

# **THE DYNAMICS OF UNIVERSITY BEHAVIOUR IN CHILE<sup>1</sup>**

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# **THE DYNAMICS OF UNIVERSITY BEHAVIOUR<sup>2</sup>**

## **1. INTRODUCTION**

Universities are complex social organizations whose long term structure, strategy and 'core' capabilities are determined both by 'mission' and resource availability. They employ highly qualified workers – professors, laboratory technicians, graduate students – and physical capital - buildings and laboratories, pilot plants, prototypes, reactors and so forth – in the production of : 1. teaching services, 2. new scientific and technological knowledge and, 3. a vast array of goods and services, both for private as well as for collective consumption, in fields such as health care, culture, environmental protection, urban development, energy production, water and land utilization, climate, desertification and more. Not all universities engage in the production of all three of the above mentioned categories of goods and services, nor do they exhibit close similarities as far as 'mission' and 'core capabilities' is concerned. They come in all sizes and styles of organization: private and public, non profit and profit oriented, involved in teaching exclusively, or engaged both in teaching, research and in the production of public goods, 'generic' and discipline-specific, licensed, (and subject to different forms of accreditation routines), or un-licensed (and scarcely monitored at all by educational authorities), and so forth. Such variance in the 'nature' of the firm suggests that large differences in university behaviour are a priori to be expected.

Universities are normally organized in Faculties imparting undergraduate and graduate teaching in different scientific and technological disciplines, i.e. the social sciences, engineering, medicine, physical sciences and so forth. Faculties then subdivide in Departments and these in Institutes, Centres and laboratories. Professors – of different levels of seniority – are normally attached to Departments for which they impart undergraduate teaching. Besides being affiliated to specific Faculties and Departments for teaching purposes, professors frequently also undertake research activities in institutes and labs. Some of them also perform administrative and managerial tasks, acting as Directors of Departments and members of academic boards, managing the day-to-day functioning of their academic units.

Technicians and graduate students normally work at the institute or lab level, but it is not uncommon for some of them to teach undergraduate students under Departmental responsibility. Department and Institutes also employ clerical and administrative personnel, accountants, lawyers, and others.

Some individuals – professors, administrators - work on a full time basis, others do it part time, combining their appointment at the university with other external activities, as private consultants to business firms, government advisors, and so forth. As a result of the above it is somewhat difficult accurately to assess how individuals allocate their time, especially so in relation as to how they divide their daily activities in teaching time, research and development time and administration and consultancy. Reliable data is hard to obtain. Contracts between professors and universities are normally specified in a rather vague language. They involve a complex principal-agent relationship in which

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<sup>2</sup> C.Contreras and Jorge Katz, Intelis, Department of Economics, University of Chile . The authors would like to acknowledge many hours of highly illuminating intellectual exchanges with Prof.Carlos Caceres from the University of Chile. Also, very valuable comments from Gustavo Crespi to an initial draft of the monograph. None of the above mentioned organizations or individuals are to be held responsible for the ideas or opinions hereby advanced.

questions of mutual obligation are treated in a very opaque way. Particularly difficult are issues related to quality aspects of teaching or research, where criteria for judgement and monitoring are specially frail.

Professors and graduate students use simple pieces of equipment and infrastructure for teaching purposes – classrooms, computers, and the like - and more sophisticated ones, such as pilot plants, prototypes, reactors, and a variety of complex experimental machines, in their search for new knowledge in the scientific and technological frontiers of different disciplines. These exploratory activities are carried out in Institutes, research centres and Labs. It is not unusual, however, for these centres or labs also to provide technical services to private firms in areas such as quality control, metrology, raw material testing and so forth. These services often constitute an important source of revenue both for the centre as well as for the university at large, as the latter normally charges an overhead for the use of its name, prestige and R&D facilities.

Some of the services offered by Centres and research labs to firms involve routine testing activities which do not demand new knowledge generation. Others, on the contrary, could be more complex, demanding ad hoc incremental knowledge generation, the use of pilot plants and experimental equipment. The border line between routine and non routine activities is often blurred and some efforts which should probably be measured as R&D activities following standard international definitions are not frequently accounted as such. This probably induces a country-wide underestimation of R&D expenditure.

