Government of South Australia
Department of the Premier and Cabinet

Australia: hub for European investments in R&D and higher education sectors

The Asian boom and Australian's proximity

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CONTENTS

1. INTRODUCTION - EMERGING MARKETS: A NEW OPPORTUNITY[1]

Today the world's centre of economic gravity is shifting to emerging markets. Once considered a mere source of cheap labour for Western companies externalizing manufacture, these regions' firms are now competing with those same Western companies on creativity and innovation as well as cost. Western companies are now finding it cheaper to relocate not only the production function, but also R&D facilities to developing countries[2], where they can find up-to-date technologies, highly skilled and specialized workers and, moreover, close proximity to a whole new market defined by emerging consumers' needs. Innovation involves not only the invention of new products but also the adoption of new distribution systems and new logistics - indeed, the development of whole new business models. Emerging countries comprise the largest world market for both Western and Eastern companies, whose best prospect is now targeting these "bottom-pyramid" consumers, who are rapidly moving from poor to middle-income status. The old stereotype of the Western company keeping its "innovative brain" in homeland headquarters and relocating production offshore is an outdated paradigm. Innovation itself has breached class boundaries. New products were previously targeted to the affluent then trickled down to the less privileged. Now, however, small and incremental improvements are applied to existing goods or services to make them immediately available to mass consumers. The less affluent end of the market, once ignored, has in recent times become a lucrative pursuit, since the less well off are also the more numerous. This has led to the term "reversed innovation", whereby cutting costs to the bone and reducing product complexity are key to capturing the lower end of the market. Firms do not fail to exploit any cost-cutting opportunity. Many of them contract out increasingly more work, retaining only

[1] This paragraph is based on the report *"The world turned upside down"*. The Economist. April 17th 2010.

[2] Fortune 500 is an annual list referring to the top 500 US companies ranked by gross revenues. Fortune 500 companies now have 98 R&D facilities in China and 63 in India.

core business and delegating secondary activities to more specialized companies. Others use existing technologies in unexpected fields, in order to make specialized services available to people who, as yet, cannot afford advanced facilities and products of their own. Finally, mass production methods are applied to unexpected fields (such as surgery) to reduce costs and increase gains from specialization. Even piracy has forced change, pushing legal producers to innovate constantly if they are to maintain market share in a world awash with highly-sophisticated replica goods.

Despite these clearly visible opportunities for innovation, emerging markets can prove to be very risky, since they are internally highly variable and volatile, both in propensity for local consumption and in consumers' tastes. This can easily manifest in retraction of brand loyalty, which companies then must combat with a constant stream of advertising aimed at raising product visibility and product differentiation. Firms willing to sell their product in emerging countries can frequently face costly distributional issues, with consumers located in rural and almost unreachable areas. Another aspect of emerging markets is that companies need to "prepare" local consumers for technological advancement, and need to be willing to invest in local capacity building prior to releasing a new product (which, of course, delivers benefits for the local community but at the same time does raise supply costs).

These transformations, reflecting a reordering of market priorities in different but related circumstances, demand many new business models. Developing countries tend to exhibit a preference towards two forms of corporate governance: highly diversified conglomerates and state-owned enterprises. On one hand, diversified conglomerates can adapt rapidly to a fast changing economic environment as they comprise a multitude of different sub-companies belonging to different businesses. This means that temporary shortages of capital or human resources in one sector can be filled by drawing these in from other sectors. On the other, partially state-owned enterprises (common in China) have the dual advantage of being backed by strong public financing but at the same time are free to operate in the global market. While state-owned enterprises hardly constitute a new business

model which western companies should emulate, many corporate structures assumed by firms in the booming emerging-market setting have a lot to teach Western companies in terms of business innovation. One striking difference is the shift from *scaling up*[3] to *scaling out*. Emerging markets' companies involve a wide range of people in the processes of production and distribution, rather than rely on the traditional resort to a centralized production structure, which not increases bureaucracy, it is inefficient in a context of dispersed populations and poor distribution systems typical of many emerging-market situations. *Scaling out,* conversely, enables firms to effectively spread their own activity as far as possible through, for example, franchise arrangements. These new and more flexible organisational frameworks are ably assisted by technologies such as the internet and mobile phones, and conducive to local allocation of resources according to demand.

The Western world is becoming increasingly challenged by this new economic and social order. An increase in price competition will be the most natural consequence in this context. Traditional western stakeholders will be the first victims of this revolution. This is why developed countries are facing a challenge no less daunting than their developing counterparts, that of reinventing themselves into new roles and structures.

Australia has always been something of an exception to traditional "Western model" countries. This work attempts to explain why Australia's role in this new scenario is bound to be crucial. The next chapters are organised as follows. Section 2 surveys Australia's current commitment to R&D investment, providing some broad statistics. Section 3 deals with education as a further stimulus to R&D. I provide a review of Australia's (higher) education system with a focus on the phenomenon of international students. Sections 4 and 5 cover the main core topics related to research and development. I then assess Australia's current involvement in R&D activity in terms both of

[3] In this model '[c]ompanies reduce unit costs by centralising their manufacturing and producing long runs of standardised items', *The Economist,* April 17, 2010, p12.

services traded abroad and of investments from and to overseas. Section 5.4 consolidates the idea of Australian openness towards foreign Western investments, providing an analysis of the national patent system. Final chapters deal with the sound environment for R&D created by both private (focus on venture capital) and public funding and taxation regime. Section six draws the main conclusions.

2. AUSTRALIAN INNOVATION SYSTEM. OVERVIEW

The role of the Department of Innovation, Industry, Science and Research (DIISR) is of crucial importance in underpinning Australia's commitment to innovation. DIISR is responsible for "encouraging the sustainable growth of Australian industries by developing a national innovation system that drives knowledge creation, cutting edge science and research, international competitiveness and greater productivity"[4]. In May 2010 DIISR took a first step towards these objectives, and released of the first *"Australian Innovation System Report"*. This document summarises Australia's current positioning compared with other OECD countries, and outlines future targets in some critical areas. The report extends the concepts contained in *Powering Ideas: An Innovation Agenda for the 21st Century*, whose main goal is to provide Australia with those tools necessary to properly face the economic challenges of the 21st century. Innovation is the key imperative in Australia becoming more productive and competitive. In the current climate, it represents an investment which protects the country against the economic downturn and creates employment. In terms of future prospects, it is the safest course through which to increase per capita income levels and national growth as a whole. The report *Powering Ideas*:

[4] Http://www.innovation.gov.au/Pages/default.aspx.

- Outlines **Australia's** 'state of the art' **innovation** performance **compared to** other **OECD** countries and, further, tracks Australia's **progress in** achieving its predetermined **targets**.
- Assesses the **features and trends of Australian innovation expenditure** in absolute terms.
- Traces **concrete guidelines for future actions**, plans and achievements.

Powering Ideas follows the previous Australian research policy planning, started in 2001, *Backing Australia's Ability*. Split into two tranches, this constituted a ten-year, $8.3 billion commitment in the R&D sector.

Nowadays, Australia can boast:

- **37** publicly funded universities, **2** privately funded universities and **1** Australian campus of an overseas university. All universities pursue research to a greater or lesser extent although the largest share is performed in universities collectively known as the Group of 8.
- A network of publicly funded research agencies including:
  - The Commonwealth Scientific and Industrial Research Organisation (CSIRO)
  - The Australian Nuclear Science and Technology Organisation (ANSTO)
  - The Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS)
  - The Anglo-Australian Observatory (AAO)
  - The Australian Institute of Marine Science (AIMS)
  - Geosciences Australia
  - The Defence Science and Technology Organisation (DSTO)
  - The Australian Antarctic Division (AAD)
  - National ICT Australia (NICTA)
  - The Bureau of Meteorology (BoM)

- **4** learned academies (Australian Academy of Science, Australian Academy of Technological Sciences and Engineering, Academy of the Social Sciences in Australia, Australian Academy of the Humanities,) and an umbrella body, the National Academies Forum.
- Research Centres: the ARC has funded **20** Centres of Excellence **3** Co-funded Centres of Excellence (NICTA-National ICT of Australia, Plant Functional Genomic and Australian Stem Cells) and 16 Special Research Centres; the NHMRC has funded 23 Centres of Clinical Research Excellence; and the Australian Government has directly funded **5** International Centres of Excellence.
- 24 Research Networks funded by the ARC (including 5 co-funded by the NHMRC).

3. EDUCATION

Higher education sector in Australia is mostly relevant in both supply and demand terms. At the end of 2009 1,002,003 students were enrolled in Australian higher education courses, 2.7% more when compared to the previous year. 27.8% of the students attended postgraduate (Master of Science and PhD) courses, while 69.2% were enrolled in bachelor classes. Focusing on broad fields of study, it can be observed that the courses most attended are those related to management and commerce (29.7%), followed by society and culture (20.7%) and health (13.3%). The high demand for management related courses is explained both by the Australian economy itself (ever more hinging on services and trade) and by the huge amount of Chinese students seeking preparation in management, which they cannot access from institutions in their home country.

The striking performance of Australian higher education system and its growing importance for the national economy are evidenced by data on the

percentage change of the number of enrolled students between 1991 and 2008. Besides an increase in the whole student population (87%), there has been an impressive and disproportionate boost to overseas students studying in Australia (814%), accounting for 27% of the whole enrolled student numbers (up from 5.5% in 1991). If we disregard minor courses (enabling courses, non-award courses), postgraduate education seems to be in most demand, having tripled over roughly the past two decades. Both the high number of overseas students and the excellence of post-graduates classes witness Australian particular role as a milestone in postgraduate education, whose connection with applied research is renowned.

	All Students	
	2008	
	No.	% of total
Level of Course		
Doctorate by Research	42,110	4%
Doctorate by Coursework	1,408	0%
Master's by Research	8,199	1%
Master's by Coursework	158,811	16%
Postgrad. Qual/Prelim.	237	0%
Grad.(Post) Dip. - new area	28,080	3%
Grad.(Post) Dip. - ext area	12,093	1%
Graduate Certificate	27,385	3%
TOTAL POSTGRADUATE	278,323	28%
Bachelor's Graduate Entry	12,773	1%
Bachelor's Honours	11,881	1%
Bachelor's Pass	655,500	65%
Associate Degree	6,694	1%
Advanced Diploma (AQF)	2,338	0%
Diploma (AQF)	3,244	0%
Other undergraduate award courses	1,129	0%
TOTAL UNDERGRADUATE	693,559	69%
Enabling courses	10,093	1%
Non-award courses	20,028	2%
TOTAL	1,002,003	100%
Broad Field of Education		
Natural and Physical Sciences	77,169	8%
Information Technology	47,557	5%
Engineering and Related Technologies	72,883	7%
Architecture and Building	24,019	2%
Agriculture, Environmental and Related Studies	16,281	2%
Health	133,413	13%
Education	96,595	10%
Management and Commerce	297,565	30%
Society and Culture	207,588	21%
Creative Arts	64,521	6%
Food, Hospitality and Personal Services	55	0%
Mixed Field Programmes	3,917	0%
Non-award courses	19,928	2%
TOTAL (c)	1,002,003	100%

Figure 1. Distribution of Australian students by field of study and by qualification.

	All Students			
	1991	**2000**	**2008**	**% change 1991-2008**
Australian	504,880	599,878	731,283	45%
Overseas	29,630	95,607	270,720	814%
Tot	534,510	695,485	1,002,003	87%
Postgraduate	92,879	142,423	278,323	200%
Undergraduate	436,038	540,719	693,559	59%
Enabling courses	5,593	12,343	30,121	439%
Tot	534,510	695,485	1,002,003	87%

Figure 2. Australian students in 1991, 2000 and 2008. By studying pattern and origin.

Australia has 39 universities (37 public institutions, 2 private ones), one branch of an overseas university, and three other self-accrediting higher education institutions. Among these, eight institutions (called "Group of Eight")[5] form a subdivision widely renowned for its outstanding research activity and professional education. The group aims to act cooperatively to influence national policies for higher education and university research, facilitate collaboration and strategic alliances, provide a network to the students enrolled and to graduates. Hence, it is not only devoted to gaining a greater influence on policy decisions, but also to improving services to students. In 2009 *THES-QS Top World 200 Ranking Times Higher Education Supplement*, all the eight universities ranked among the best 85.

University	**Ranking**
Australian National University	17
University of Melbourne	36
University of Sidney	36
University of Queensland	41
Monash University	45
University of New South Wales	47
University of Adelaide	81
University of Western Australia	84

Figure 3. Ranking of Group of Eight Universities.

Funding to higher education institutions comes primarily from the Commonwealth (public), both in the form of direct support to certain universities and in the form of scholarships granted to students. The

[5] These are: The Australian National University (Canberra), The University of Sidney (Sidney), The University of Melbourne (Melbourne), The University of Adelaide (Adelaide), The University of Queensland (Brisbane), The University of Western Australia (Perth), The University of New South Wales (Sidney), Monash University (Melbourne).

Government's research and innovation packages - *Backing Australia's Ability I* (2001-05) and *Backing Australia's Ability II* (2005-11) had been providing approximately $8 billion in Federal Government funding over ten years towards the promotion of science and innovation, the commercialisation of research, and the advancement of Australia as a knowledge economy. By far the second most important source of income are fee-paying international students, whose numbers (as will be seen in the next pages) are extremely high when compared to other countries. An approximate representation of the distribution of Australian universities among the states and territories is provided in the table below.

Western Australia	Curtin University of Technology, Edith Cowan University, Murdoch University, University of Notre Dame Australia, University of Western Australia
Northern Territory	Charles Darwin University
Queensland	Queensland University of Technology, Bond University, Central Queensland University, Griffith University, James Cook University, Southern Cross University, University of Queensland, University of Southern Queensland, University of the Sunshine Coast, Australian Catholic University
New South Wales	Australian Graduate School of Management, Charles Sturt University, Macquarie University, Souther Cross University, University of New England, University of New South Wales, University of Newcastle, University of Sydney, University of Technology Sydney, University of Western Sydney, University of Wollongong,
Victoria	Deakin University, Monash University, RMIT University, Swinburne University of Technology, University of Ballarat, University of Melbourne, La Trobe University, Victoria University,
Australian Capital Territory	University of Canberra, Australian Defence Force Academy
South Australia	Carnagie Mellon University, Cranfield University, University College London, University of Adelaide, University of South Australia, Flinders University
Tasmania	University of Tasmania

Figure 4. Main universities by State/Territory.

South Australia's higher education institutions now include overseas universities which have established a campus in Adelaide's CBD[6]. This follows the South Australian Government's efforts to attract overseas institutions to Adelaide to realise the Premier's vision to develop Adelaide as 'University City of the Future'.

International education is an important sector in the Australian economy. Latest data from the Australian Bureau of Statistics (ABS) show that this sector contributed $15.5 billion export income to the national economy in 2008-09, the third largest source of overseas earnings. The majority of the revenue came from on-shore activity ($15 billion), while $505 million was generated from Australian campuses overseas[7]. In the South Australian context, education represents the State's fourth largest export, behind wine, copper and cars, contributing (in 2007) $673 million to the federal balance sheet[8] and also stimulating the tourism industry due to families visiting their children from overseas, and students embarking on frequent trips to their home countries. In 2007, international students that chose Australia as a place to study numbered 455,185[9]; of that cohort 23,327 chose to attend South Australian courses. Adelaide stands out particularly for its higher education supply. In 2007, 11,471 students out of 23,327 were enrolled in higher education programs (with South Australia share being 50%), while the same percentage reduces to 39% at the national level. This is evidence of the outstanding positioning of South Australia as a centre of high specialization for international students not only among the other Australian States and Territories but also compared to the whole Eastern Asian world. As a matter of fact, East Asia is the primary source of demand for education services provided across the whole nation. On the next page are the graphs

[6] These universities, Carnegie Mellon Heinz College, and University College London's School of Energy and Resources, are located in Adelaide's International University Precinct in the heart of the city.
[7] *"Export income from education services by the top 50 nationalities 2008".* Research Snapshot. Australian Education International (AEI).
[8] *"South Australia's International Education Plan 2008-2014".* Education Adelaide.
[9] This number is referred to ALL kind of education degrees, higher education being only a part of it.

representing the share of enrolments (the first two graphs depict all sectors, the second two higher education only) held by the top ten nationalities, both in South Australia, and in Australia in general in 2010[10].

[10] "AEI International Student Enrolment Data 2010".

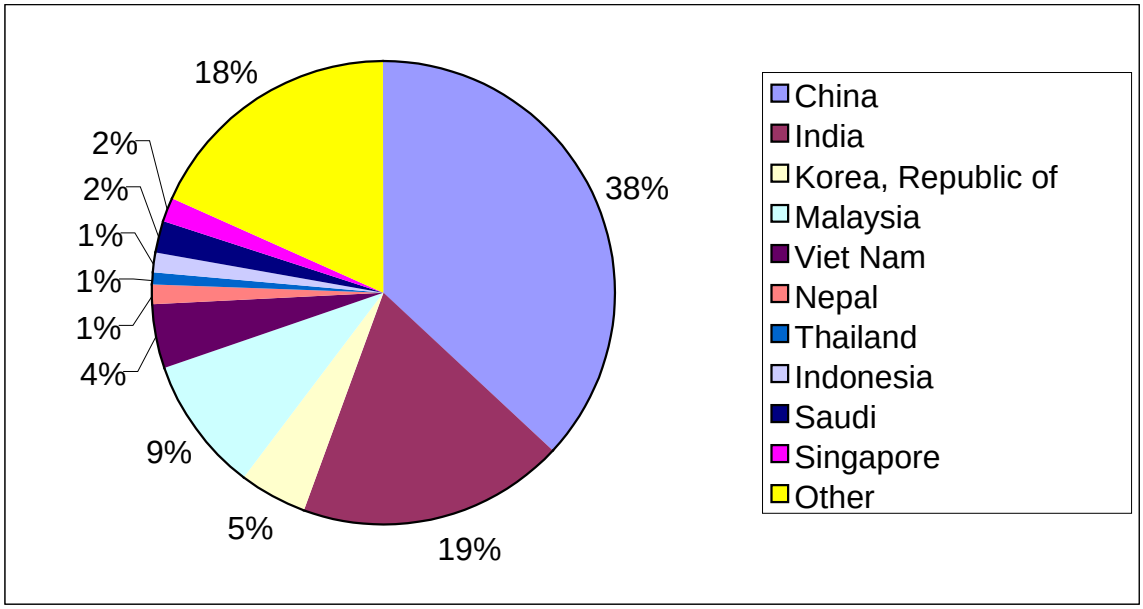

Figure 5. All-stages enrolments by nationality – South Australia – Feb 2010.

