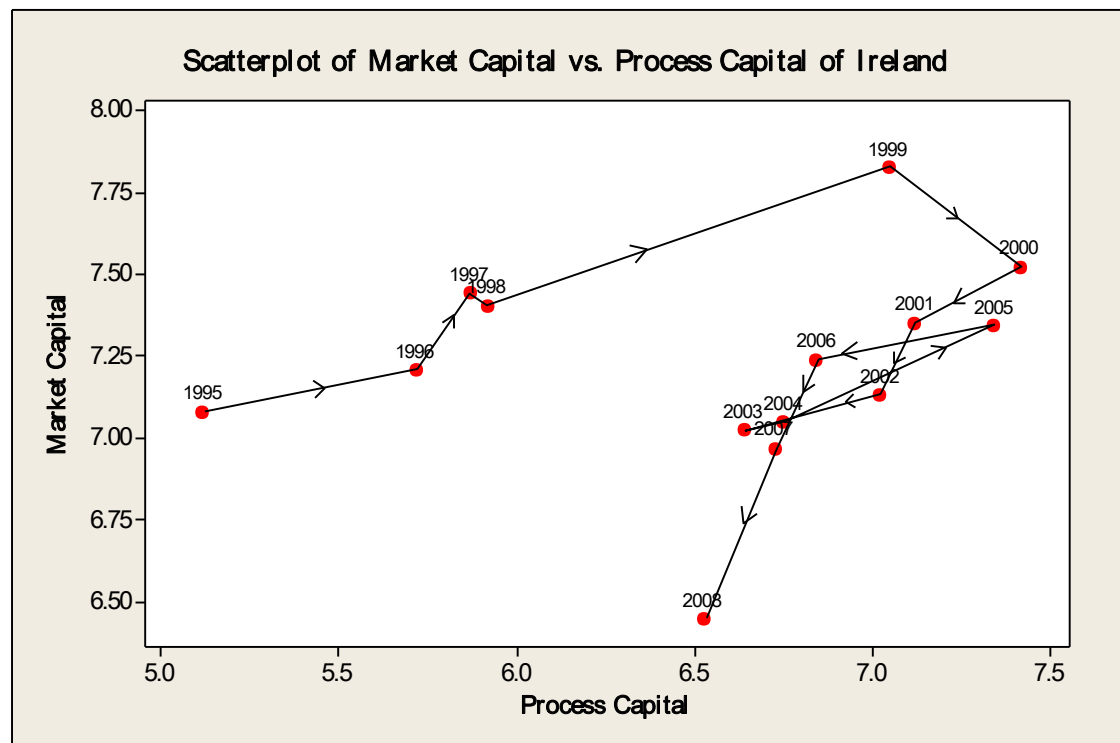


Figure 2: Scatter plot of market capital vs. process capital of Ireland

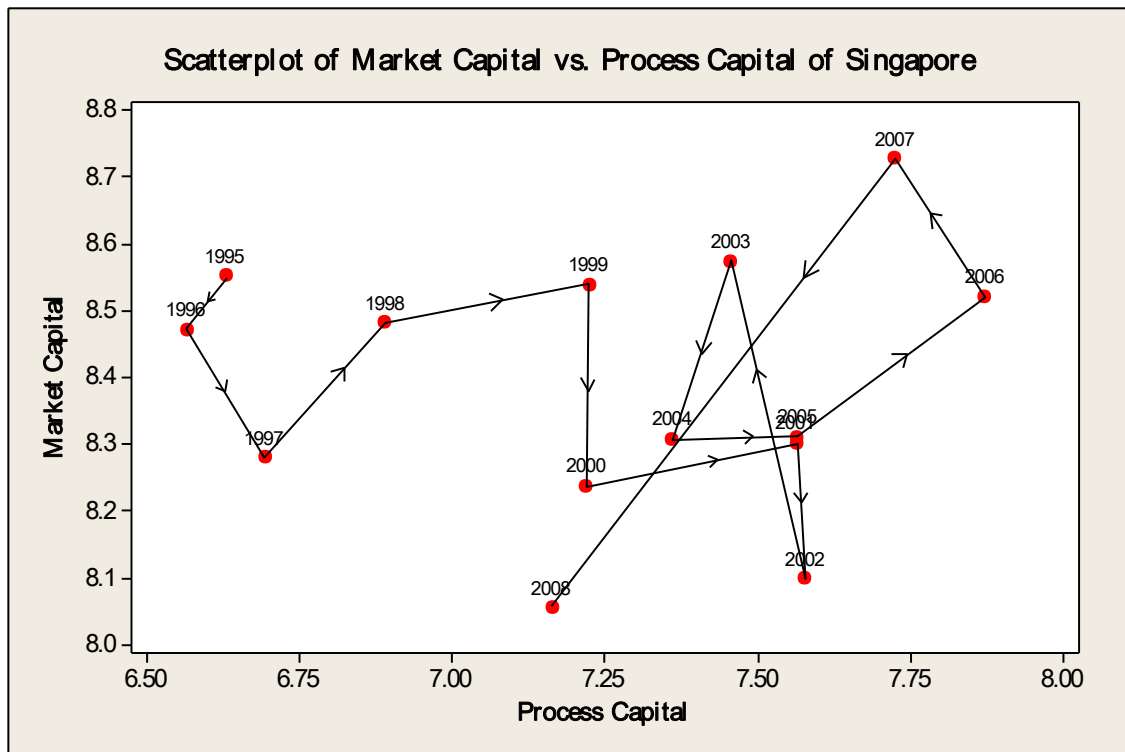


Figure 3: Scatter plot of market capital vs. process capital of Singapore

5.3 Step #3

Since there is initial evidence that market capital and process capital decline may partially explain the financial problem of Iceland, Ireland and Singapore, a raw data check was conducted to identify the problem variable. The investigation has indeed pointed to the variation of “capital availability” in the process capital dimension, which agrees with the common perception that financial crisis is directly impacted by money related indicator. Our further check covering all human capital, market capital, and renewal capital indicators did not show a clear connection with the financial crisis. As a result, we have decided to settle on the in-depth examination of the capital availability changes of some countries from 1999 to 2008 as indicated in Table 4.

Table 4: Capital availability ratings of the countries strongly or significantly impacted by the financial crisis

Capital availability	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Finland	8.67	8.00	7.79	8.27	8.03	8.07	7.66	6.19	5.55	5.43
Iceland	5.60	3.00	2.09	3.95	3.68	4.93	4.86	3.33	-	-
India	2.76	2.93	3.69	4.61	5.67	5.33	5.24	5.53	4.29	3.93
Ireland	8.34	7.85	7.09	7.52	7.17	7.25	7.68	6.71	5.12	5.15
Italy	6.09	5.46	5.37	5.25	5.56	5.34	5.35	5.63	4.44	4.87
Japan	6.58	6.50	5.36	5.51	6.36	6.43	6.60	6.45	6.29	6.30
Korea	4.34	4.31	5.42	4.86	4.67	5.51	4.86	5.18	5.11	4.84
New Zealand	5.79	4.72	5.41	5.10	5.56	4.18	3.93	4.25	3.38	4.24
Russia	2.70	2.81	3.36	3.63	4.00	4.29	5.25	4.39	4.22	2.70