Faculty members divide their teaching time between undergraduate and graduate teaching. Professors (and graduate students) show typical work days of nearly ten to eleven hours, including weekends, which makes for a rather long work week of around 55 to 57 hours. Available data for the US indicates that “an average academic work day entails 4.2 hours spent on instruction, 3.2 hours on research and a balance of 2.5 hours spent on miscellaneous activities” (L. Leslie et.al. 2000).

Received literature shows that departmental returns to teaching tend to exceed returns to research activities (D’Sylva, 1998), and that the difference between them tends to be larger for the social and the physical sciences vis a vis the life sciences. Thus, departments could increase their revenue by doing more teaching than research. The extent to which this is so seems to vary across disciplines.

The above introductory paragraphs serve to identify some of the complex issues demanding examination if we are to understand how universities, departments and individuals behave in the world of teaching and research.

In actual fact, universities all over the world are going through a long term decline in the provision of fiscal block grants covering their various activities, and this is inducing them to search for alternative sources of income to maintain their ‘mission’ as far as teaching activities, research and public goods production is concerned. Among the sources of funds becoming more important over the past two or three decades fees to undergraduate and graduate students appear prominently, but also contract research, competitive funding for R&D activities, gifts and donations, have increased in importance as well. As sources of funds change so do also university strategies, organization and ‘core capabilities’. Even if ‘mission’ constitutes an important conditioning factor affecting long term university behaviour, sources of funds play a significant role as well.

Many of these questions have not so far been explored in detail in relation to Chilean Universities. Chile has at present 60 universities catering for over 600.000 students. 25 of these universities are 'public' in the sense that they belong to the Council of Rectors of Chilean Universities (CRUCH). The remaining 35 universities are private, all of them created after the process of market de-regulation enforced by the military authorities in 1981. The de-regulation of tertiary education markets allowed private universities to enter the market and a large number of them were erected during the 1980's and 1990's. The 25 CRUCH 'public' universities further subdivide in 16 which are truly public in the sense that they have to report to the Contraloria General de la Republica and be accountable for the use of their resources, and 6 which in spite of belonging to CRUCH are not public sector organizations in the above sense.

Some Chilean universities – public or private - are quite large (catering for 20 to 30 thousand students each) – other much smaller, dealing with a student population of a few thousand people. Some cover 50 or 60 disciplines, others specialize in just a few academic fields. A number of Chilean universities have not so far received accreditation in many of the 6 areas that demand being evaluated for 'full accreditation'. The accreditation can be granted for 2 to 7 years. Only a small group of highly prestigious universities have so far received accreditation in all 6 categories, and for a full 7 year period. Public information on the accreditation status of different universities – both public and private – is highly opaque affecting market outcome. This suggests that the disciplinary role market forces are expected to have impeding monopolistic practices from the part of service providing organizations does not adequately obtain in this field of economic activity. In other words, as far as university markets is concerned consumer protection is not adequately taken care of by the 'invisible hand' of markets. As students can not freely move from one university to another carrying with them their academic credits there is a major element of market rigidity which allows firms to capture above 'normal' profits in a highly segmented market for educational services.

The above description identifies an interesting set of 'stylized facts' suggesting the need for a detail exploration of the structure and behaviour of Chilean university markets. The results of such exploration are presented in the sections that follow.

## **2. THE DYNAMICS OF CHILEAN UNIVERSITY MARKETS**

### **2.1. Market de-regulation, demand-side subsidies and the expansion of supply and demand for university services.**

Table 1 describes the evolving pattern of market entry that obtained in Chilean University markets in the period 1980-2006.