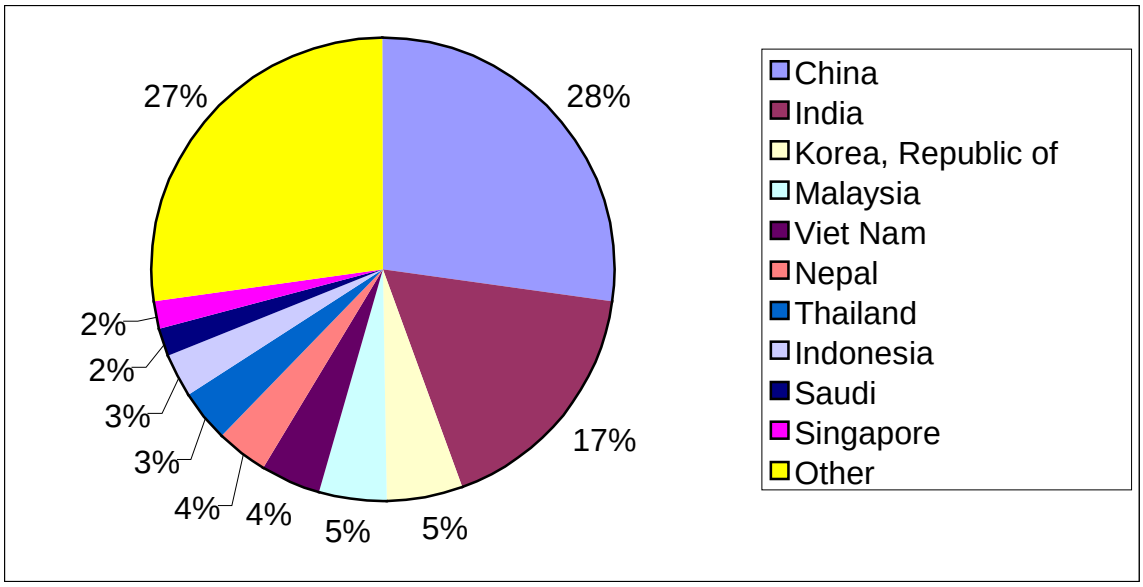

Figure 6. All-stages enrolments by nationality - Australia – Feb 2010.

The lion's share of enrolments comes from China and India, which together account for more than a half of the total enrolments of international students in South Australia. Compared with other states South Australia receives a greater proportion of Chinese students. At national level, Malaysian enrolments constitute a more substantial share.

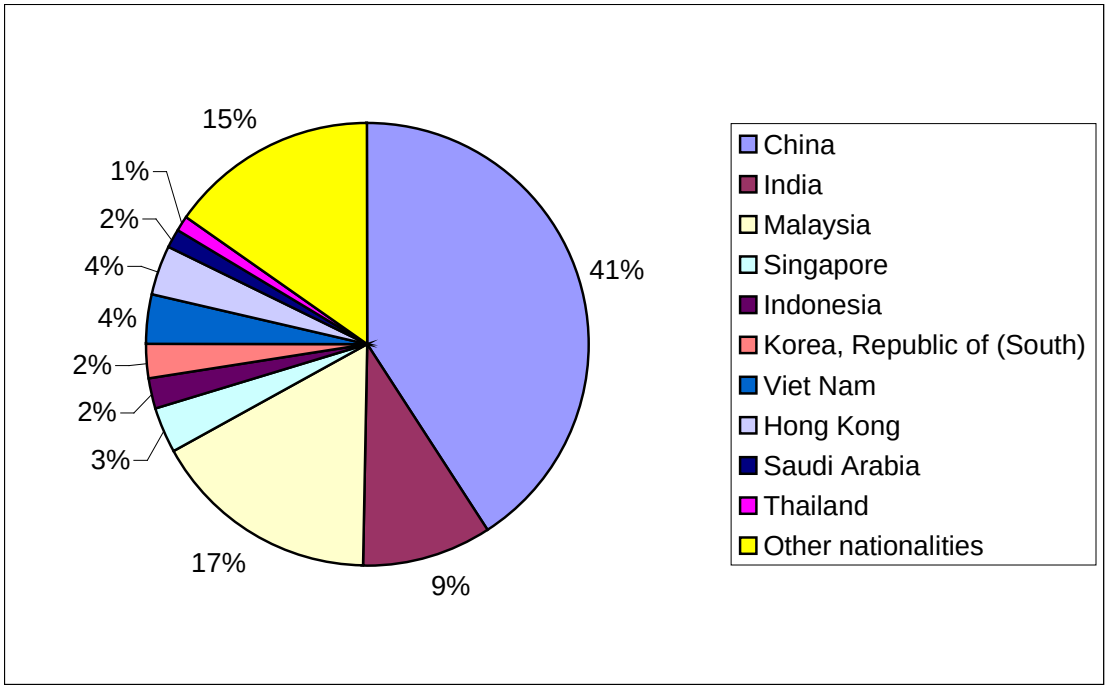

Figure 7. Higher education enrolments by nationality – South Australia – Feb 2010.

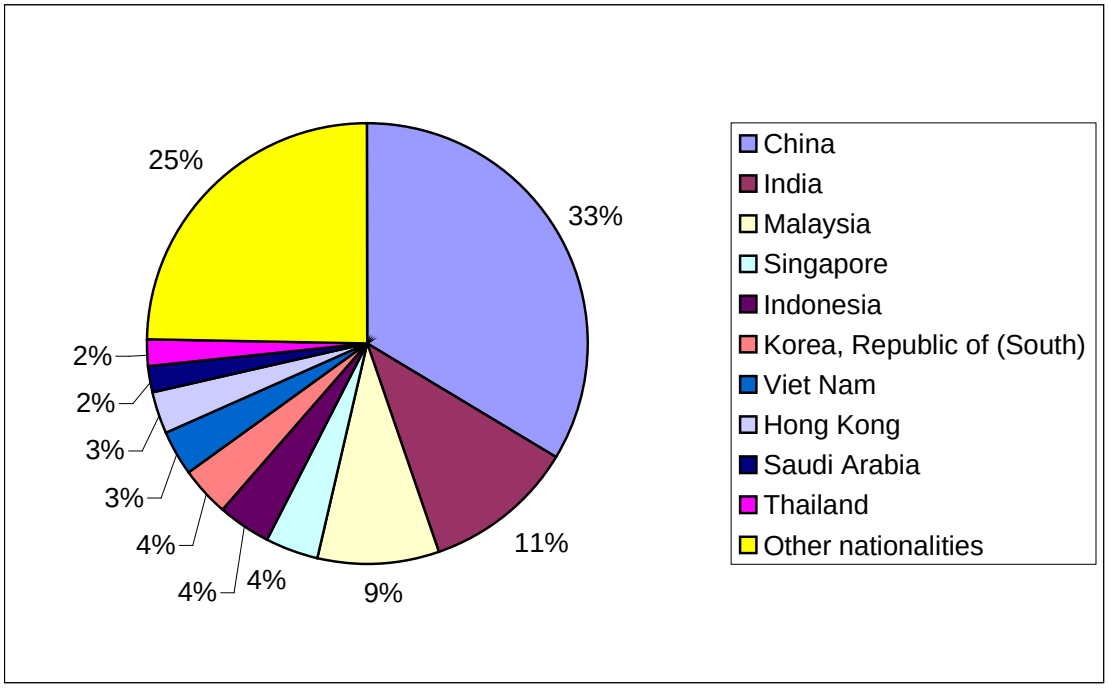

Figure 8. Higher education enrolments by nationality – Australia – Feb 2010.

Focusing specifically on the higher education sector, South Australia's performance in attracting Chinese students improves further. Enrolments from

Asia exceed those from India when the higher education sector is taken by itself. Regional proximity, combined with fast recent growth, seems to be the main driver of Australia's increased share of Malaysian students. Recent historical trends of higher education enrolments in Australia and South Australia are instructive[11].

	South Australia				Australia			
	2007	**2008**	**2009**	**2010**	**2007**	**2008**	**2009**	**2010**
China	3,150	3,321	3,714	4,684	39,211	38,277	43,553	54,026
India	1,545	1,397	1,287	1,086	18,606	18,335	18,417	17,787
South Korea	306	293	305	285	4,784	4,794	5,304	5,673
Malaysia	1,601	1,571	1,759	1,920	13,062	12,506	13,558	14,326
Vietnam	159	205	297	419	2,320	2,675	3,628	5,279
Thailand	140	131	116	108	3,647	3,119	2,813	2,868
Indonesia	149	120	166	251	6,446	5,506	5,671	6,123
Hong kong	372	336	372	420	5,782	4,525	4,688	4,808
Singapore	383	378	371	376	6,174	5,650	6,048	6,454
Others	Nepal	22	29	76	94	1,106	1,991	2,499	2,796
	Taiwan	135	130	120	119	2,884	2,495	2,394	2,457
	Bangladesh	59	55	54	72	2,224	1,728	1,416	1,573
	Myanmar	9	9	10	5	204	248	313	383
	Papua New Guinea	4	3	2	7	132	141	155	197
	Fiji	3	3	3	6	252	215	224	210
	Macau	2	3	4	6	65	65	125	166
	Mongolia	1	1	1	0	48	47	53	72
	Bhutan	5	2	5	7	112	93	129	202
	Philippines	5	8	32	45	507	534	662	907
	tot Others	245	243	307	361	7,534	7,557	7,970	8,963

Figure 9. Trend of the enrolments in higher education sector by country of origin of students.

2007, as the year of the financial crisis, also impacted upon export figures for education services from Australia. The table shows a decrease in the number of students enrolled in 2008 from almost all Australia's sources of international students.

[11] Monthly time series of international students enrolments – 2010. AEI.

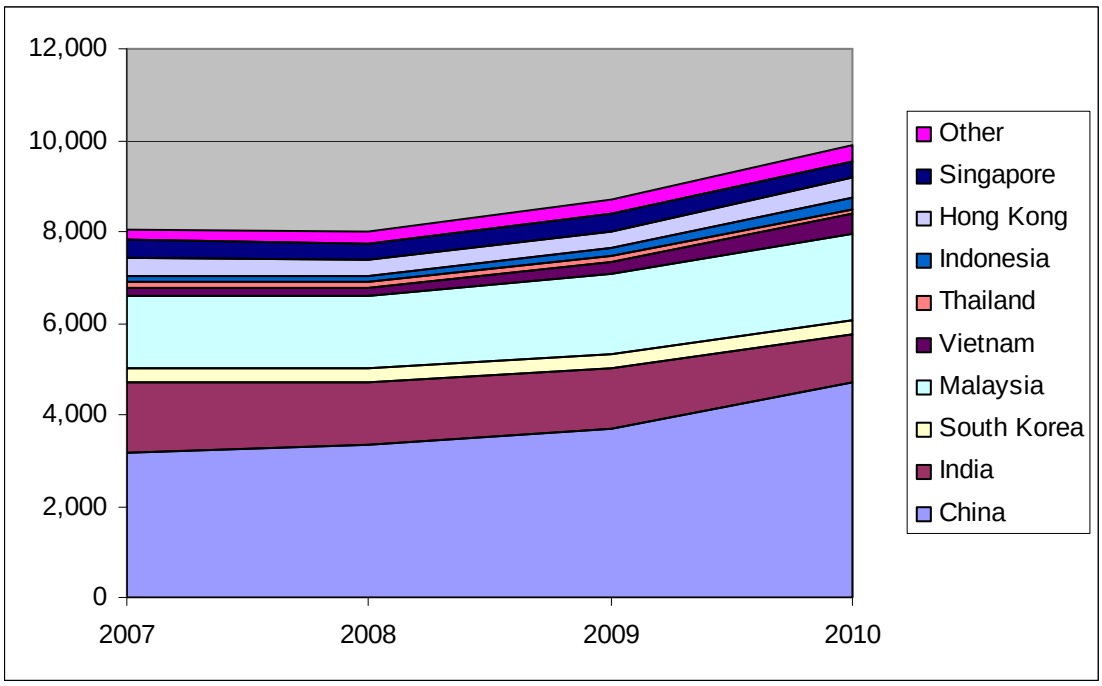

Figure 10. South Australia enrolments in higher education programs by main country of origin.

Of the nine major sources of international students enrolling in Australia, only Vietnam and South Korea did not experience a negative rate of enrolment for this year (Vietnam even increased of 15.3%). The most significant falls in student numbers can be attributed to Hong Kong, Thailand, Indonesia and Singapore. Hong Kong (-21.7%) and Singapore (-8.3%) are Australian traditional source markets, now reaching maturity. In recent times they have been improving their own domestic education systems with a view to retaining higher numbers of students at home. The opposite, however, applies for Vietnam, China, India and Malaysia, which are currently experiencing booming growth but lack skilled managers and engineers able to lead their new companies. At the same time, as their domestic education services are inadequate, they are forced to seek education services overseas. In addition, a classical "Western" education is highly preferred by employers over a domestic one when selecting for appointments. For this reason, both the United States and the United Kingdom are considered Australia's direct competitors in securing international students. In the higher education context, in which the student requires a stable living environment for some years, it is worth noting that Australian cities have generally been considered

sound places for students to live and study. The Mercer Human Resource Consulting's "*2009 worldwide quality of living survey*"[12] lists five Australian cities among the top 50 for quality of living: Sydney (10th), Melbourne (18th), Perth (21st), Adelaide (30th) and Brisbane (34th). In contrast, the first American city is Honolulu (29th), followed by San Francisco (30th) and Boston (35th), and London takes only the 38th position. Clearly Australia is a good place to live, aside from considerations about education itself. Moreover, average tuition fees are often lower (around $10,00 –$20,000) when compared with those applied to international students in the UK (£10,000 per year, or approximately AUD$17,200) and in the USA (US$20,000, or approximately AUD$16,000). Finally it is worth noting that the Australian unemployment rate is currently 5.3%[13] (March 2010), compared to USA at 10.2% (March 2010) and UK at 8% (February 2010). This means that international students who wish to undertake work in Australia should find it easier than elsewhere due to a healthier labour market.

[12] Http://www.mercer.com/referencecontent.htm?idContent=1173105#Top_50_cities:_Quality_of_living. Mercer evaluates standard of living according to each city scoring in 39 factors, grouped in 10 categories: Political and social environment, economic environment, socio-cultural environment, health and sanitation, school and education, public services and transportation, recreation, consumer goods, housing, natural environment.

[13] Australian Bureau of Statistics. *"Labour force, Australia, March 2010"*. N. 6202.0.

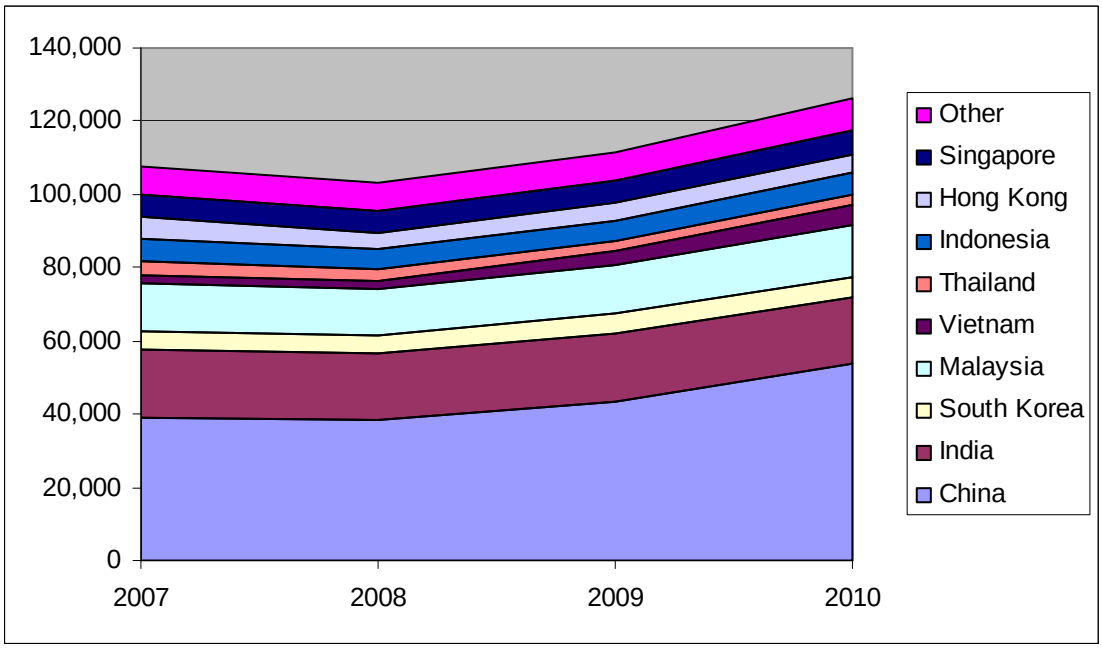

Figure 11. Australia enrolments in higher education programs by main country of origin.

Vietnam and China are the only two sources of international students that increased their flows to Australia in the period 2007-2008. Vietnam's share shows the biggest increase from 2007 to 2010 (164%), followed by Indonesia (68%) and China (49%), while the number of enrolments from India (-30%) and Thailand (-23%) has been decreasing. In conclusion, the total proportion of East-Asian students decreased in 2008 but increased over the whole period under consideration (that is, 2007-2010) by 17%. In South Australia alone the figure arises to 23%.

Most of the international students attending higher education courses in Australia choose Management and Commerce programs (48%, in line with the need for skilled managers in their homelands), followed by IT and Society and Culture programs. Bachelor degrees cover the vast majority of enrolments (56%), then Master of Science (35%) and PhD (15%), repeating a

pattern widely spread in every developed country (that is, a higher number of students are admitted to the first stages of education)[14].

Outcome	Living in Australia	Left Australia	Australian domestic graduates
Working	73%	81%	81%
Studying and not working	8%	4%	6%
Not working and seeking work	13%	8%	6%
Other	6%	7%	7%
Total	100%	100%	100%

Here is a helpful table summarizing outcomes for international students facing the choice of whether to work or to keep studying after graduating with an Australian qualification[15].

Table 12. Outcomes of international students finishing their degrees in Australia

International students remaining in Australia found it slightly more difficult to find a job than either those international students who left Australia or Australian domestic graduates. In all groups the majority of survey respondents who reported being unemployed and actively seeking work were recent 2008 graduates seeking work in a job market affected by the global financial crisis[16].

Transnational higher education (namely, the provision of education to international students provided by Australian institutions offshore) plays a minor yet not negligible role in determining the total revenues of the sector. In 2007, it accounted for 72,282 students enrolled, 26.5% of the total international students (273,099)[17], mainly located in Singapore and Malaysia, where Australian institutions have built campuses abroad.