Singapore	7.80	6.93	7.42	7.08	7.24	7.37	6.81	7.19	7.13	5.29
Spain	7.57	6.32	6.67	7.00	7.60	7.33	6.40	5.92	4.43	4.40
Taiwan	6.43	5.95	6.05	6.31	6.63	6.49	5.58	6.00	5.61	4.95
United Kingdom	5.92	5.24	6.40	5.69	6.02	5.33	5.42	5.28	4.48	4.15

Based on Table 4, Iceland's lacking of capital has begun to show starting from 2000 even though its 2007 and 2008 data are missing. In its better year of 1999, Iceland's 5.60 capital availability rating is still much lower than its Nordic peer – Finland's rating of 8.67 in the same year. Iceland's lasting low capital availability rating should have conveyed a very strong signal for the interested parties. If someone picked up the message early enough and adopted proper coping measures, Iceland's financial system meltdown might have been prevented. As for Ireland, Table 4 also indicates a relatively large scale

decline, from 7.68 in 2005 to 5.15 in 2008. The drastic drop of Singapore's capital availability from 7.13 in 2007 to 5.29 in 2008 is another evidence of the connection between GDP decline and capital availability. For comparison purpose, Table 4 also includes the countries with the 2008-2007 GDP gap of more than -2.1%, based on Table 3 results.

In regard to the 2008 global financial crisis, Iceland has been the hardest hit of all Nordic countries. This Icelandic financial crisis involves the collapse of all three of the country's major banks. The full cost of the crisis exceeds 75% of the country's 2007 GDP. It is not surprising that past excellent performer, such as Iceland with inherent system weakness, banking in the case of Iceland, tumbled down within a short time. This research provides valuable data for a deep reflection in contemplating the future national competition.