**Table 1**  
The creation of universities, professional institutes and centres for professional training,  
Chile 1980-2006<sup>3</sup>

Number of	1980	1986	1990	1995	2000	2006
CRUCH universities	8	20	20	25	25	25
Private universities		3	40	45	39	36
Total universities	8	23	60	70	64	61
CRUCH Professional Institutes	--	4	2	--	--	--
Private Professional Institutes	--	19	76	73	60	43
Total Professional Institutes		23	78	73	60	43
Centres for Professional Training		132	161	127	116	102
<b>Total tertiary education Establishments</b>	<b>8</b>	<b>178</b>	<b>300</b>	<b>270</b>	<b>240</b>	<b>206</b>

Looking at market entry we notice that different market scenarios have prevailed over the past decades, very much resembling the conventional evolutionary path described in the literature as the 'life cycle' of many industries. Exploring in further detail the process of market entry we notice that some universities have opted for what we call here a 'low end' market entry strategy – involving the expansion of production capacity – i.e. enrolling more students - both in their original facilities, but also opening up new branch campuses in different parts of the country - without concerning themselves deeply for quality of services and accreditation aspects, whereas other universities opted for a 'high end' market entry strategy, i.e. erecting new teaching and research facilities on the basis of high quality professorial staff, 'state-of-the-art' infrastructure and a 'world class' teaching curricula. In a few cases universities have chosen to do both, expanding low-cost teaching activities in order to generate the cash flow from which to finance the erection of a 'world class' teaching or research facility. Cross subsidization across campuses, disciplines and activities are quite frequent under current market organization arrangements as we shall see later on in the paper.

The nature of both models of market entry is quite different and so is their impact upon market functioning. The 'low end' market entry strategy reflects a short term profit maximization behaviour associated, on the one hand, to the fact that demand for university services was increasing at a very rapid pace, offering a clear opportunity for profits in a very opaque market environment and, on the other, to the undemanding regulatory environment which allowed new universities to enter the market without having to comply with strong accreditation requirements. Contrariwise, the 'high end' market entry

<sup>3</sup> CNAP 1999-2007. El modelo chileno de acreditacion de la educacion superior. Consejo Nacional de Acreditacion, Santiago 2007 Page. 24.

strategy caters for high income groups of society which can afford much higher fees for university services but demand better services in return. A major process of segmentation has emerged in Chilean university markets as a consequence of the above, reinforcing the already high degree of social segmentation prevailing in the country.

Let us now look at the demand side of the market. We notice that enrolment in Chilean universities underwent a major expansion during the past two decades, making the local student population to grow from 245.000 students in 1990 to over 678.000 at the end of 2007.

Various different forces fuelled this rapid expansion of demand for tertiary education in Chile over the past two decades. On the one hand, the economy performed outstandingly well during a large period of time, in particular between 1984 and 1998. On the other, the increasing availability of scholarships, grants and credit, facilitated entry to universities and other tertiary education institutions. Table 2 below indicates that the enrolment in tertiary education organizations multiplied by a factor of four between the early 1980's and 2006. It is important to notice that such expansion was much stronger in the lower quintiles of the distribution, making the access rate to university in the group 18-24 in the lowest quintile of the distribution to increase from 4% to 15%, from 1990 to 2003 and from 8% to 21% in the next lower quintile.

**Table 2**  
Enrolment in Chilean Tertiary Education Organizations 1983-2006

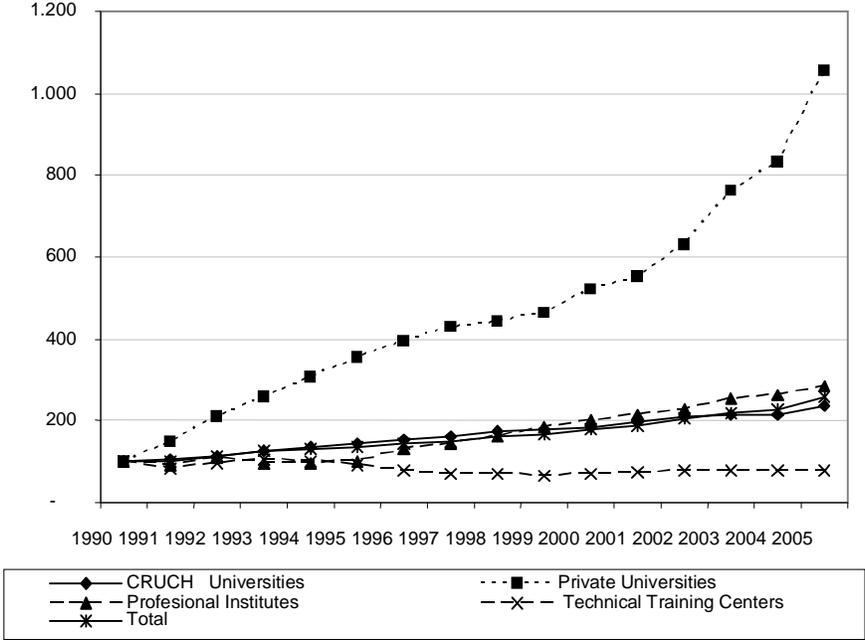
	1983	1985	1990	1995	2000	2006
CRUCH universities.	105.341	108.674	108.119	154.885	201.186	256.750
Private universities	2.708	4.953	19.509	69.004	101.386	180.346
Total Universities	108.049	113.625	127.628	223.889	302.562	473.096
Prof. Institutes	25.244	32.233	40.006	40.980	79.904	119.251
Prof. Training Centers	39.702	50.425	77.774	72.735	53.354	63.387
<b>Total</b>	<b>172.995</b>	<b>196.283</b>	<b>245.408</b>	<b>337.604</b>	<b>435.830</b>	<b>619.734</b>