[14] "*International student enrolment in higher education in 2008".* Research snapshot. AEI.
[15] Figures in the table are averages over the period 2004-2008.
[16] *"International student employment outcomes survey".* Research snapshot. AEI.
[17] *"Transnational education in the higher education sector".* Research snapshot. AEI.

4. NATIONAL RESEARCH CENTRES

This section presents an overview of the main **National Research Centres** in terms of number of people employed or involved in their activities, budget and research areas.

4.1 CSIRO[18]. The *Commonwealth Scientific and Industrial Research Organization*, is Australia's national science agency and one of the largest and most diverse research agencies in the world. The primary role of the CSIRO includes contributing to the objectives and responsibilities of the Australian Federal Government, and providing new ways to benefit the Australian community and improve the economic and social performance of a number of industry sectors through research and development. CSIRO's budget estimates for 2010-11 is $1,396,920,000, 52% of which comes from the government and 32% from mainly private funds. The agency's core areas of impact are: astronomy and space, climate change, energy, environment, farming and food, health and wellbeing, ICT, manufacturing, materials, mining and minerals, oceans and coasts, transport and infrastructure. Over 6,600 people are employed in the institute.

CSIRO international activity has three pillars:

- **Talent**. Developing opportunities for CSIRO's staff outside Australia, as well as enabling overseas researchers overseas to contribute to Australia's research agenda, thus expanding the knowledge base and building a culture of excellence in research inquiry.
- **Impact**. Internationally significant projects supporting national needs.
- **Networks**. Participation in a global network to share research facilities, knowledge and intellectual property.

[18] Http://www.csiro.au/.

In 2008-2009 the agency was involved in the International Secondment Program, which aimed to address gaps in existing projects through international secondments to leading overseas institutions. CSIRO focuses on five priority areas defined by both geographical and socio-economic factors: China, India, Research for Development, North America and Europe.

CSIRO's international collaboration works through partnerships, including foreign governments, small companies through to large multinationals, and from collaborative research to consulting and supervision. Among CSIRO's collaborations, those with the USA are the most numerous even though USA ranks only at number six as the country of origin of CSIRO staff.

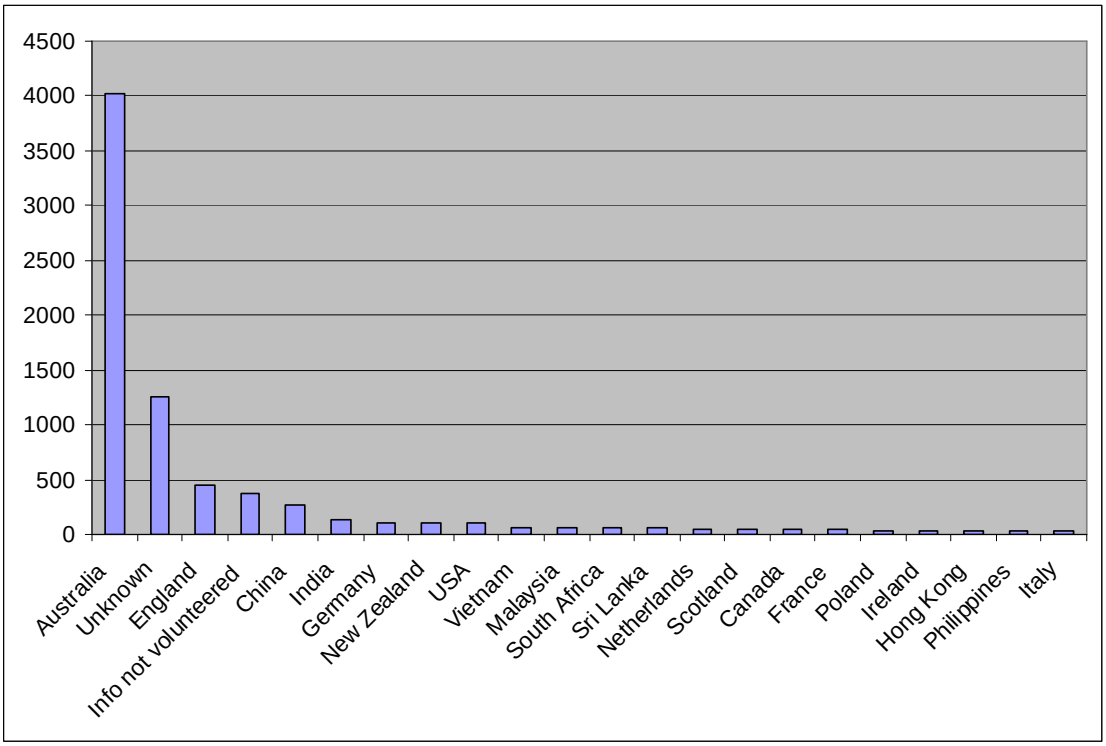

Figure 13. Diversity of CSIRO people – top 20 countries of birth.

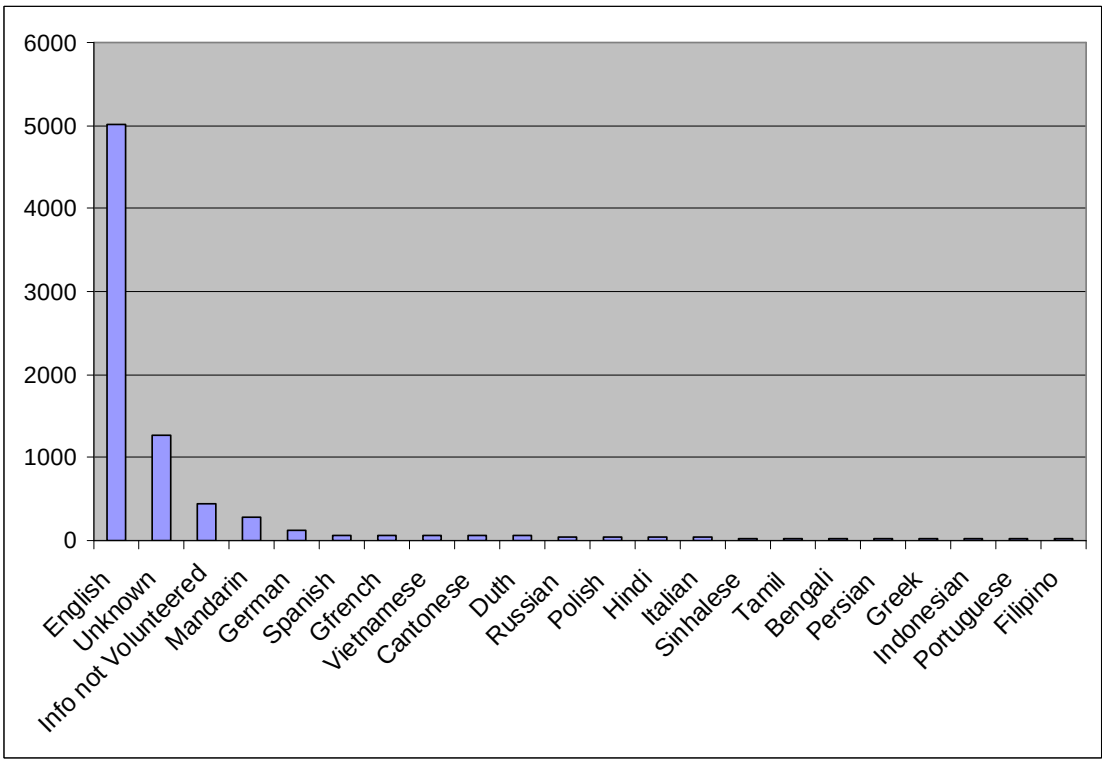

Figure 14. Diversity of CSIRO people – top 20 languages spoken.

Looking at the languages spoken by CSIRO people, we discover that Mandarin is the second most widely spread in the organization.

A significant proportion of CSIRO's publications are co-authored with international partners: in 2008 these numbered 982 (44% of the total number of publications). USA has always been CSIRO's long-term publishing partner. In 2008 China surpassed England to move into number two position, just behind the US.

Country	2005	2006	2007	2008	2009 (up to June)	Total
USA	232	273	259	292	198	1254
England	93	117	93	115	81	499
China	48	81	84	147	70	430
Germany	59	73	75	102	51	360
France	56	88	63	92	57	356
Canada	57	82	76	85	45	345
Japan	42	48	48	57	34	229
New Zealand	44	41	47	56	23	211
Netherlands	27	33	35	47	36	178
Italy	21	31	24	33	29	138
Scotland	14	26	19	38	16	113
India	24	18	20	25	18	105
Spain	19	16	21	23	19	98

Figure 15. CSIRO's publications with international partners from 2005 to mid 2009.

Total value of CSIRO's contracts with international components exceeded $122,000 in 2008-09, while single project investments are highly variable, from less than $50,000 to over $1,000,000 dollars. The vast majority of CSIRO's international engagement activities were in the form of collaborative research, followed by consulting and testing activities and technology transfers.

Finally it is worth noting that CSIRO also works with some of the most important multinational companies.

Company	2008-09
Bayer	9
BHP Billington	5
Boeing	26
DuPont	3
Kraft	6
Shell	3
Sigma-Aldrich	3

Table 16. CSIRO's main multinational companies.

4.2 ANSTO[19]. The *Australian Nuclear Science and Technology Organization* is a public research organization responsible for delivering specialized advice, scientific services and products to government, industry, academia and other research organizations. It pursues that agenda through the development of new knowledge, delivery of quality services, and support for business opportunities. ANSTO's primary fields of interest are: nuclear medicine (products and development), environment and climate change research, materials engineering, neutron scattering, business and strategic services. ANSTO funding from government for 2010-11 is set at around $165 million. The agency has currently more than 960 people on staff.

4.3 AAD[20]. The *Australian Antarctic Division* was formed in 1948 to administer and coordinate Australian National Antarctic Research Expeditions, which later became the Australian Antarctic program. AAD maintains the Antarctic Treaty System and enhances Australia's influence in it, protects the Antarctic environment, understands the role of Antarctica in the global environment and runs scientific works of practical and national significance. It employs 300 people. Federal budget for AAD in the year 2009-2010 was $114 million.

4.4 CRC[21]**.** *The Cooperative Research Centre* provides funding to build critical mass in research ventures between end-users and researchers which tackle clearly-articulated major challenges for the end-users. In this regard CRCs pursue solutions that are innovative, of high impact and capable of being effectively deployed by the end-users. A CRC is an incorporated or unincorporated organisation, formed through collaborative partnerships between publicly-funded researchers and end-users. CRCs must comprise at least one Australian end-user (either from the private, public or community sector) and one Australian higher education institution (or research institute

[19] Http://www.ansto.gov.au/home.
[20] Http://www.aad.gov.au/.
[21] Https://www.crc.gov.au/Information/default.aspx.

affiliated with a university). There are currently 48 CRCs operating in 6 sectors: manufacturing technology, ICT, mining and energy, agriculture and rural-based manufacturing, environment, medical science and technology. Since the commencement of the CRC Program (1991), all parties involved have committed more than $12.3 billion (cash and in-kind) to CRCs. This includes almost $3 billion from the CRC Program, $3.1 billion from universities, $2.5 billion from industry and $1.2 billion from CSIRO.

4.5 DSTO[22]. The *Defence Science and Technology Organization* is part of Australia' Department of Defence. DSTO is the Australian Government 's lead agency charged with applying science and technology to protect and defend Australia and its national interests. In the 2008-09 budget, $372.5 million was committed to DSTO funding.

5. RESEARCH AND DEVELOPMENT

5.1 EXPENDITURE PROFILE – AUSTRALIA

The following table displays Australian GERD (Gross Expenditure on Research and Development) for years 2004-05 and 2006-07.

	2004-05	2006-07	% increase
Business	8,879	11,746	24%
Australian Government	6,148	6,957	12%
State Government	918	1,069	14%
Other Australian	628	684	8%
Overseas	621	545	-14%
total GERD	17,194	21,001	18%

Figure 17. GERD by source of funds, 2004-05 to 2006-07 (million $).

[22] Http://www.dsto.defence.gov.au/.

The data bear witness to the outstanding effort by Australia in boosting innovation, both in the private and public sector. In 2006-2007, GERD/GDP[23] in Australia was about 2.06%, 56% of which was financed by the business sector, 41% by governmental institutions and a residual 3% by overseas ones. BERD/GDP experienced the most substantial increase, from 0.67% in 1998-99 to 1.27% in 2007-08, though remaining under the OECD average (1.58% in 2007-08). GERD growth from the previous year was 18%, mostly due to private sector investments.

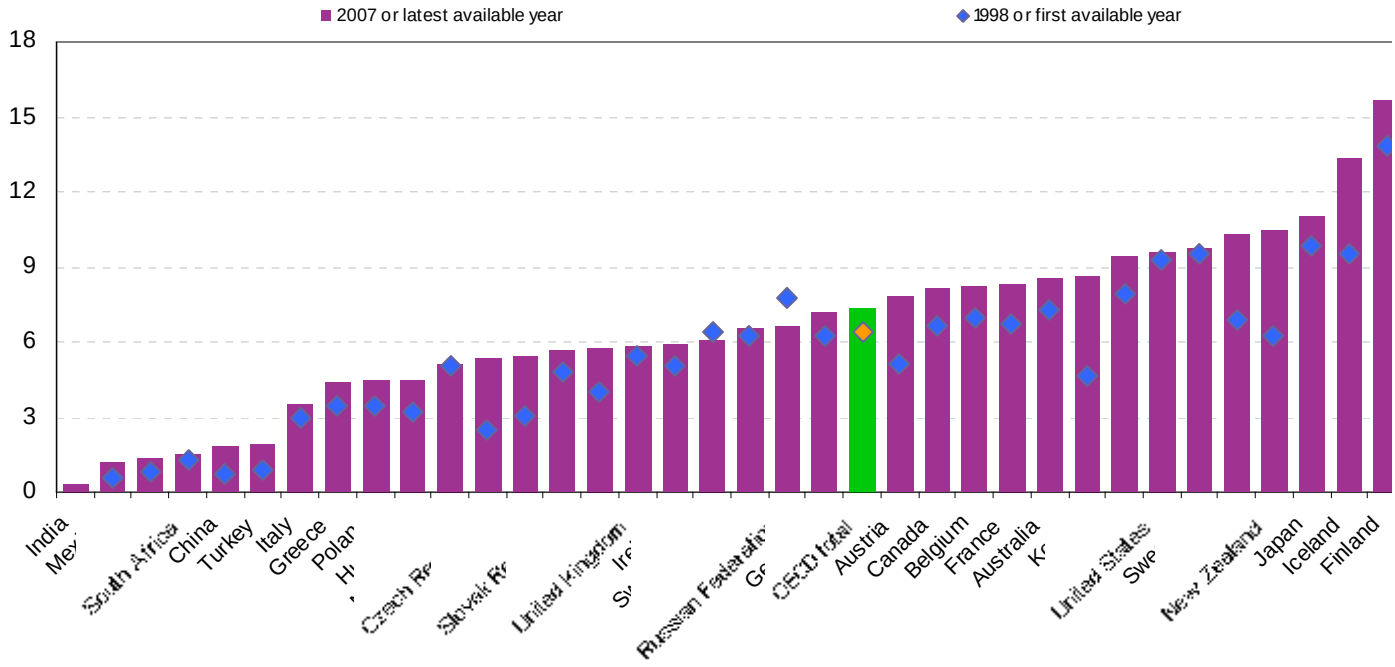

Figure 18. Number of researchers per thousands employment, full-time equivalent on R&D. OECD source.

Another significant measure of R&D commitment of a country is the number of researchers per thousand employment. On this count, Australia performs better than the OECD average, with 8.5 researchers for every 1000 employees.

[23] *Gross expenditure on research and development over GDP*. It is used as a target by many countries.

With regard to scientific papers, according to Essential Science Indicators[24] among the 148 top-performing countries in all fields, Australia ranked No.11 for citations (2,662,008), No.9 for papers (261,001), and No.25 for citations per paper (10.20). This feature includes rankings in all fields for Australia. Australia is widely renowned for clinical medicine expertise, followed by biology and chemistry, and plant and animal science.

Ranked by Citations

Rank	Field	Papers	Citations	Citations per paper
1	clinical medicine	57,962	739,354	12.76
2	biology & biochemistry	14,807	237,019	16.01
3	plant & animal science	25,373	198,602	7.83
4	chemistry	17,567	179,194	10.2
5	molecular biology & genetics	6,787	155,864	22.97
6	geosciences	12,541	134,577	10.73
7	physics	14,865	125,295	8.43
8	environment/ecology	11,340	121,322	10.7
9	neuroscience & behavior	7,270	110,523	15.2
10	immunology	4,623	95,032	20.56
11	psychiatry/psychology	10,158	84,946	8.36
12	space science	4,781	84,568	17.69
13	microbiology	4,648	71,861	15.46
14	engineering	16,432	71,755	4.37
15	social sciences, general	15,422	59,067	3.83
16	agricultural sciences	7,208	47,428	6.58
17	pharmacology & toxicology	3,672	41,597	11.33
18	materials science	7,260	40,958	5.64
19	mathematics	5,805	21,481	3.7
20	computer science	6,589	20,382	3.09
21	economics & business	5,549	19,323	3.48
22	multidisciplinary	342	1,860	5.44

Figure 19. Australian Scientific Papers. Source: Essential Data Indicators from September 1, 2008 update covering a 10-year + 6-month period, 1998 June 30, 2008.

Additional information is provided in the following table which shows Australia's world share of science and social-science papers over the years from 2004 to 2008. These are expressed as a percentage of papers in each of 21 fields in the Thomson Reuters database[25], and Australia's relative citation impact compared to the world average in each field in percentage terms.

[24] A compilation of science performance statistics and science trends data based on Thomson Scientific database.
[25] Http://thomsonreuters.com/products_services/science/science_products/a-z/essential_science_indicators.

Field	Percentage of papers from Australia	Relative impact compared to world
Environment/Ecology	5.11	26
Psychiatry/Psychology	5.03	-4
Geosciences	4.99	27
Plant & Animal Sciences	4.9	21
Economics & Business	4.88	-23
Social Sciences	4.83	3
Space Science	4.41	26
Agricultural Sciences	4.03	4
Immunology	3.9	6
Clinical Medicine	3.34	23
Microbiology	3.04	14
Biology & Biochemistry	2.83	7
Neuroscience & Behavior	2.79	-6
Molec. Biol. & Genetics	2.73	1
Computer Science	2.7	5
Engineering	2.32	9
Mathematics	2.31	23
Pharmacology & Toxicology	2.21	13
Materials Science	1.86	15
Physics	1.75	30
Chemistry	1.58	9
Australia's overall percent share, all field: 3,02		

Figure 20. Scientific papers from Australia, 2004-2008. Source: Thomson Reuters.