6. Early signs of PIGS-country problems from this set of data

In early 2010, people began to talk about the PIGS countries. "PIGS" is an acronym for a group of four countries: Portugal, Ireland, Greece and Spain – all in deep economic trouble in the eurozone (<http://news.kyero.com/2009/1/26/pigs-portugal-ireland-greece-spain>). Our dataset also reflects the troubles of these countries. The following presentation proceeds according to the alphabetical order of country names.

The recent discovery of the weak situation of Greece might have been possible to detect in 2000. Figure 4 indicates that market capital/process capital peaked in 2000, after which it continued to fall until it halted at a very low level in 2008 – a clear negative correlation line from 2000 to 2008. Consequently, the financial capability of Greece eroded into its current situation that requires external loan support. Somehow, our data predicted what has been reported by EU governments, namely, that Greece shocked bond markets and its deficit in 2009 was a staggering 12.5 percent of GDP, far above its estimate of 3.7 percent made in the spring (<http://www.taipeitimes.com/News/worldbiz/archives/2010/01/14/2003463439>). This downturn somewhat reflects Greece's troubling 9.7% unemployment rate for 2009, and the forecast of gross debt in 2010 of 125% GDP and stock performance of -10.5% as of Feb. 11, 2010 (<http://news.bbc.co.uk/2/hi/8510603.stm>).

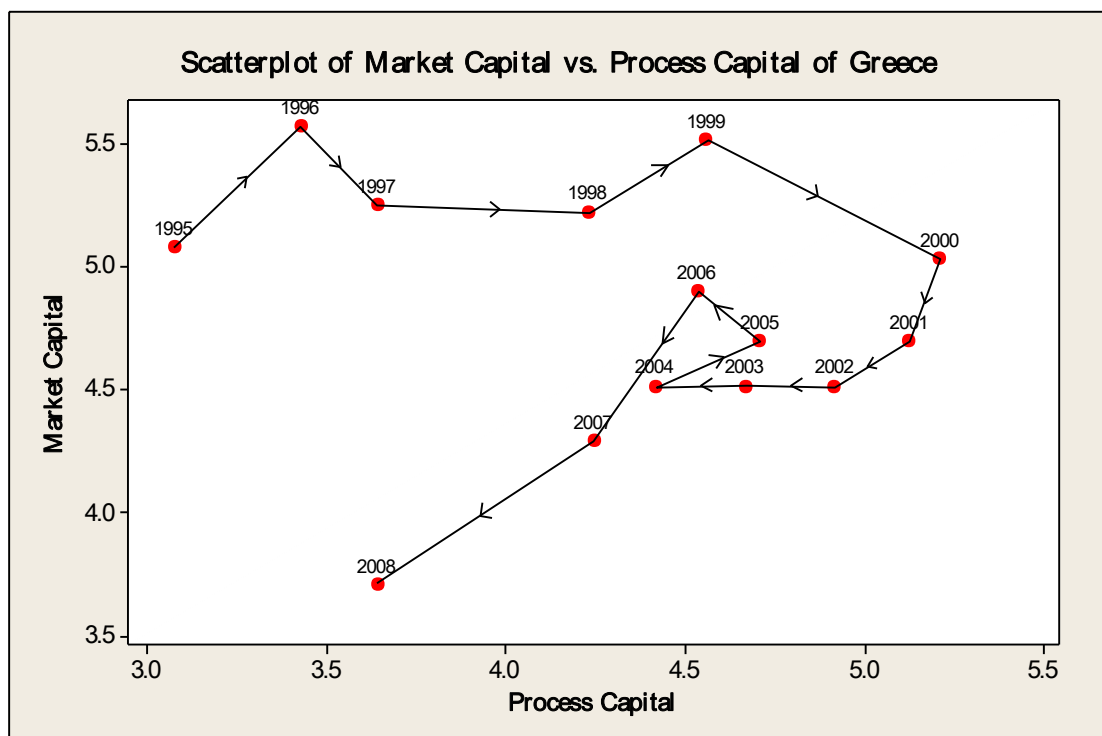


Figure 4: Scatter plot of market capital vs. process capital of Greece

Ireland's situation has been reported in the last section and Figure 2. For Portugal, as shown in Figure 5, its short-term value creating capability began to slide in 1998, with market capital declining year after year although a slight improvement in process capital was recorded. This downturn reflects Portugal's troubling 10.4% unemployment rate in 2009, a projected gross debt in 2010 of 84.6% GDP and a stock market decline of -9.7% as of Feb. 11, 2010 (<http://news.bbc.co.uk/2/hi/8510603.stm>).