Throughout this period the Chilean production structure underwent a major process of 'technological deepening', particularly so in natural resource processing activities such as copper mining, salmon farming, fruit and wine production, the forestry industry. Many new firms were erected bringing with them 'world class' manufacturing technologies, rapidly gaining share in world markets. These new production facilities demanded new, more professional, management, as well as skilled man power in a large number of different disciplines. The strong signal coming from the production structure was clearly perceived by the educational sector and a steady process of market entry of new universities and Centres for Professional Training followed. 10 new universities opened up between 1990 and 2005. The total number of university students increased from 245.000 in 1990 to 435.000 in 2000.

It should be noted that it is mainly private universities that have gained market share throughout this period. Their studentship multiplied by a factor of ten. A recent report by OECD indicates that the

growth spurt was due both to proliferation of branch campuses from existing universities as well as to the creation of entirely new ones (see Figure 1).

**Figure 1**  
 Averaged indices for tertiary undergraduates by type of institution (1990=100)

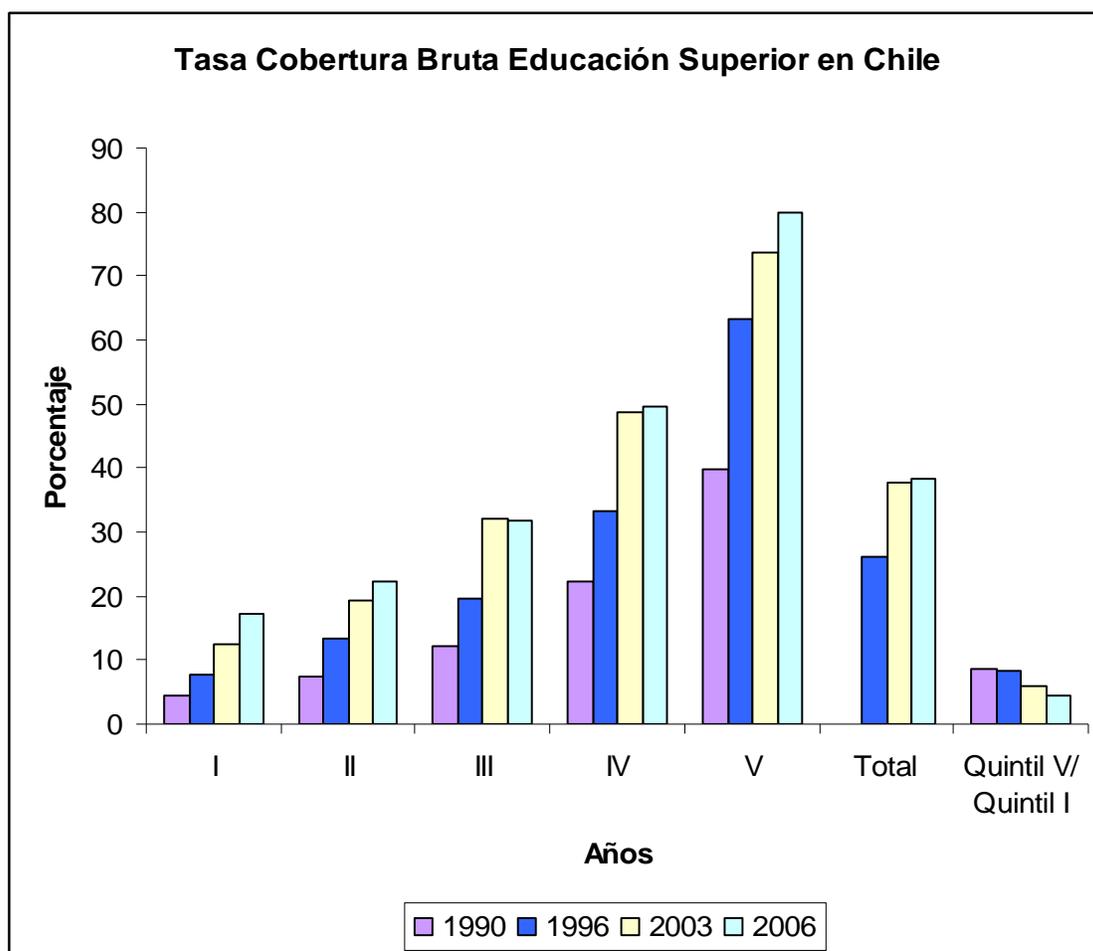


Source: Based on MINEDUC (2006)

As already mentioned, the rate of new student enrolment was also fuelled up by demand-side subsidies facilitating market entry. This was specially so in the lower quintiles of the distribution, as shown in Figure 2.

**Figure 2**  
 Access to Tertiary Education by Income Bracket  
 Chile 1990-2006

<b>Quintiles de ingreso</b>	<b>1990</b>	<b>1996</b>	<b>2003</b>	<b>2006</b>
I	4,6	7,6	12,4	17,3
II	7,5	13,5	19,2	22,4
III	12,2	19,7	32,1	31,7
IV	22,4	33,2	48,6	49,6
V	39,7	63,2	73,7	80,0
<b>Total</b>	<b>15,6</b>	<b>26,1</b>	<b>37,8</b>	<b>38,3</b>
Quintil V/ Quintil I	8,6	8,3	5,9	4,6



Fuente: CASEN 2006