Australia demonstrates national excellence in environment/ecology, psychiatry/psychology, geosciences and plant and animal sciences.

The most recent spur to the innovation system (and to the private sector) has been the Commonwealth's science and innovation budget for 2009-2010, rising 25% to $8.58 billion from the previous year (in 2007-2008 it was $6.56 billion and in 2008-2009 was $6.88 billion). This appropriation reverses previous trends that saw Commonwealth's Science and Innovation expenditure as a percentage of GDP fall by 22% since 1993-1994. Business expenditure on R&D followed a similar pattern. While growing since the late 1990s, it still lagged behind other OECD countries.

A more comprehensive measure of the whole innovation performance of a country is given by the "investment in knowledge" index[26]. In 2004, Australia dedicated 3.9% of its GDP to investments in knowledge, above the median but under the average of the 18 OECD countries. R&D expenditure constituted the lion's share (1.8%), followed by software (1.1%) and higher education (1%). Focusing on research, which is the fuel for innovation, *Powering Ideas* sets two targets that must be reached at national level: increasing the number of research groups performing at world class level, as measured by international performance benchmarks; and increasing the number of students completing higher degrees. *Powering Ideas* points out that "it is especially important that we increase the level of collaboration between public researchers and private industry – we rank last in the OECD on this measure". Despite producing 2 per cent of world research, Australia still seems to find it difficult to implement new discoveries and innovations industrially and thus to grow the economy through their commercialisation. The link between higher education institutions and especially small and medium enterprises is weak. In 2006 only 3.1% of SMEs collaborated with higher education institutions (10% of large companies). Over the next decade, the Australian Government aspires to doubling collaboration among the main research institutions as well as those which potentially enact innovative projects.

5.2 VENTURE CAPITAL

The Australian Bureau of Statistics[27] has been carrying out a survey on venture capital and later stage private[28] equity since year 1999-2000[29]. Data

[26] It is given by the sum of R&D and higher education expenditure from both public and private sources and by expenditure on software.
[27] Web site http://www.abs.gov.au/.
[28] For the purpose of this survey, only data regarding venture capital will be taken into consideration, since later stage private equity focuses on possibilities of profits deriving from "turnaround" companies and not from new R&D projects.

on annual investments in this sector have been collected according to variables such as industry of investee company, stage of development of investee company, location of investee company's head office, and source of funding for investment. This annual survey is a valuable source of information since it provides us with a good proxy of the real amount of Australian money devoted to R&D and high tech projects by the business sector. By definition, venture capital is associated with high risk, short to medium-term private equity investment in new and innovative firms which are in their first stages of the economic cycle. Usually, profits are expected to result from capital gains rather than from a regular income stream. That is why venture capitalists literally bet on projects with the greatest potentialities but also significant risks. Currently, venture capital is the only engine that, together with public expenditure, can really boost a country's innovation performance. The ABS survey clearly demonstrates not only Australia's attitude towards newly-born companies seeking funds for pioneering projects,[30] but also towards older stable foreign firms which want to relocate their R&D branches to a more favourable operational context. In view of the current lack of investments in R&D expenditure in Europe, mainly in response to the world economic crisis that has halved such long-run investments, where can a European company find appropriate funding? Australia can resolve this question, as the data can show.

[29] Australia Bureau of Statistics. *"Venture capital and later stage private equity".* 2008-2009. N. 5678.0.

[30] Paradoxically, highly risky projects are ultimately funded by pension funds, which are institution almost risk-free for their investors (retirees). This balance between high risk investments and low risk and regular payments to retirees is obtained through diversification of risks.

Below is a graph representing the amount of money for all new and follow-on investments made by Australian private equity funds, by stage of investee company.

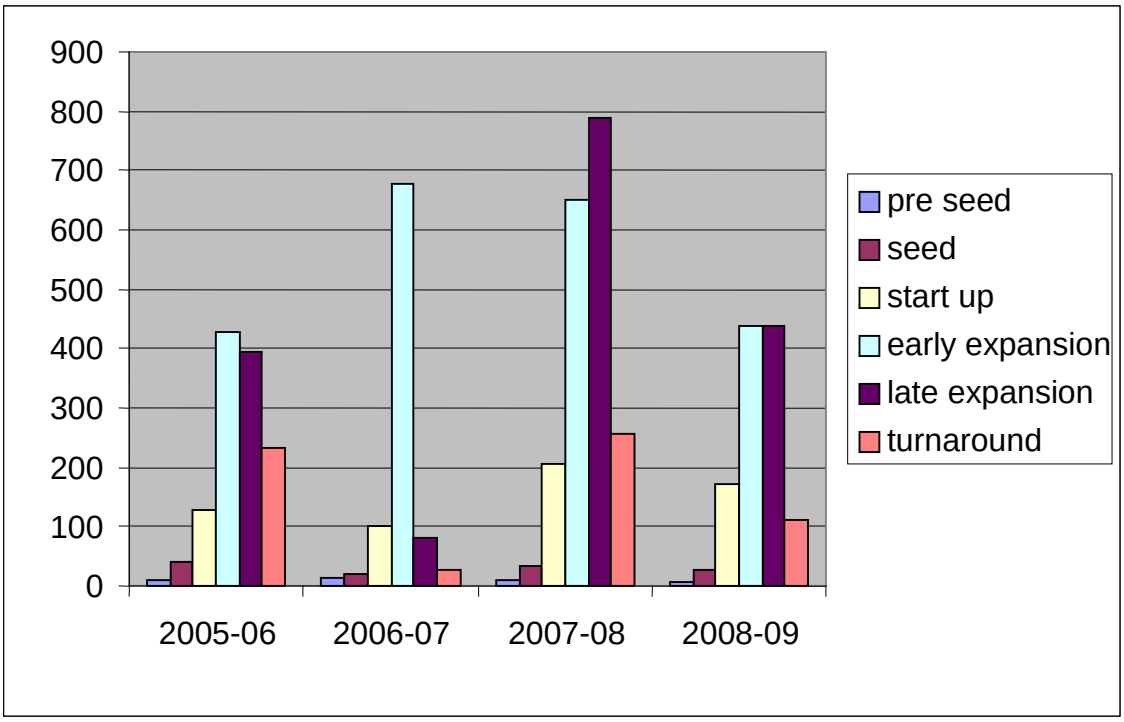

Figure 21. New and follow-on investments made by Australian private equity funds, by year, by stage of investee company – million $.

The legend in the graph refers to different stages of development of the investee company: pre-seed, seed, start-up and early expansion companies might not yet be fully operational or able to generate profits, late expansion and turnaround companies are at their final stages and need refunding in order to keep producing.

The crisis which began in 2008 has hit investments in this sector in each stage of investee company development (we can see a downward jump in allocations from 2007-08 to 2008-09), but it has not stopped the upward trend started in 2006-07. Obviously, pre-seed, seed and start-up companies are the least funded stages because of the marked risks associated with them, while early expansion firms, though being highly innovative, are considered the

most eligible ones for financial consideration. Over $400 million was devoted to investees at this stage of development in 2008. If we consider the average amount per company released by venture capitalists by year (graph below),

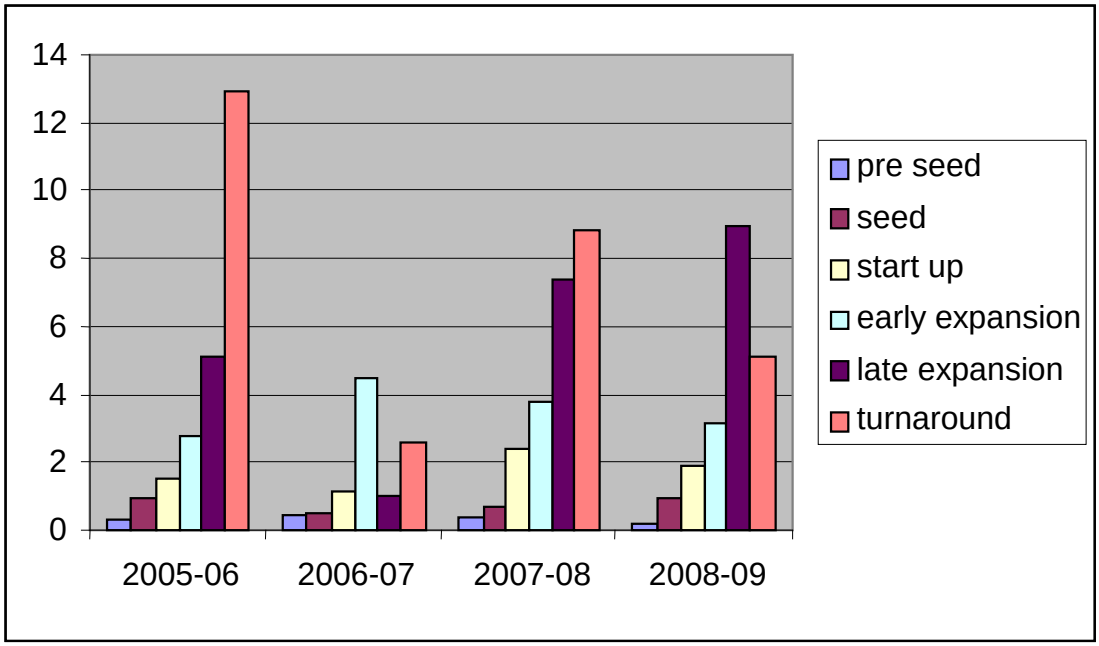

Figure 22. Average investment of Australian venture capitalists by year, by stage of investee company – million $.

we can clearly see that crisis has not affected this sector as much as it has finance or other economic fields. Only average investments in turnaround companies seem to diminish, but the reason is clear: mature and near to bankruptcy firms are not affordable bets in periods of such heavy economic turmoil. The slight decrease in average investment in the other fields could be due to the fact that venture capitalists might tend to follow a more cautious funding strategy in this difficult period, characterized by a higher than usual number of investments in smaller-sized single initiatives. According to the golden rule: larger portfolio variety, less risk. A quick look at the number of single interventions per year by stage of investee company can clarify this concept[31]:

[31] In the graph I omit stage "late expansion" and "turnaround" because of minor interest in this research.

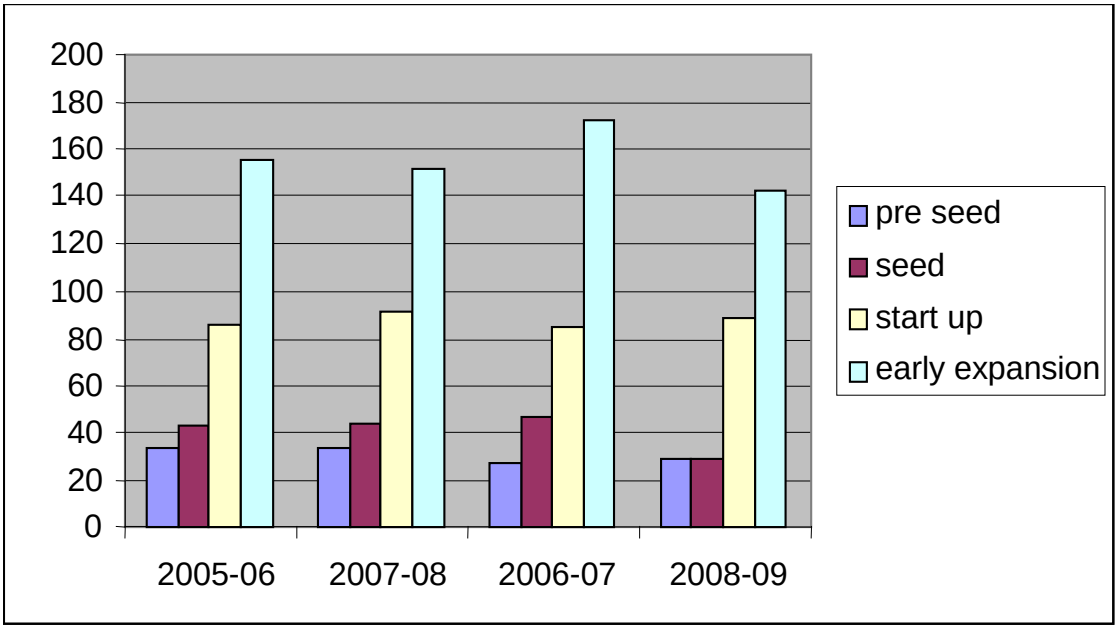

Figure 23. Number of interventions by year, by stage of investee company.

Both pre-seed and start-up companies experienced an increase in the number of interventions in which they were involved in from 2007 to 2008, but in general the situation seems stable, despite the crisis. Looking at the geographical distribution of investments (through location of investee company head office, graph below) and their evolution in time (graph below),

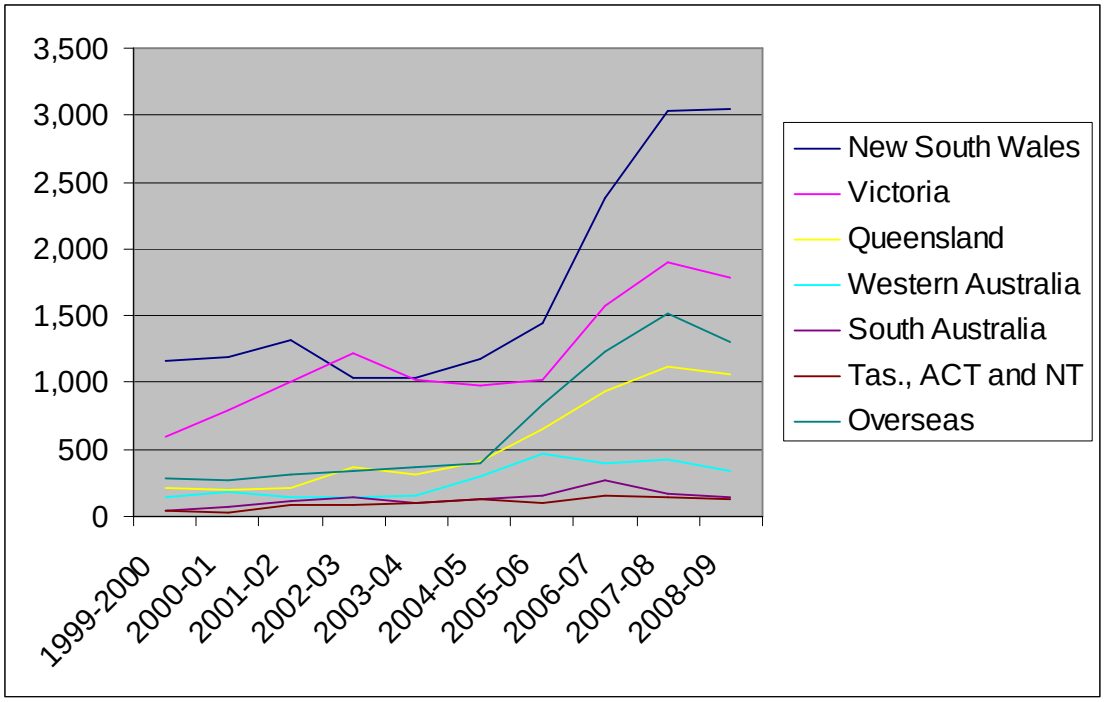

Figure 24. Geographical distribution of investments by year.

we notice that New South Wales shows an outstanding performance in terms of resources devoted to venture capital, with Victoria following. Australian funds do not neglect overseas opportunities, as proved by the upward trend of the graph below.

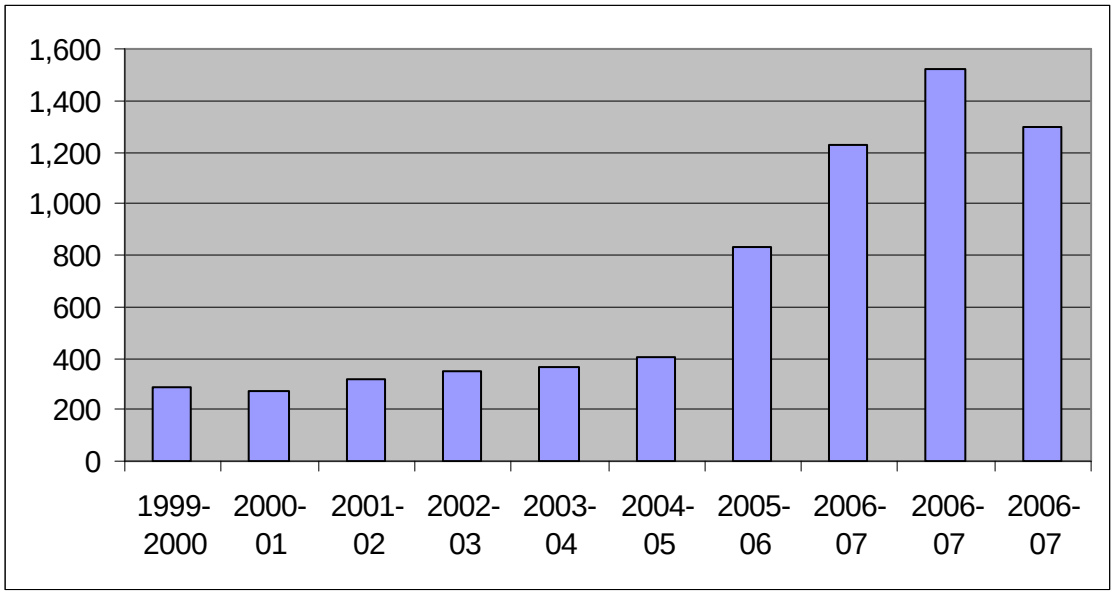

Figure 25. Overseas investments of Australian venture capitalists.

This is a clear sign of the international nature of Australian private equity. It nevertheless represents an important opportunity that could be exploited by European companies moving their R&D branches to Australia. European know-how and solid corporate balance sheets can be very appealing for funds seeking investment opportunities in the innovation area. The Italian case is problematic: the current credit crunch prevents the corporate sector from accessing enough money to grant either long-term projects or short-term innovation. A more generous and forward-looking system like the Australian one could be highly beneficial for Italian firms wishing to invest but faced with a credit shortage. Highly innovative and experimental sectors such as biotechnologies, health and pharmaceutical industries, whose R&D activity is a core feature, may be increasingly interested in Australia, as the graph below shows.