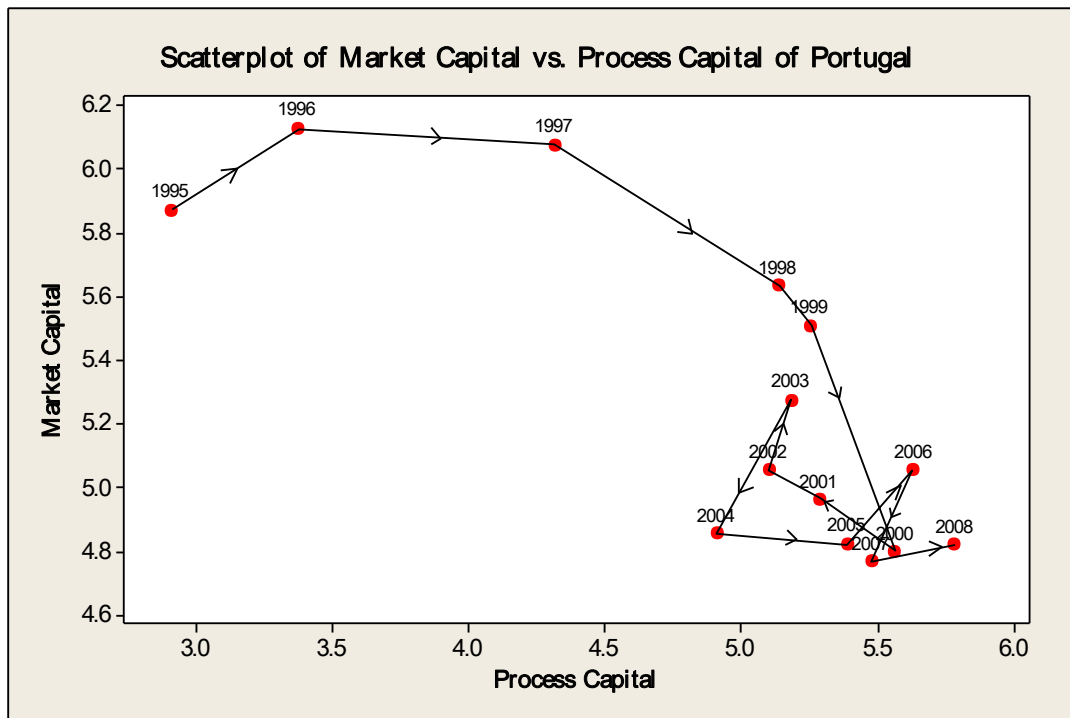


Figure 5: Scatter plot of market capital vs. process capital of Portugal

For Spain, in regard to the development of market capital and process capital, as shown in Figure 6, a generally negative correlation appears starting from 2001 with 2008 hitting rock bottom. The declining short-term value creating capability partially explains Spain's disturbing 19.5% unemployment rate in 2009, a projected gross debt in 2010 of 66.3% GDP and a stock market decline of -13% as of Feb. 11, 2010 (<http://news.bbc.co.uk/2/hi/8510603.stm>). Spain has been very hard-hit by huge declines in its property markets, and so it remains the only major economy in Europe still in recession; as a result, Spain government announced a 50bn-euro austerity package, including a civil-service hiring freeze, at the end of January 2010 (<http://news.bbc.co.uk/2/hi/8510603.stm>).