A wide and heterogeneous middle class emerged in Chile as a result of both previously mentioned processes. A virtuous circle developed of faster economic growth associated to quality upgrade of the labour force, to faster productivity growth and to increased international competitiveness.

Seen on an international perspective, Chile exhibits one of the highest leverage ratios in the world, complementing its public investment for tertiary education with private funding. In view of the above the OECD Report ends up advising a major expansion of public investment in Education in the forthcoming future. No other economy, including countries such as Korea and Japan, that have also used private investment as their main source of funding for tertiary education expansion, has a private/public funding ratio as high as Chile.

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Having so far examined the major forces 'explaining' supply and demand expansion for university education in Chile, we now turn to aspects of quality of services.

## 2.2. Accreditation status of Chilean universities.

Not all Chilean universities, education institutes and teaching programs have successfully gone through 'peer-review' and accreditation processes. Accreditation can be obtained over six different spheres of activity: 1. Institutional management, 2. Undergraduate Teaching, 3. Research, 4. Post Graduate Teaching, 5. Relationship with the community and 6. Infrastructure, and could be obtained for two to seven years depending upon the level of quality and accountability attained by each university in each of the previously mentioned spheres. Only a small number of local universities – 12 out of 60 - have received accreditation in four or more of the above categories, and for periods of four to seven years. Accreditation is clearly related to prestige and constitutes an attractor for high quality students and well as for better trained faculty. On the other hand, accreditation also means costs in tangible and intangible assets.