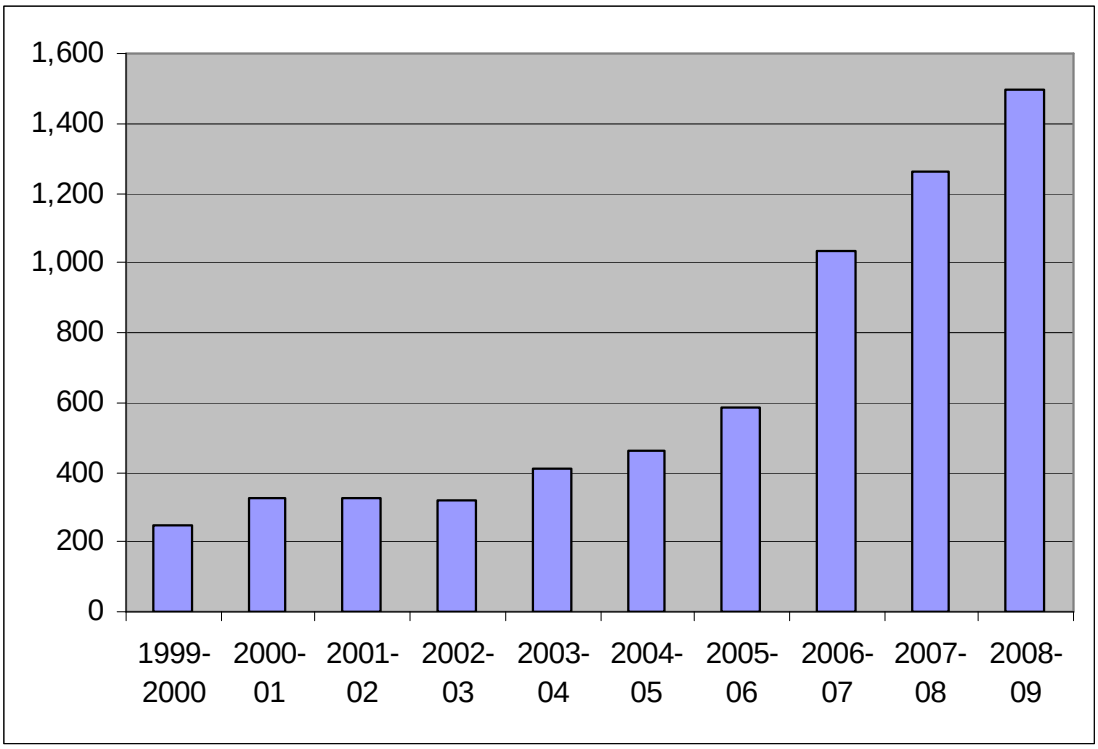

Figure 26. Investments of Australian venture capitalists in Biotech and Pharmaceutical sector.

In December 2008, Australian funds devoted to the high technology sectors were six times higher than when compared to ten years ago. And the growth could not be stopped by international crisis. Between 2007 and 2008, these funds grew at a rate of 18%.

Caslon Analytics[32] provides an exhaustive list of venture capital funds and associations operating in Australia. Shown below is a selective list of the most interesting ones, based on criteria connected to the target and the amount of investments.

- **Advent Private Capital.** Founded in Melbourne in 1984, it invests in a wide range of opportunities, being a generalist fund. Direct equity investment is usually $5-60 million per investee company.

[32] http://www.caslon.com.au/vcnote.htm.

Advent specializes in packaging suitable equity/debt financing combinations for its investee companies. Among investors in Advent are some of the largest superannuation funds, such as ING. Still, Advent's investment criteria exclude early-stage and start-up companies.
www.adventprivatecapital.com.au

- **Allen & Buckeridge.** This is a fund investing in high-growth technology companies, also in co-investment with the Commonwealth. A special Allen and Buckeridge Emerging Technology Fund of $51 million is devoted to early-stage tech-investments with subsequent follow-on funding. Deal sourcing is focused on technology developed initially within major Australian universities and government research centres. Total investments are about $279 million.
www.a-b.com.au

- **CM Capital.** This supplies funds to help life science, telecommunication/IT or renewable energy companies reach the market with their winning ideas. CM's knowledge of US markets is used to assist investee companies in their international spread. A total amount of $263 million is invested, 42 only dedicated to early-stage companies.
www.cmcapital.com

- **Technology Venture Partners.** A leading venture capital firm in Australia, it specialises in investment in the information, communication and new media ("ICM") technology sectors. TVP manages AUD$190 million in funds**.**
www.tvp.com.au

- **Accord Capital Investors.**
- **Aegis Partners**. www.aegispartners.net

- **AMWIN Management.** www.amwin.com.au
- **Australian Mezzanine Investments Pty Ltd.**
- **Australian Technology Group Ltd.**
- **Blue Peak.** www.bluepeak.com.au
- **Citicorp Equity Capital Ltd.**
- **Colonial First State Private Equity.** www.colonialfirststate.com.au/
- **Equity Partners Management.** www.equitypartners.com.au
- **GE Capital Equity Capital Group.** www.geequity.com
- **Hitachi data systems Australia R&D.**
- **Macquarie Technology Funds Management.** www.macquarie.com.au
- **Momentum Funds Management.** www.momentumvc.com.au
- **Newport Capital Funds Management.** www.newportcapital.com.au

The following organizations are specifically based in South Australia.

- **Trans Tasman Commercialisation Fund (TTCF).** It is a joint initiative of South Australia's, Victoria's and New Zealand's universities (University of Adelaide, University of South Australia, Flinders University, Monash University, University of Auckland). Beginning in 2008, Westcheme superannuation fund is investing $30 million in the fund over five years, while the State Government of South Australia and Victoria will contribute $1.25 million per year and the New Zealand Government will contribute NZ$1 million. The aim is to finance ideas coming from university research, in order to develop them from a commercial and business point of view, with economic returns for South Australia. www.ttcf.com.au

- **Terra Rossa Capital.** It is a fund established in 2006 and manages $35 million of the South Australian Life Sciences Advancement Fund, which aims to creating value exclusively from

life sciences research, and identifying early-stage opportunities suitable for commercial exploitation. Fields of interest are human health, agricultural, industrial and environmental biotechnology. www.terrarossacapital.com

- **Playford Capital.** This fund is devoted to ICT technology ventures. Playford Capital committed $1.3 million to six South Australian companies in 2008, which became $9.8 million adding government grants (over $71 million throughout the whole life of the fund). Playford also gained returns selling investee companies. www.playford.com.au

- **Venture Capital SA.** This group is focused on three main areas: training of entrepreneurial businessmen seeking private equity investment, venture capital activities themselves, and networking activity aimed at matching demand and supply of venture capital funds. www.vcsa.com.au

5.3. TAXATION REGIME FOR R&D EXPENDITURE

From a taxation point of view, Australian legislation also offers a friendly environment to R&D expenditure. Until 1 July 2010, companies basing their R&D organization in Australia were allowed a 125% tax deduction on R&D expenses, plus a 175% deduction for R&D expenditure exceeding a base amount of prior-year spending. The 125% deduction was the equivalent of a flat 7.5% tax credit. Legislation regarding R&D tax incentives has been recently amended. Now eligible R&D expenditures will generate a tax offset for the company linked to aggregate turnover of R&D spending:

- A 45% tax offset refundable to R&D entities with aggregate turnover of less than $20 million.
- A 40% tax offset, non refundable, for all the other R&D entities.

Tax incentives are designed so that they will eventually benefit the whole economy through spillovers triggered by the incentives themselves. Thus, only "core"[33] R&D expenses are eligible for incentives, since all other supporting costs do not attract widespread benefits. In the words of the Government's website[34], "It's little surprise then, that many companies from around the world are choosing to locate their R&D facilities to Australia". Government's statistics point out that "50% of the most innovative companies in Australia are foreign". A quick comparison with United States' legislation about R&D tax incentives highlights Australian supremacy in this area. The US allows a maximum 10% credit for qualified R&D expenditures in excess of a calculated base amount. Alternatively, companies are provided with a 12% credit on R&D expenditures that exceed 50% of average R&D expenditure over the prior three years. In addition, the US requires that the possible deduction for R&D expenses be reduced by the amount of any R&D credit, leading to an overall reduced incentive. Only Singapore and South Korea apply more effective tax incentives, with tax holidays from 5 to 7 years for newly-settled companies.

5.4. INVESTMENTS

Despite geographical isolation and the distance from both Europe and North America, Australia is proving to be a strategic support for both Western economic poles aiming to penetrate the largest-rising market: Asia.

[33] First and foremost experimental activities, systematic and investigative. involving threshold level of novelty and technical risk.
[34] www.austrade.com

Furthermore, this country is itself the centre of a constellation of smaller economies with which it is well connected (Pacific islands and Southern Indonesia).

The world economic arena is by no means a static phenomenon. But current global financial and real-economy crises are significant in its recent evolution. In 2001 Jim O'Neill, Goldman Sachs' head of economic research, coined the acronym BRIC (Brazil, Russia, India, China). These four emerging countries looked set to become the new driving force in the world economy. Nine years later, and with the emergence of global crisis in between, the situation has further changed. According to FMI, in 2013 emerging markets' GDP will overcome those of the advanced economies', China representing 11.4%, Mexico 2% and Indonesia 1.3% of the total. Alex McKie[35], in a study for Euromonitor International, has included Indonesia among the eight emerging economies of the future. J.O'Neill tends to include eleven countries in the count, among which are the Republic of Korea and Viet Nam from Far East Asia. As a whole, no one can disregard South-East Asia economies. If only for demographic reasons, McKie claims that these new countries will be potential markets for Western economies. However, it will take them some time also to become great producers, like China. This is why Australia takes a pivotal role in this game: a true Western enclave, able to provide foreign investors with the most advanced technologies and support to reach the place where business is now - Asia. Australia's optimistic position in this fast changing context can be evidenced by its International Investments Position. This is a balance-sheet voice that "measures Australia's stock of external financial assets and liabilities"[36], namely Australian investments abroad and foreign investments in Australia. Narrowing the number of foreign countries to those of the Asia-Pacific area, we can have a good idea of the connections that link Australia to its neighbours.

[35] Futurologist, researcher and strategist specializing in understanding consumer trends and the social impact of technology.
[36] Definition given by Australian Bureau of Statistics. www.abs.gov.au.

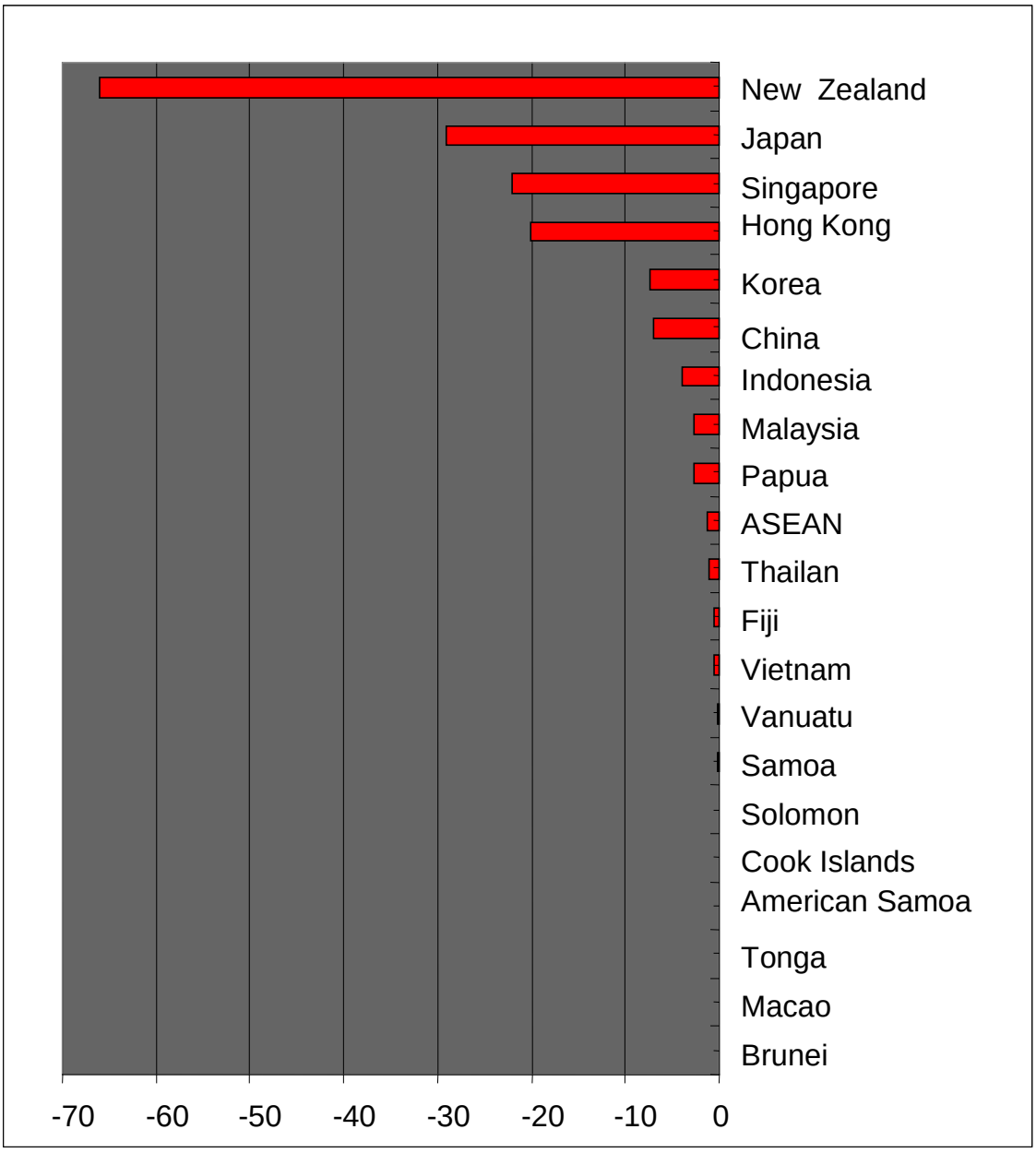

Figure 27. Australian investments in Asia and Pacific – levels (billion $) – 2008.

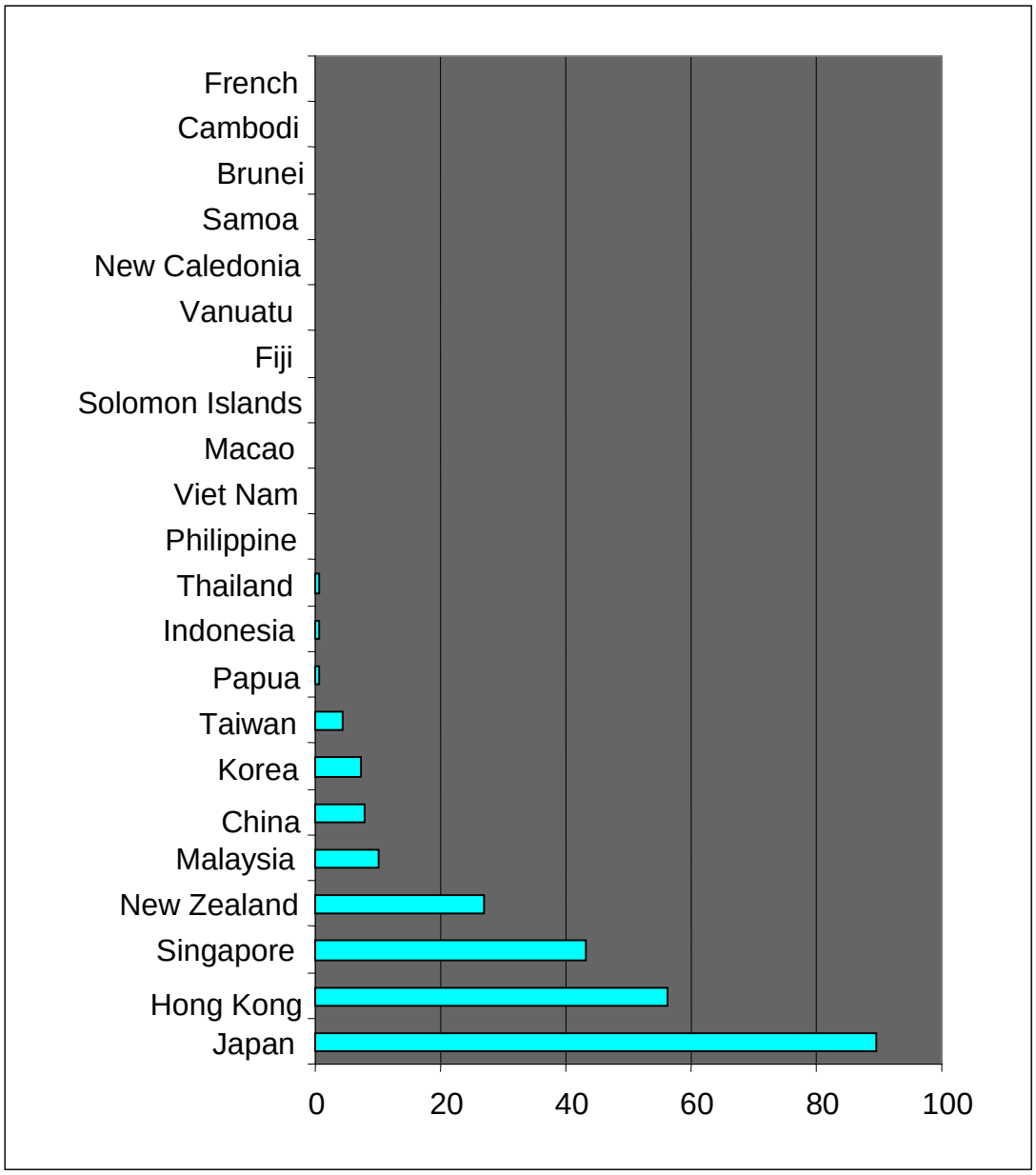

Figure 28. Asia and Pacific investments in Australia – levels (billion $) – 2008.

The red graph describes the amount of Australian investments in Asia and the Pacific, in the year 2008, in $ billions per country of destination, while the light-blue one focuses on the complementary side, investments from foreign Asia and the Pacific countries to Australia in the same year. Australian investments overseas are reported in negative values for accounting reasons, since they represent outflows of money from the home country.

New Zealand is clearly the first destination for Australian investors who seek overseas opportunity in close proximity, due to its geographical location and cultural similarity. Then come Japan, Singapore and Hong Kong, the most developed countries of the area, with more than $20 billion of investments each. The ASEAN community plays an important role, too, which can be better appreciated by looking at the historical trends below.