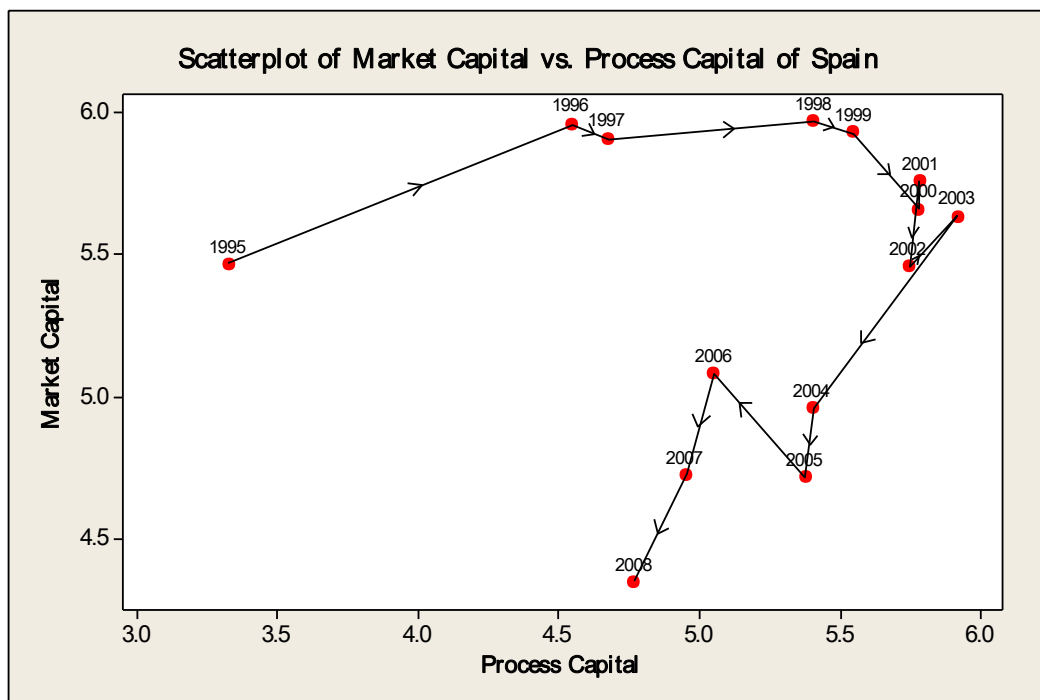


Figure 6: Scatter plot of market capital vs. process capital of Spain

7. Lessons learned for regaining competitiveness

On the one hand, market capital and process capital are the two key aspects that are more easily attainable if a nation is willing to engage a heavier investment for a short term development. On the other hand, they are susceptible to decline when the situation becomes unfavorable. To remedy the problem of Iceland, restructuring Iceland's banking system to increase capital availability, rather than heavily on loan is a "must". In addition, the countries in trouble can invest more in the long term national development determinants - human capital and renewal capital. Although these two capitals take time to create and accumulate, they are the key elements of national sustainable competitiveness. It seems that national intellectual capital development also undergoes a life cycle. Those currently at the peak may decline some day, especially as more and more countries are becoming aware of the value of intellectual capital and are aggressively pursuing it. Yet, while competitors are catching up, the key success factor in the future may lie in aspiring to a national vision, leveraging human capital, consolidating the roots of innovation, and enhancing social skills (Stahle, 2007) for the renewal and effective transfer from intellectual capital to financial performance, or, in other words, to enhance human capital with components of process capital, which leads to financial performance. This process may require more social innovation and societal entrepreneurship.

Although intellectual capital does not necessarily translate to financial performance and current financial performance may not guarantee future national development, yet the ebb and flow of Iceland in the current financial crisis may provide insights for policy makers. Iceland has been a rising star in economic development in the past few years and has received a consistently high ranking in world standard-of-living surveys; moreover, it was number one of the OECD countries according to The Global Benchmark Report 2006. But its 2008 national financial meltdown hit the country very hard. On the contrary, the relatively intellectual capital static Norway thrives by going its own way. In 2006, Norway's economy grew by just under three percent (GDP growth 2.5%). Instead of spending its riches lavishly, it passed legislation ensuring that oil revenue would go straight into its sovereign wealth state fund, which is used to make investments around the world. Now its sovereign wealth fund is close to being the largest in the world and its banks represent just two percent of the economy and tight public oversight over their lending practices have kept Norwegian banks from taking on the risk that brought down their Icelandic counterparts (http://www.nytimes.com/2009/05/14/business/global/14frugal.html?_r=2&hp).

However, countries recently in trouble as reported earlier should still have great potential to regain competitiveness as shown in Table 5. For instance, human capital of Iceland has been advanced from #7 to #3 and renewal capital advanced from #18 to #7, comparing the earlier 1995-2000 and the most recent 2005-2008 period ranking. In the same rein, Greece, Ireland, Portugal and Singapore all have human capital and renewal capital advancement comparing the first and the most recent third period ranking. The only exception is that Spain declines three ranks in human capital, yet increases two ranks in renewal capital.

Although gloomy at the moment, those countries which encountered financial problems recently should have the potential to regain their national strength, provided that their long-term determinant – human capital and renewal capital continue to steadily increase over the coming decade, for in today's knowledge economy the intangible intellectual capital is surely the key foundation for future national development.

Table 5: Human capital and renewal capital changes of the six countries recently in trouble

Human Capital	(1st Period - 3rd Period)	1st Period 1995-1999	3rd Period 2005-2008	Renewal Capital	(1st Period - 3rd Period)	1st Period 1995-1999	3rd Period 2005-2008
	Difference	Ranking	Ranking		Difference	Ranking	Ranking
Greece	1	30	29	Greece	6	34	28
Iceland	4	7	3	Iceland	11	18	7
Ireland	4	20	16	Ireland	0	20	20
Portugal	6	25	19	Portugal	5	32	27
Singapore	8	23	15	Singapore	8	17	9
Spain	-3	22	25	Spain	2	25	23

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(Number of Broadband Internet subscribers)
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