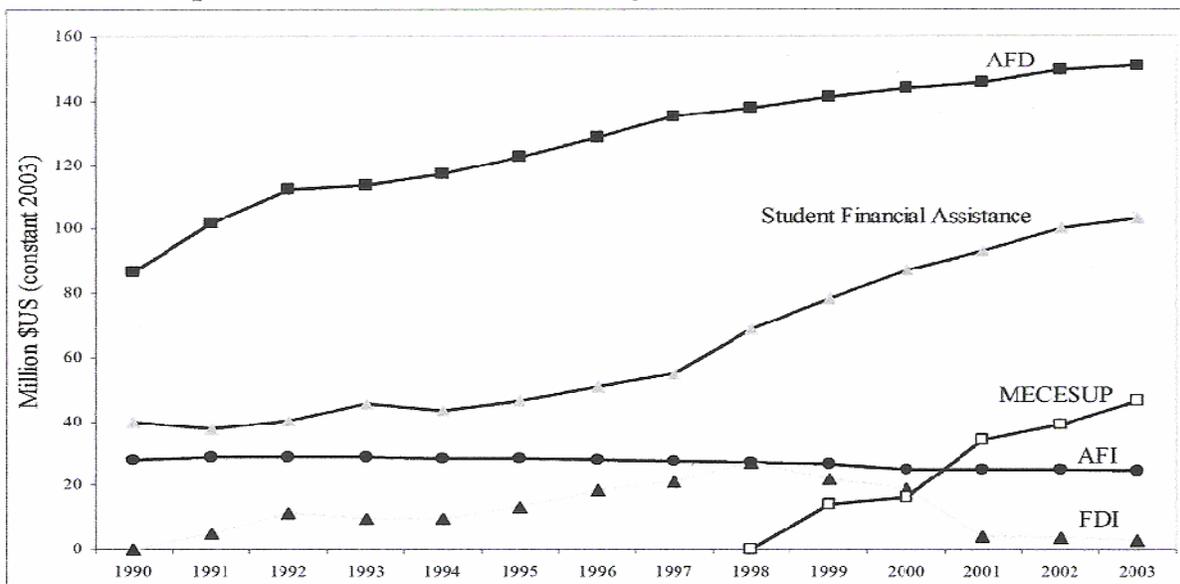
The university industry shows a complex and variegated scenario as far as accreditation is concerned. Only a small number of Chilean universities have received accreditation in all six categories under evaluation, and for seven years. The group includes the University of Chile, the Catholic University, and the University of Concepcion. Close behind we find a small group of universities which have received accreditation in four or five of the above mentioned categories, and for shorter periods of time, say, four years. This group includes Universidad Austral, Universidad Catolica de Valparaiso, Universidad del Bio-Bio, Universidad de Talca. On the other hand, a large number of universities have not yet been accredited, or their accreditation is only institutional and for a period of two years, elapsing shortly. This third group includes both public and private universities.

Among private universities only a small group has done well as far as accreditation is concerned. This group includes Universidad del Desarrollo, Adolfo Ibañez, Diego Portales, Los Andes, Andres Bello and Universidad Mayor. These private universities are currently gaining prestige and market share in teaching services for undergraduate students. Some of them are also attaining significant progress in expanding 'in house' R&D activities, as we shall see later on in the paper.

### 2.3. The financial model underlying the functioning of Chilean universities.

CRUCH universities finance their activities with resources coming from different sources. Although fiscal block grants (AFD+AFI) continue to be a major source of revenue, Figure 7 indicates that the relative share of block grants in total university revenue is gradually falling. In 1990 AFD+AFI represented 67.6% of total public contributions to Chilean Universities. By 2005 AFD+AFI constituted 44.4% of total CRUCH revenue and in 2007 they represented just 39.2%. It is important to notice that these numbers refer to the average for the 25 CRUCH universities but that a considerable variance prevails among them in the extent to which they rely of AFD+AFI as a source of finance. Other sources, such as tuitions and fees, competitive funds for R&D activities, external contracts, donations have been expanding in relative terms as fiscal block grants have gradually lost relative weight, but the variance across universities in the extent to which this has been so in each case varies considerably. This we examine in Section 4 of the paper. The relative decline in fiscal block grants and the concomitant expansion of these other alternative sources of revenue is shown in Figure 3. We notice that the process accelerated after 1997-1998.