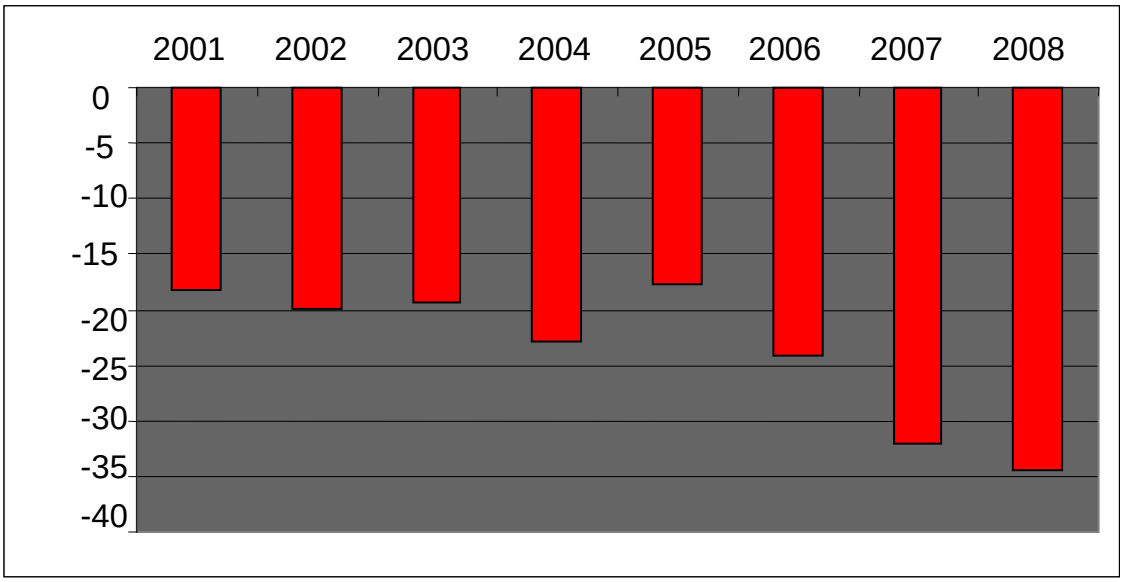

Figure 29. Australian investments in overall ASEAN community – levels (billion $) – 2008.

Since 2001 total Australian investments directed to ASEAN have been growing. In 2008 they reached a threshold of almost $35 billion. On the other hand, Australia itself is regarded as a good investment opportunity for Japan, Hong Kong, and Singapore, which are both the richest and most likely countries to invest abroad. ASEAN's position is led by Singapore, whose interest in Australian companies has been driving the growth of investments for at least six years.

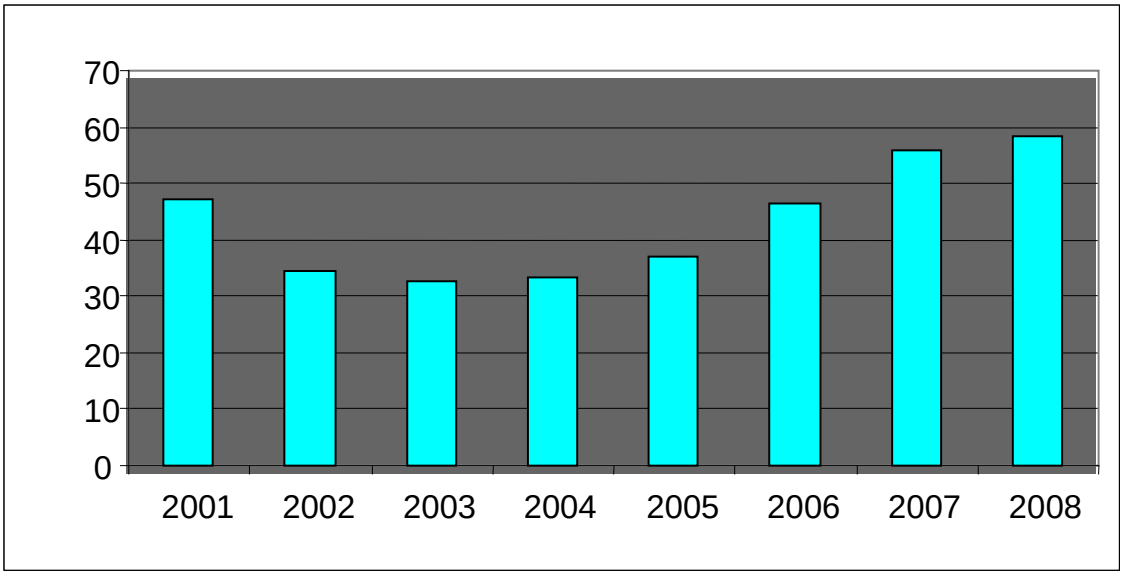

Figure 30. Overall ASEAN community investments in Australia – levels (billion $) – 2008.

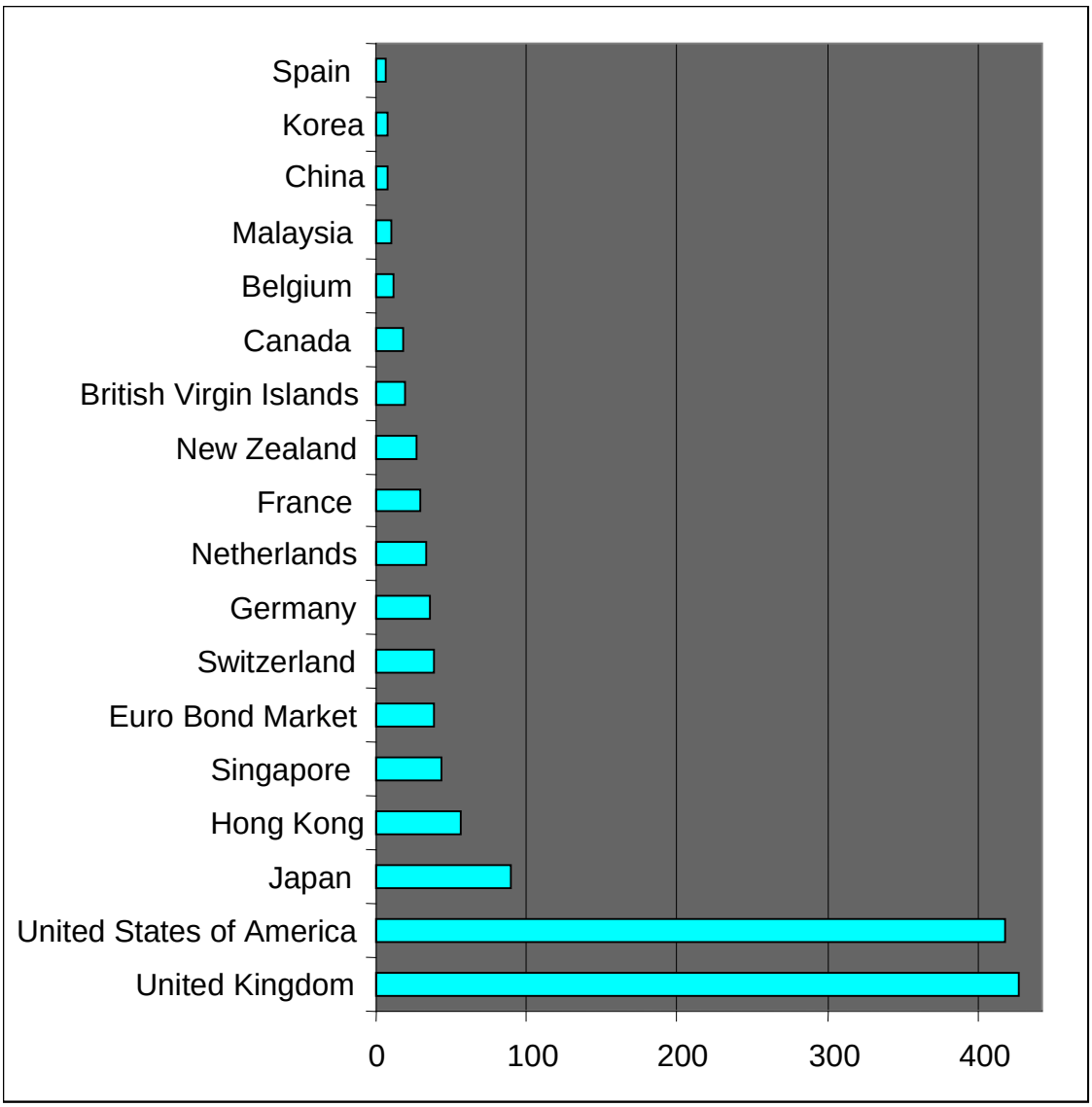

Figure 31. Foreign investments in Australia – levels (billion$) – 2008.

Despite the growing importance of Asia as an investor in Australia, the United States and Europe are still the main foreign providers of capital to Australia. The UK is clearly the most important investor (with over $400 billion), followed by the US. Asian countries (mainly Japan, Hong Kong and Singapore) are also bringing an increased capital inflow. “Australia’s strong and stable economy and well-managed companies make it a highly attractive location for foreign investment”.[37]

Finally, the net position in terms of investments can enable us to better discriminate case by case whether Australia is a net importer or exporter of capital to and from its neighbours.

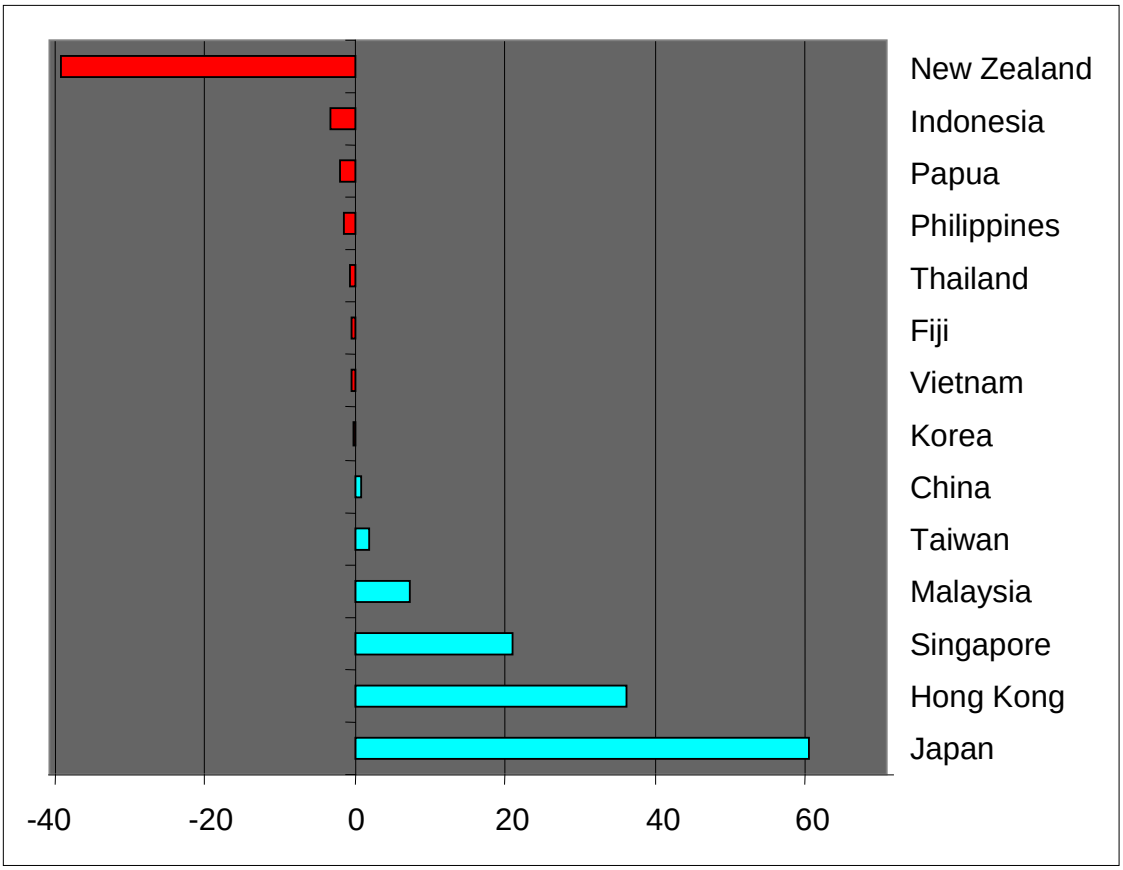

Figure 32. Net Australian position in investments towards and from Southeast Asia and Pacific – levels (billion $) – 2008.

[37] www.business.nsw.gov.au

Some results are obvious. Singapore, Japan and Hong Kong are not surprisingly net investors to Australia. While others are worth noticing. Malaysia, for example, stands out among ASEAN members, following Singapore's footsteps into finance and signalling a growing distance from Indonesia, Philippines and Thailand, which remain final destinations of investments from Australia. These countries could exploit financial capitals and know-how coming from Australia to partially improve their own situation inside the ASEAN community and evolve towards tertiary economy models such as Singapore.

5.5 AUSTRALIAN INTERNATIONAL POSITION IN SERVICES TRADE SECTOR

Australia's position as an international R&D and higher education facilities provider can be further illustrated through its balance of trade with the rest of the world. On a regular basis, the Australian Bureau of Statistics makes data available about International Trade in Goods and Services in Australia[38]. Since 1971, figures on total Australian exports and imports in $millions have been collected on a monthly basis. Net exports of services have been then classified according to the Extended Balance of Payment Services Classification (EBOPS)[39] which includes the category "other business services", namely services related to professional and technical activities, encompassing research and development. The following graphs present Australian exports of this kind of services for the longest timespan available.

[38] Data are presented both in seasonally adjusted and in simple raw-trend series. For the purpose of this research, seasonally adjusted data are reputed more reliable given that they are estimated removing from the original series calendar related effects occurring on a regular basis. Irregular random influences are not considered biasing the analysis and they are not removed from the trend.

[39] It is a standard classification of services used to allow international comparisons according to an internationally accepted coding system.

This helps us make long run considerations since the timespan covers almost forty years of trade.

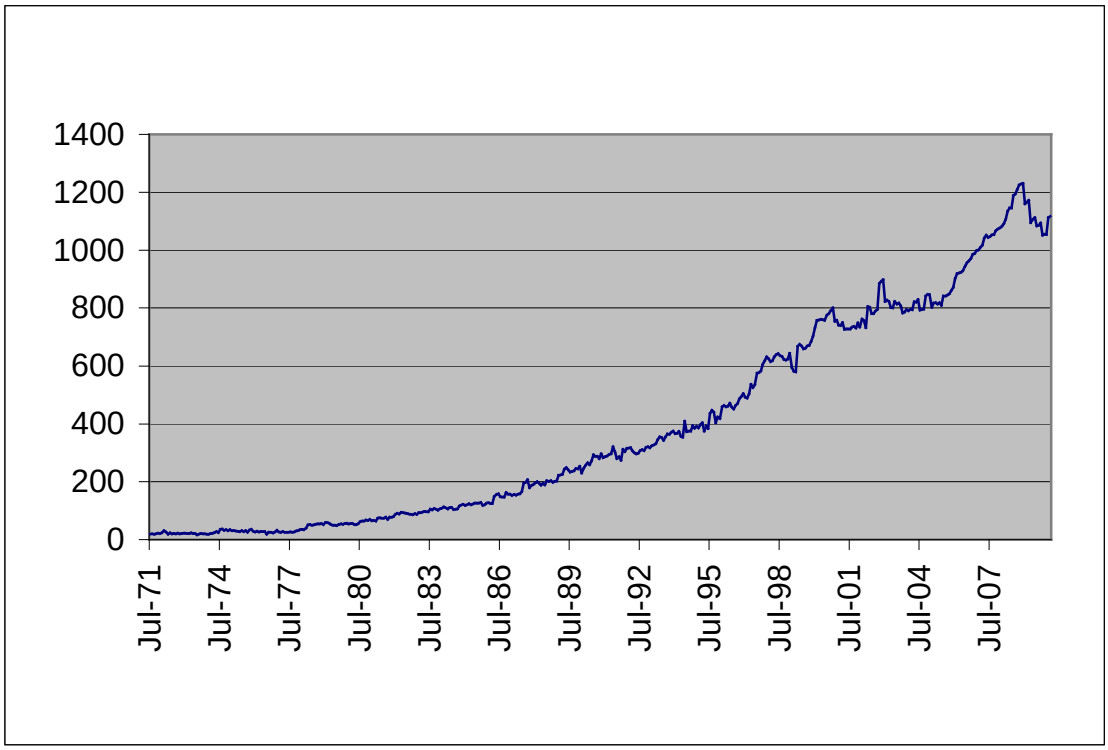

Figure 33. Credit – Other services (monthly) – seasonally adjusted – million $.

Australia's growth in professional and high-skilled services has proved to be exponential in the period under consideration. Not surprisingly, the spread of these tertiary activities assisted specific industries. The increasing specialization (starting from the `80s) stimulated the initial demand for sophisticated services. Despite this upward trend, two caveats must be borne in mind if we are to draw reasonable conclusions. First of all, the current international crisis has not hit this sector alone, but basically all sectors. A further look at short run performances in this field is required to ascertain whether the crisis has reversed the current positive trend, or simply reflects a temporary change in the upward movement. Secondly, the net position (export minus imports) presents a somewhat more ambiguous picture, as the graph below shows.

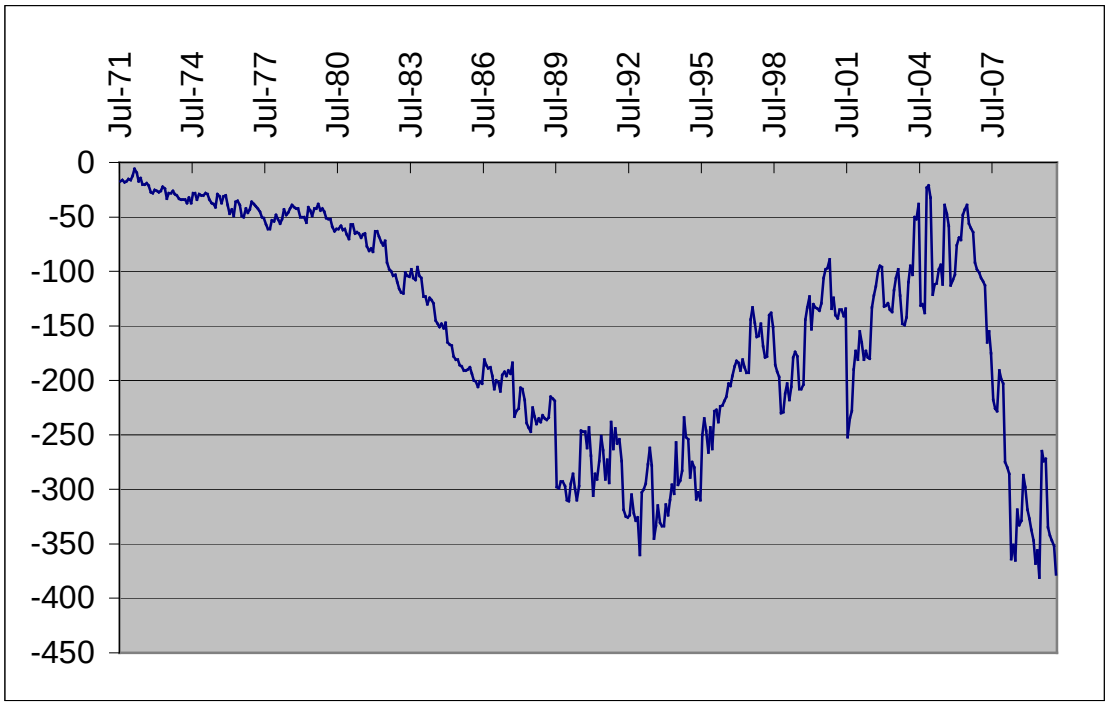

Figure 34. Net position – Other services (monthly) – seasonally adjusted – million $.