**Figure 3**  
Sources of funds of Chilean Universities.  
1990-2003



Source: MINEDUC (2004)

**Table 3**

Fiscal Sources of Funds for Chilean Universities<sup>4</sup>  
(At constant MM 2005 \$)

<u>Item</u>	<u>1990</u> %	<u>2000</u>	<u>2005</u>	<u>2007</u> %
1.Fiscal Direct Support	61.934 51.1	102.575	109.483	122.714 34.0
2.Fiscal Indirect Support	20.016 16.5	17.915	17.695	18.864 5.2
Block Grants	<b>67.6</b>	<b>49.5</b>	<b>44.5</b>	<b>39.2</b>
Total fiscal resources.	121.120 100	243.220	285.650	360.589 100

Source: J.Katz & R.Spence, 2008 and OECD, 2008, pag.143, Table 8.10 (for 2007)

We close here our introductory examination of the growth process of Chilean university markets in the past three decades. One of the main motivations for the present enquiry has been that of illuminating the large degree of variance in structure and performance that prevails between CRUCH universities. In order to proceed in such direction we now turn into a more disaggregated level of analysis looking at the 25 universities at CRUCH on a comparative basis.

### **3. CRUCH UNIVERSITIES ON A COMPARATIVE PERSPECTIVE.**

#### **3.1. Source of funds.**

Data on sources and uses of funds for the 25 universities at CRUCH are annually published by the Ministry of Education in its web site. Such data is now used to examine on a comparative perspective differences in structure and performance between public sector universities in Chile. We begin by looking at differences in sources of funds.

Universities collect resources from various different sources. They enrol more students given their physical infrastructure and in this way they expand their collection of student fees. They could also opt for opening up new branch campuses in different regions of the country and/or expanding the number of disciplines and careers they impart instruction upon. In addition to the above, universities can also expand their revenue by carrying more R&D efforts, applying for such purpose for public funding in agencies like Conicyt, Corfo and others. They can also press for a larger share of fiscal block grants, or apply for private donations. Finally, they could also obtain more funds from consultancy services.

Table 4 provides information as to the major differences in sources of revenue for the 25 CRUCH universities in 2000 and 2006. It also reflects changes in sources of funds for each CRUCH university between the above mentioned years.

**Table 4**  
Sources of revenue of CRUCH universities

<sup>4</sup> CNAP 1999-2007. El modelo chileno de acreditacion de la educacion superior. Consejo Nacional de Acreditacion, Santiago 2007. MM is million (10<sup>6</sup>)