From 1971 to 1992, Australia was a net importer of professional and technical services, even though export of internally provided services kept increasing too. The trend reversed in the mid-1990s, in conjunction with the exponential increase in the Australian export of these services. But the most interesting message coming from the graphs is that associated with years 2007-2008. Exports clearly increased, but the net position plummeted to a deep deficit. Australian demand for business services exceeded supply at least until the present crisis, which now appears to have opened up a wealth of emerging business opportunities.

The graph below refers to the same aggregate ("other services"), but over a shorter period (2006-07, 2007-08, 2008-09). In 2008-09 the "other services" category exports increased by $2,777 million, 9% when compared with $32,225 million in 2007-08[40]

[40] Australian Bureau of Statistics. *"Characteristics of Australian exporters".* 2008-09. N. 5368.0.55.006.

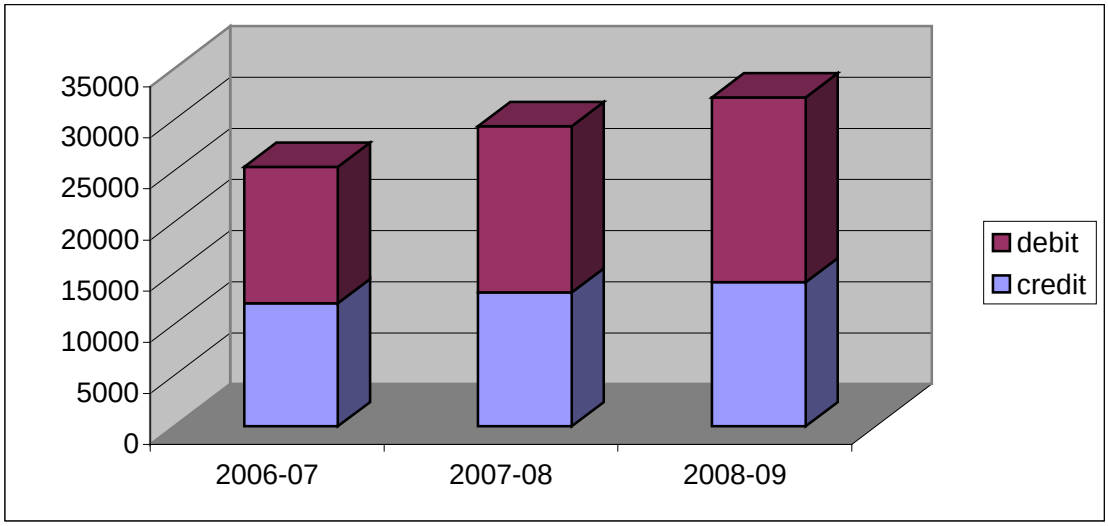

Figure 35. Other services import-export (yearly) – million $.

Over a shorter timeframe, “other services” exports increased, but this effect was cancelled out by stronger imports. A more recent and detailed look at the same index (but on a monthly basis) shows the following flat pattern.

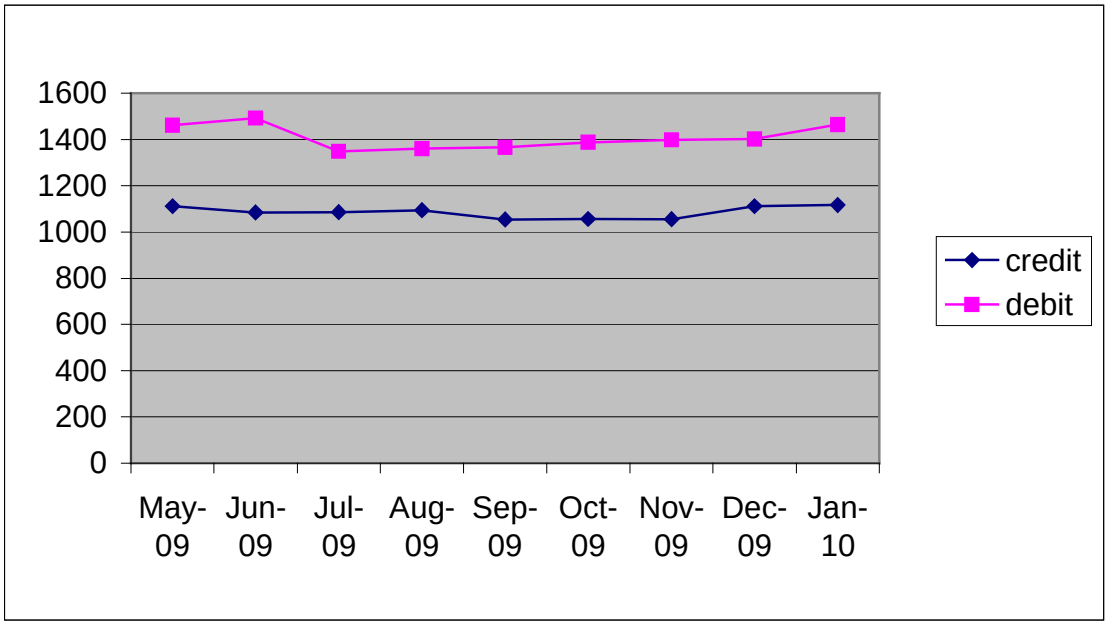

Figure 36. Other services import-export (yearly) – trend – million $.

Looking specifically at R&D imports and exports in 2009, the situation is comparable to that of the aggregate data, but with an important difference: Australian R&D trade is in surplus since exports largely exceed imports.

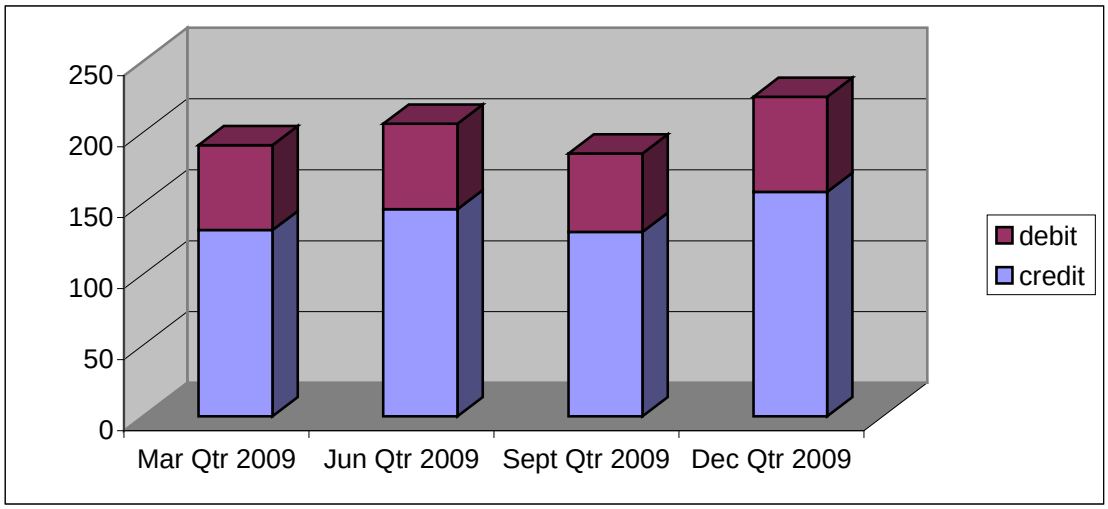

Figure 37. R&D services import-export (quarterly) – million $.

This makes Australia a net exporter of R&D services, at odds with Australian overall trade balance for services, which was in deficit as of February 2010. It is worth noting that in these statistics the exporter is "the owner of the exported good or the provider of the exported service. (…) if an export takes place, it must involve an Australian resident selling a good or a service to a non-resident"[41]. Hence conclusions drawn here tend to exclude trade with branches of foreign-based companies which settle in Australia on a longer-term basis.

5.6 PATENTS[42]

Measuring R&D productivity of a country is not a straightforward task. R&D processes do not always lead to tangible products and, consequently, to revenues registered on the balance sheet – which tends to be the most reliable way to assess the success or the failure of any product or service. In addition, R&D projects usually involve long lapses of time, several companies

[41] Australian Bureau of Statistics. *"Characteristics of Australian exporters".* 2008-09. P. 18.
[42] Data for this section were kindly made available by IP Australia, under request.

collaborating together, and a multitude of actors. This complexity makes it difficult to assign a unique unit of measurement. Common proxies for input measures are R&D expenditure or number of researchers. These are measures that can be easily derived from official national accounts. The only problem is that they are not indices, meaning that they do not measure the actual results, but rather efforts made, with no guarantee of success. A much more reliable proxy for R&D productivity is the number of patents filed by a country. This is an output measure that focuses on the final stage of R&D activity which is patent registration, a quantity that is both easily measurable and highly meaningful, being directly related to country's efforts towards innovation and success in achieving it. The power of patent registration as an indicator of R&D productivity can be appreciated simply looking at the meaning of the word "patent": a "right granted for any device, substance, method or process which is new, inventive and useful. It is legally enforceable and gives the owner the exclusive right to commercially exploit the invention for the life of the patent itself"[43]. It is clear that the patent is the final step of an R&D process, the most straightforward and safe way to cash from previous efforts because it prevents other individuals from doing it without paying a fee. For the purpose of our analysis, then, the number of patents filed each year in Australia will be a proxy for the actual appeal of Australian R&D facilities not only for domestic companies but also for the foreign ones.

IP Australia is the national institution in charge of administering Australia's system of intellectual property rights. Part of its mandate is the creation of a secure environment for innovation activity, which boosts not only domestic R&D productivity but also foreign investments in this field. Australia seems to have bet strongly on this strategy, granting foreign patents filed at national level the same protection as their domestic counterparts.

[43] Http://www.ipaustralia.gov.au/ip/patents.shtml. IP Australia is the government body responsible for registering and administering patents.

Before looking at the data, further clarification is needed. There are two main kinds of patent for which a firm in Australia can apply: standard[44] and innovation[45] patents. Our analysis will include two additional categories of property rights: provisional patents and non-practicing entity (NPE) owners of patents. The former is an inexpensive kind of protection that guarantees twelve months to an applicant to consider the commercial worth of the invention and to resolve issues such as finance and licensing. NPE companies are, instead, institutions that buy and enforce patents in order to gain profits from litigations against infringers rather than developing or marketing an actual product. The majority of their income is derived from settlements, court awards and licenses.

The first very important effect of Australian patent policy is clear from the following graph.

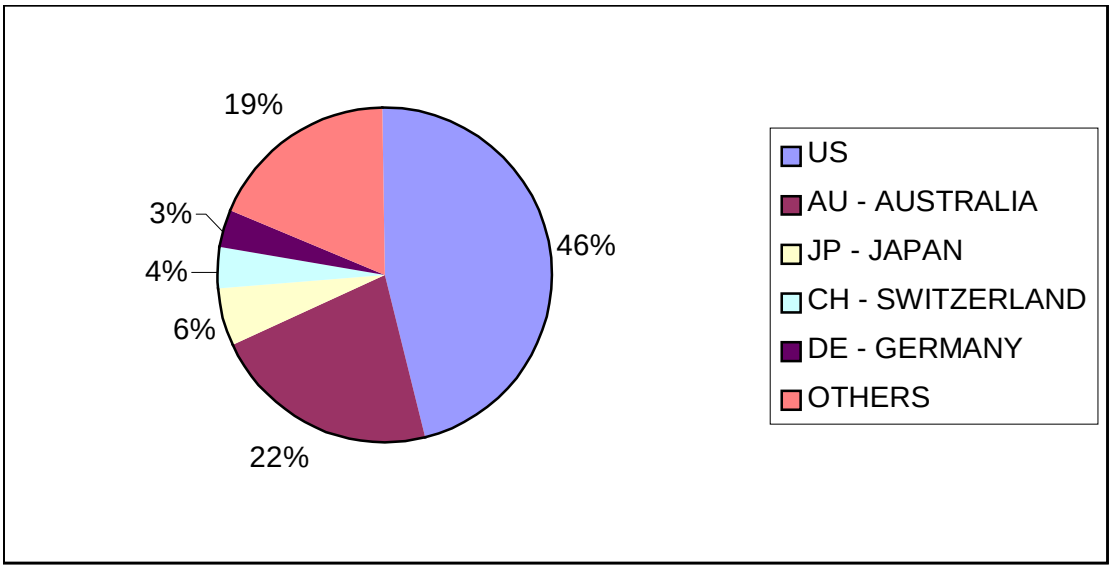

Figure 38. Standard patent filed in 2010 in Australia by country of origin.

With regard to number of standard patents filed in Australia (the basic and most widely used category to assess innovation outcomes), the United States' performance currently exceeds Australia's own. A highly innovative

[44] A standard patent gives a long-term protection and control over an invention for up to 20 years.
[45] An innovation patent represent a faster and cheaper option compared to the standard one. It lasts a maximum of 8 years.

country such as the United States has found in Australia a very favourable environment to establish its R&D structures and register its own inventions. The magnitude of this phenomenon is such that US patent registrations are more than double compared with Australian ones. In fact, Australian inventions in 2010 counted for less than one fourth of the whole amount of standard patents registered. If we look at the other two categories in the field of intellectual property available in Australia (see table below)

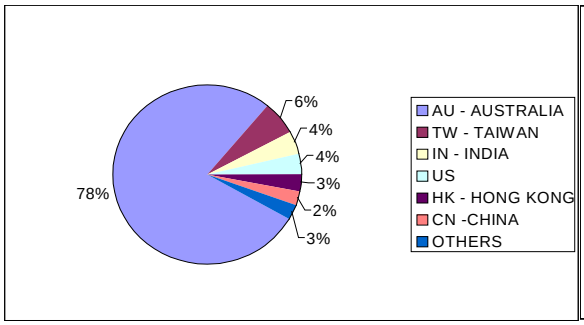

Figure 39. Innovation patent filed in 2010 in Australia by country of origin.

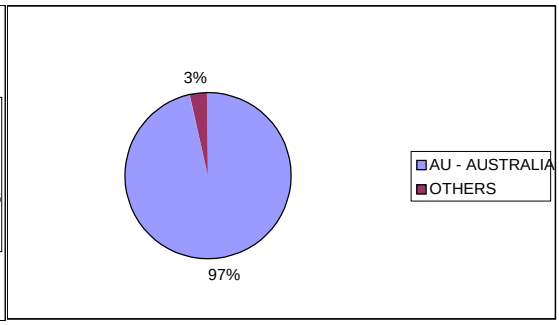

Figure 40. Provisional patent filed in 2010 in Australia by country of

we should apparently draw different conclusions: provisional and innovation patents are a monopoly of Australian firms. But the reason for this is that these two legal tools guarantee short-term and temporary exclusive use of the invention. Provisional patents, in particular, meet the needs of those who do not yet know whether their invention will be financially exploitable. Innovation patents are a not as firm a guarantee as standard patents, since they imply a smaller degree of innovativeness in the R&D process. Given that a foreign firm devotes significant financial and human resources to set up R&D facilities abroad, it is obvious that the degree of commitment is also higher, and the requested level of protection as well.

NPE's patents are a completely different issue. This graph depicts the present Australian situation.

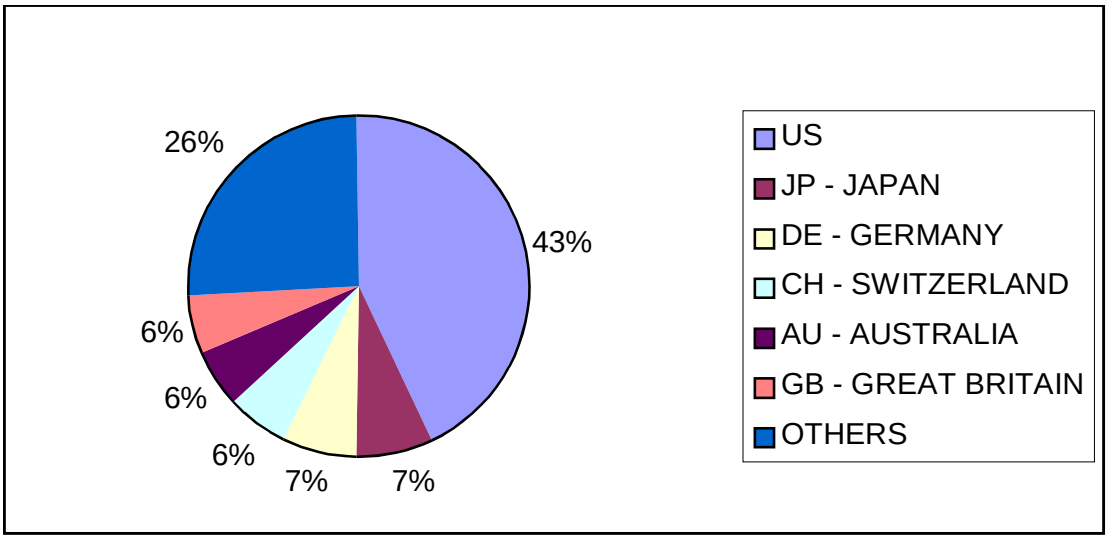

Figure 41. NPE patent filed in 2010 in Australia by country of origin.

The US plays the most substantial role also here while Australia, overcome by Japan and Germany, is further demoted. NPE patents cannot actually be considered a proxy for R&D activity, since they are often bought from original inventors for the sole purpose of claiming the associated right in front of a court.

The following graphs represent North America's[46] total number of patents registered since 2004 until 2009, by patent typology.

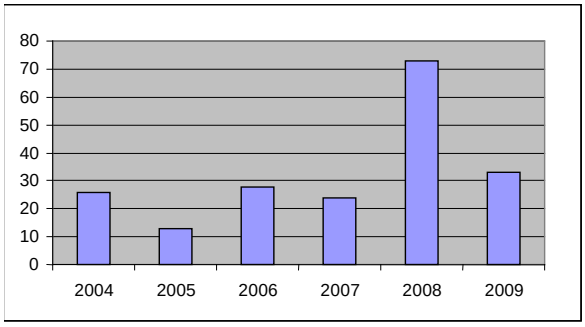

Figure 42. Innovation patent filed in Australia by US and Canada.

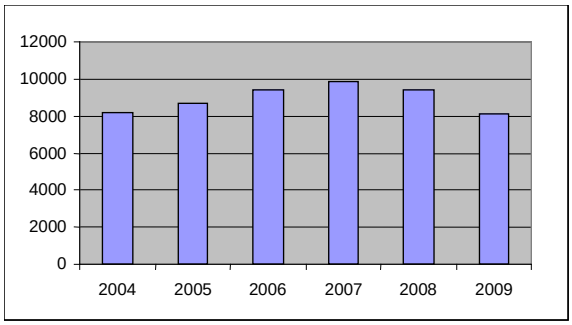

Figure 43. NPE patent filed in Australia by US and Canada.

[46] US and Canada.

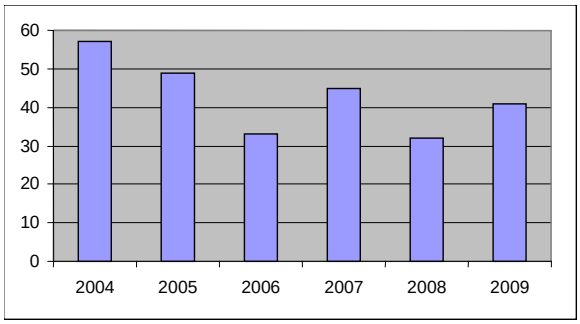

Figure 44. Provisional patent filed in Australia by US and Canada.

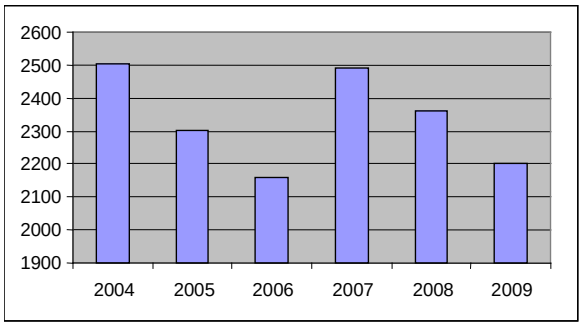

Figure 45. Standard patent filed in Australia by US and Canada.

All patent categories showed a decrease in their number from 2007 to 2008 and a heavier drop from 2008 to 2009. In the context of the global crisis, this is by no means unexpected. Moreover, the effects of the crisis on the number of patents filed in a country are not immediately discernible as with other economic sectors, especially finance. Considering the huge amount of investment and the length of processes embedded in new inventions (which often require years to be brought to the market), we can assume that, from the moment in which a company starts an R&D project to the registration of the final related patent, at least a certain number of years will pass (generally considered about five, but opinion varies). This means that current crisis effects on patents will be subject to time-lags. While financial markets are extremely sensitive and react suddenly to economic signals, these particular indicators (patents) display a different pattern. The shorter the production process, the faster the receptiveness to crisis. In fact, US provisional patents are the only ones experiencing an increase from 2008 to 2009, thanks to partially improved economic conditions. The apparently odd result of innovation patents for 2008 (the actual year of the crisis) is easily justified by the same rationale.

Focusing on European[47] patents filed in Australia since 2004

[47] Here “European” has a geographical more than political connotation. We include in the list of European countries: Switzerland, Germany, Great Britain, France, Sweden, Italy, Denmark, Norway, Netherlands, Lichtenstein, Austria, Spain, Belgium, Finland, Ireland,

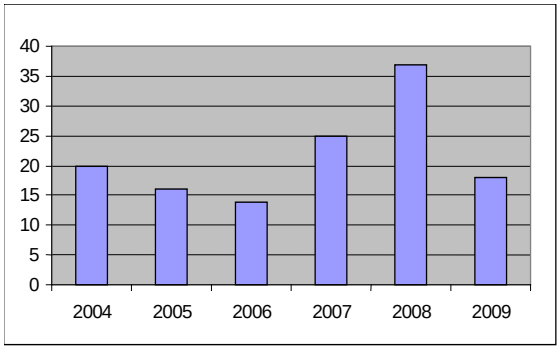

Figure 46. Innovation patent filed in Australia by European countries.

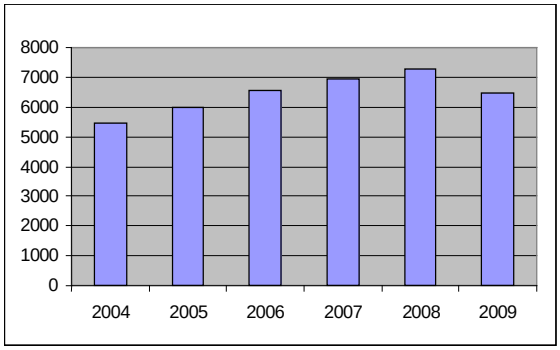

Figure 47. NPE patent filed in Australia by European countries.

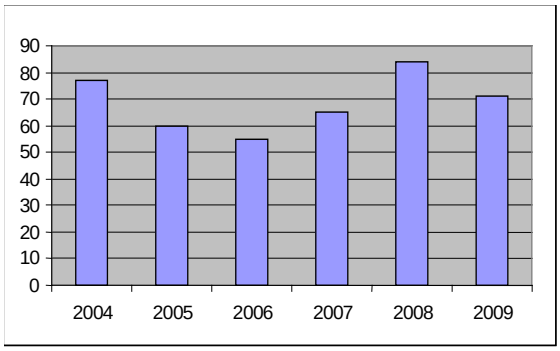

Figure 48. Provisional patent filed in Australia by European countries.

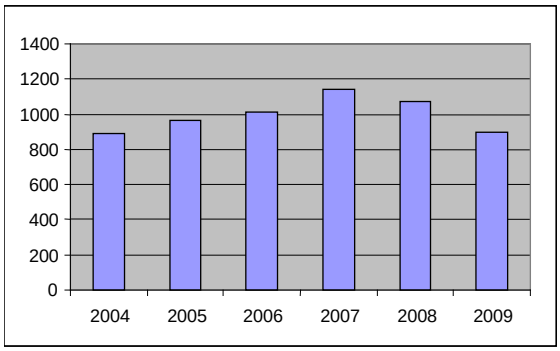

Figure 49. Standard patent filed in Australia by European countries.

we notice a similar pattern compared to North America's situation. The 2009 drop in the number of patents filed is due to the above lagged effect of cuts in R&D financing. But the trend can be better understood considering the absolute values of the number of patents filed by macro-areas in 2010.

	INNOVATION	NPE	PROVISIONAL	STANDARD
US and CANADA	13	1963	8	566
EUROPE	4	1462	5	197
AUSTRALIA	254	245	1427	258

Figure 50. Number of patents filed by macro-area in 2010.

This additional piece of information sheds lights on some important issues. North America alone filed a higher number of patents[48] in Australia than

Luxembourg, Ukraine, Greece, Hungary, Estonia, Cyprus, Czech Republic, Latvia, Poland, Serbia, Slovenia, Slovakia, Andorra, Albania, Bosnia Herzegovina, Bulgaria, Belarus, Gibraltar, Croatia, Iceland, Monaco, Malta, Portugal, Romania, San Marino, Turkey.

[48] Considering all kinds of patents.

Australia itself in 2010. North America plus Europe's total number of patents filed in Australia are twice over the number of Australian ones. This is at odds with the situation of previous years, which show a predominance of domestic patents over foreign ones, even though the ratio "domestic/foreign" patents is decreasing.

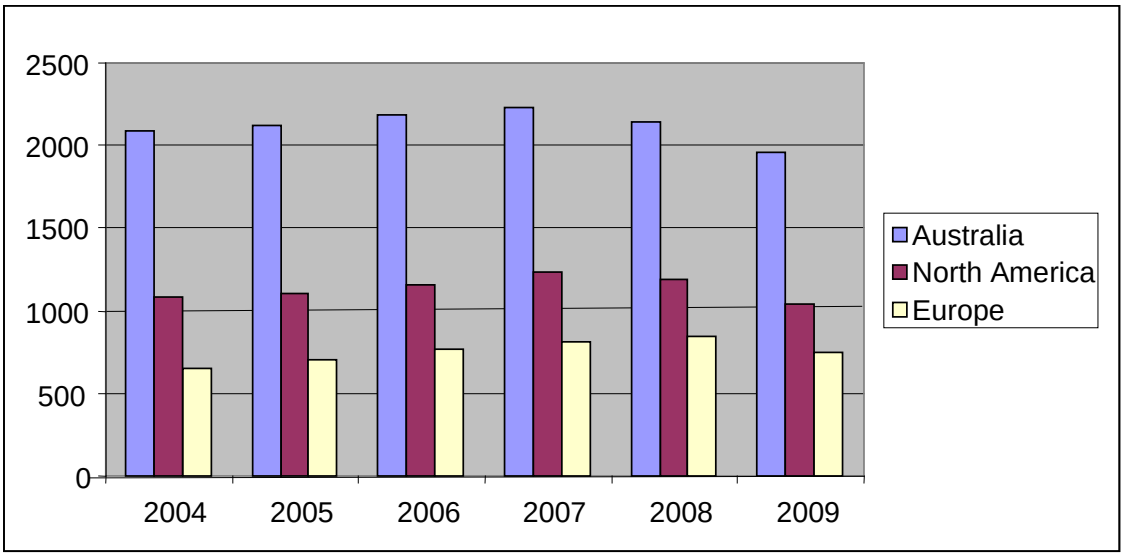

Figure 51. Total number of patents filed by major countries.

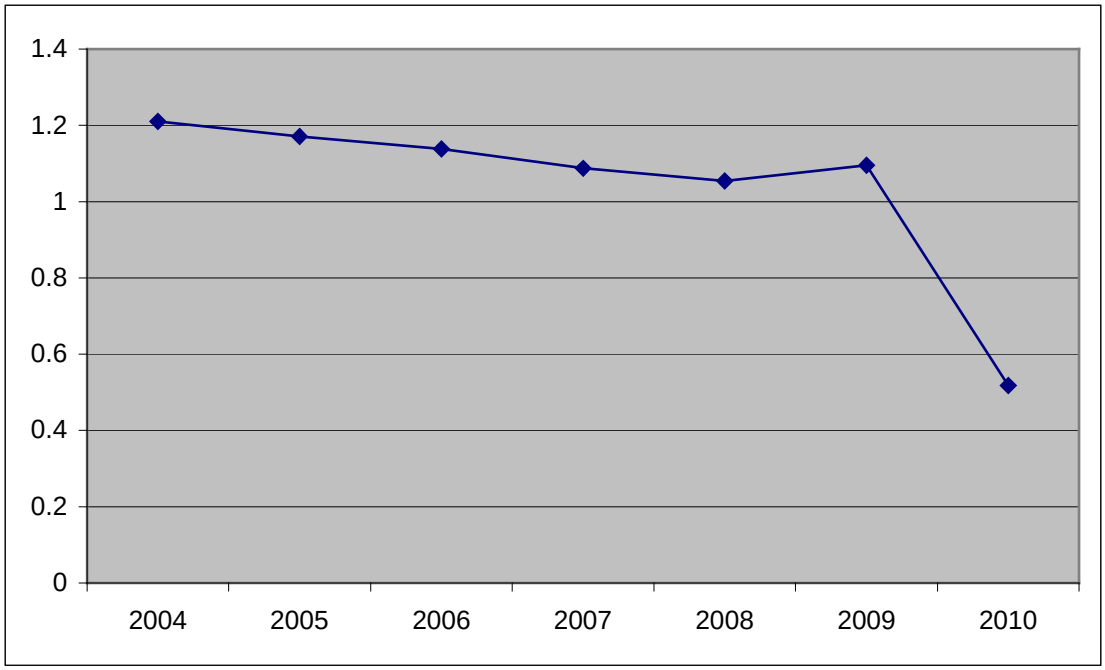

Figure 52. Ratio of total Australian patent over European and American ones (AU/(EU+US)).

The meaning of this ratio is clear: Australia has built an increasingly more positive reputation around its R&D facilities, attracting a higher number of investors from abroad who are interested in developing their new inventions in a technologically advanced environment. It is common practice to file the patent when it was conceived and developed. A look at the graphs below will help us to point out the main components of this trend.

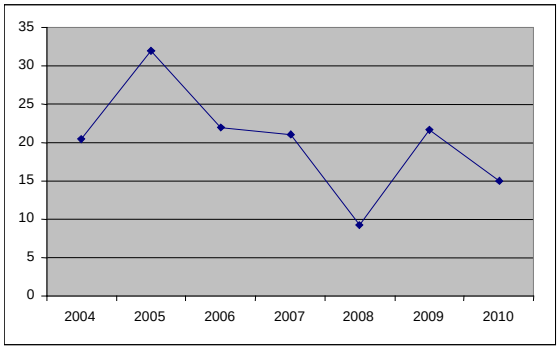

Figure 53. Innovation AU/(EU+US).

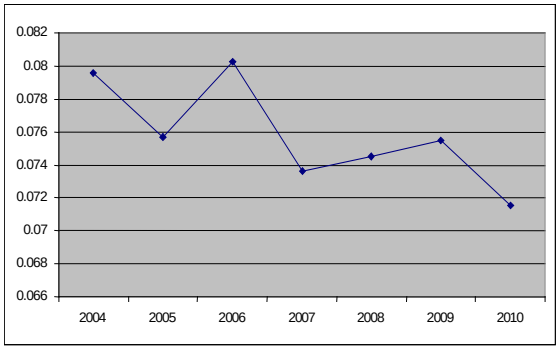

Figure 54. NPE AU/(EU+US).

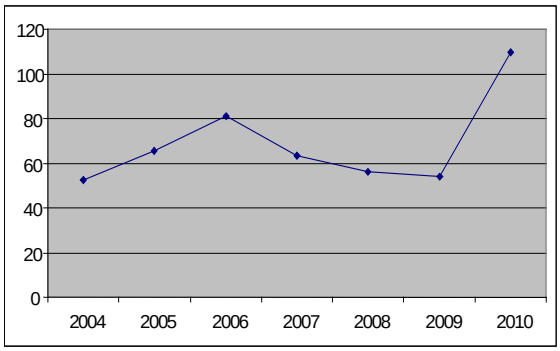

Figure 55. Provisional AU/(EU+US).

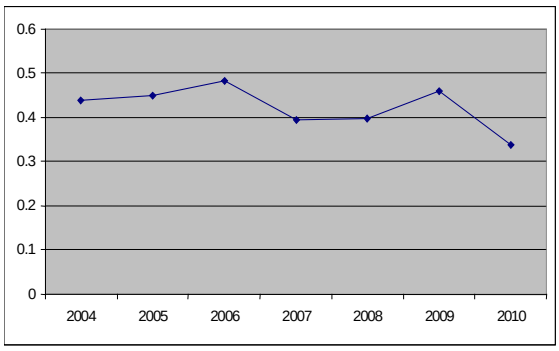

Figure 56. Standard AU/(EU+US).

Innovation and provisional patents still remain a prerogative of domestic companies. As we showed above, overseas investments are worthwhile only in the case of serious commitment and long-term legal protection (standard and NPE patents). In general, the trend is decreasing for all the categories, namely foreign patents will, ultimately, be filed more often than domestic ones in Australia.

The table below represents the total current amount of patents "produced" in Australia per country of origin. These numbers are obtained by summing up not only filed patents, but also those sealed, accepted and certified and subtracting those ceased, lapsed, withdrawn and revoked. This provides us with a more correct measure of the comprehensive turnover of patent applications.

	2004	2005	2006	2007	2008	2009
AUSTRALIA	-7386	-6805	-5810	-4819	-3476	6884
US	999	2598	5491	7324	10337	9687
SWITZERLAND	336	504	728	998	1305	1244
GERMANY	296	546	884	1143	1577	1395
JAPAN	465	658	982	1391	1758	1675

Figure 57. Total number of patent registered in Australia by country of origin.

Domestic patents (patents registered in Australia by Australian firms) underwent a dramatic increase from 2008 to 2009, even though negative in the previous period. Other major countries registering their inventions in Australia experienced a steady growth for the whole period. Foreign countries' ties with Australia prove to be strongest. The movement is not one way: Australia both provides foreign countries with advanced R&D facilities eligible for innovation activity, and it receives from foreign settlements a non-stop stream of knowledge and expertise.

5.7 CONCLUSION

This paper sought to position Australia within the new economic scenario emerging in the aftermath of the recent global crisis, which has changed geopolitical relations among the nations, and transformed their existing status as net exporters/importers, growing/stagnating economies, developed/undeveloped countries.

A systematic analysis of data drawn from different fields has led to unambiguous results, reinforcing my initial assumptions. First of all. the higher education sector, with 39 universities and more that one million students enrolled (one quarter of them coming from abroad just to attend Australian courses) is a melting pot where the seeds of research and development grow into patented discoveries, traded by industry globally. Second, Australian expenditure in R&D was 2.06% of GDP in 2006-2007 (last period available), 56% of which was financed by business sector and the remaining part by government institutions, positioning Australia over the average compared to the other OECD countries with regard to R&D spending. Third, in addition to substantial governmental subsidies and a favourable taxation over R&D expenditure, there has also been a cohort of venture capitalists especially devoted to fostering innovation and boosting commercial exploitation of research results.

Australia stands out as a key vantage point for Western companies wanting to redefine their global reach by exploiting emerging post-financial crisis opportunities in Eastern markets. It not only has close geographic proximity to ASEAN emerging markets and the two demographic and economic giants China and India, it also offers political stability, state-of-the art R&D facilities, and a higher education system unparalleled by others in the region (despite their own economic success).

In 2009, China experienced 8.45% GDP growth, India 6.8%, ASEAN 1.3%, while EU experienced a –4.05% result and USA –2.4%. This data points strikingly to the necessity for Western economies to open up to the Eastern world not only in the quest for cheap labour but also as a potential new market for their products. ASEAN countries represent at least 580 million inhabitants, with a combined GDP, in 2009, of $1.5 trillion. On the other hand, Australia's connection with Western economies (USA and EU) also proved to be strong both in terms of services traded and foreign direct investments. Additionally, Australia's intellectual property system is mostly international, and integrated with these economies. Enjoying a series of free trade

agreements with the vast majority of its neighbouring countries, Australia can establish itself (and, indeed, already it does) as a "hub" for European and North American companies intending to invest overseas in research and development.

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