Universidad	Government support*			Tuition fees			Self generated resources		
	2000	2006	% variation	2000	2006	% variation	2000	2006	% variation
U. Austral	<u>51.3%</u>	<u>47.1%</u>	-8.2%	23.0%	23.2%	1.1%	25.8%	29.7%	15.4%
U. Federico Santa María	<u>34.8%</u>	<u>33.5%</u>	-3.7%	24.3%	25.3%	3.9%	40.8%	41.2%	0.9%
U. Católica de Valparaíso	<u>37.4%</u>	<u>33.3%</u>	-11.0%	<u>46.3%</u>	<u>43.6%</u>	-6.0%	16.2%	23.2%	<b>42.6%</b>
U. Metropolitana de C.Educación	<u>34.4%</u>	<u>33.1%</u>	-3.7%	<u>37.1%</u>	37.8%	1.9%	28.5%	29.0%	2.0%
U. de Tarapacá	<u>33.1%</u>	<u>30.3%</u>	-8.4%	30.0%	36.3%	20.7%	36.9%	33.5%	-9.3%
U. de Antofagasta	<u>37.4%</u>	<u>30.1%</u>	-19.5%	34.3%	<u>40.3%</u>	17.7%	28.3%	29.6%	4.4%
U. de Talca	<u>39.0%</u>	<u>29.8%</u>	-23.6%	30.1%	<u>40.5%</u>	34.6%	30.9%	29.7%	-3.9%
U. de Concepción	<u>33.4%</u>	<u>26.9%</u>	-19.4%	17.3%	23.4%	35.6%	<u>49.4%</u>	<u>49.7%</u>	0.7%
U. Católica del Norte	<u>36.5%</u>	<u>24.7%</u>	-32.4%	29.9%	29.4%	-1.6%	33.6%	<u>45.9%</u>	<b>36.7%</b>
U. de la Serena	<u>27.6%</u>	<u>24.3%</u>	-11.7%	30.2%	27.9%	-7.8%	<u>42.2%</u>	<u>47.8%</u>	13.2%
U. Católica de Concepción	<u>24.3%</u>	<u>24.3%</u>	-0.2%	<u>57.0%</u>	<u>54.3%</u>	-4.7%	18.7%	21.4%	14.5%
U. de Atacama	9.7%	<u>19.7%</u>	<b>103.6%</b>	11.5%	17.3%	<b>50.0%</b>	<u>78.8%</u>	<u>63.0%</u>	<b>-20.0%</b>
U. de Santiago	20.8%	19.0%	-8.9%	33.8%	<u>44.1%</u>	30.5%	<u>45.3%</u>	36.9%	-18.7%
U. de Magallanes	18.5%	14.3%	-22.8%	28.8%	31.9%	10.7%	<u>52.7%</u>	<u>53.8%</u>	2.2%
U. del Bio-Bio	16.5%	13.7%	-17.0%	<u>45.5%</u>	<u>42.7%</u>	-6.1%	38.0%	<u>43.6%</u>	14.7%
U. de Chile	19.4%	11.7%	<b>-39.6%</b>	24.4%	21.7%	-11.1%	<u>56.2%</u>	<u>66.6%</u>	18.5%
Pontificia U. Católica	14.5%	11.6%	-19.8%	26.4%	29.3%	11.0%	<u>59.1%</u>	<u>59.0%</u>	0.0%
U. Arturo Prat	11.5%	11.5%	-0.4%	<u>63.0%</u>	<u>72.5%</u>	15.2%	25.5%	16.0%	<b>-37.2%</b>
U. Católica del Maule	11.1%	10.6%	-4.7%	<u>39.2%</u>	<u>46.6%</u>	18.9%	<u>49.7%</u>	<u>42.8%</u>	-13.9%
U. de Playa Ancha	8.1%	8.2%	0.9%	<u>50.8%</u>	<u>40.4%</u>	<b>-20.5%</b>	41.1%	<u>51.4%</u>	25.1%
U. Católica de Temuco	7.8%	7.7%	-0.9%	<u>52.3%</u>	<u>52.6%</u>	0.5%	39.9%	39.7%	-0.5%
U. de Valparaíso	19.0%	7.5%	<b>-60.6%</b>	38.6%	<u>52.0%</u>	<b>34.7%</b>	<u>42.4%</u>	40.6%	-4.4%
U. de la Frontera	11.2%	7.1%	<b>-36.9%</b>	<u>36.0%</u>	36.6%	1.4%	<u>52.7%</u>	<u>56.3%</u>	6.9%
U. de Los Lagos	12.3%	6.1%	<b>-50.5%</b>	<u>47.6%</u>	<u>52.8%</u>	10.9%	40.1%	41.1%	2.5%
U. Tecnológica Metropolitana	6.5%	5.6%	-14.3%	32.3%	<u>39.0%</u>	20.6%	<u>61.1%</u>	<u>55.4%</u>	-9.4%
<b>General Average</b>	<b>23.1%</b>	<b>19.7%</b>	<b>-14.7%</b>	<b>35.6%</b>	<b>38.5%</b>	<b>8.0%</b>	<b>41.4%</b>	<b>41.9%</b>	<b>1.3%</b>

Source: CRUCH statistics

Note: \*Direct (AFD) funding + indirect funding (AFI) + FCSU repayments

The figures in the Table correspond to 2000 and 2006 and reflect two different issues worth noticing. On the one hand, large differences do in fact prevail across CRUCH universities in the extent to which they rely on student fees, government support and self-generated funds as sources of funds. Major differences are noticed both in 2000 and in 2006 across CRUCH universities in this respect. For example, student fees represent as much as 70% of total revenue in the case of Universidad Arturo Prat, and only 17% in the case of Universidad de Atacama in 2006. The other 23 CRUCH universities fall somewhere in between these two extreme cases. A closely similar picture can be found in 2000. Notice also that fiscal resources constituted 47% of total revenue for Universidad Austral and only 7.1%, 6.1% and 5.6% respectively for Universidad de La Frontera, Universidad Los Lagos and Universidad Tecnológica Metropolitana, in 2006. Finally, and as far as self-generated funds is concerned, we also find a large variance to prevail. In the case of Universidad de Chile self-generated resources account for 66% of total revenue, 63% at the Universidad de Atacama and 59% at the Catholic University of Chile.

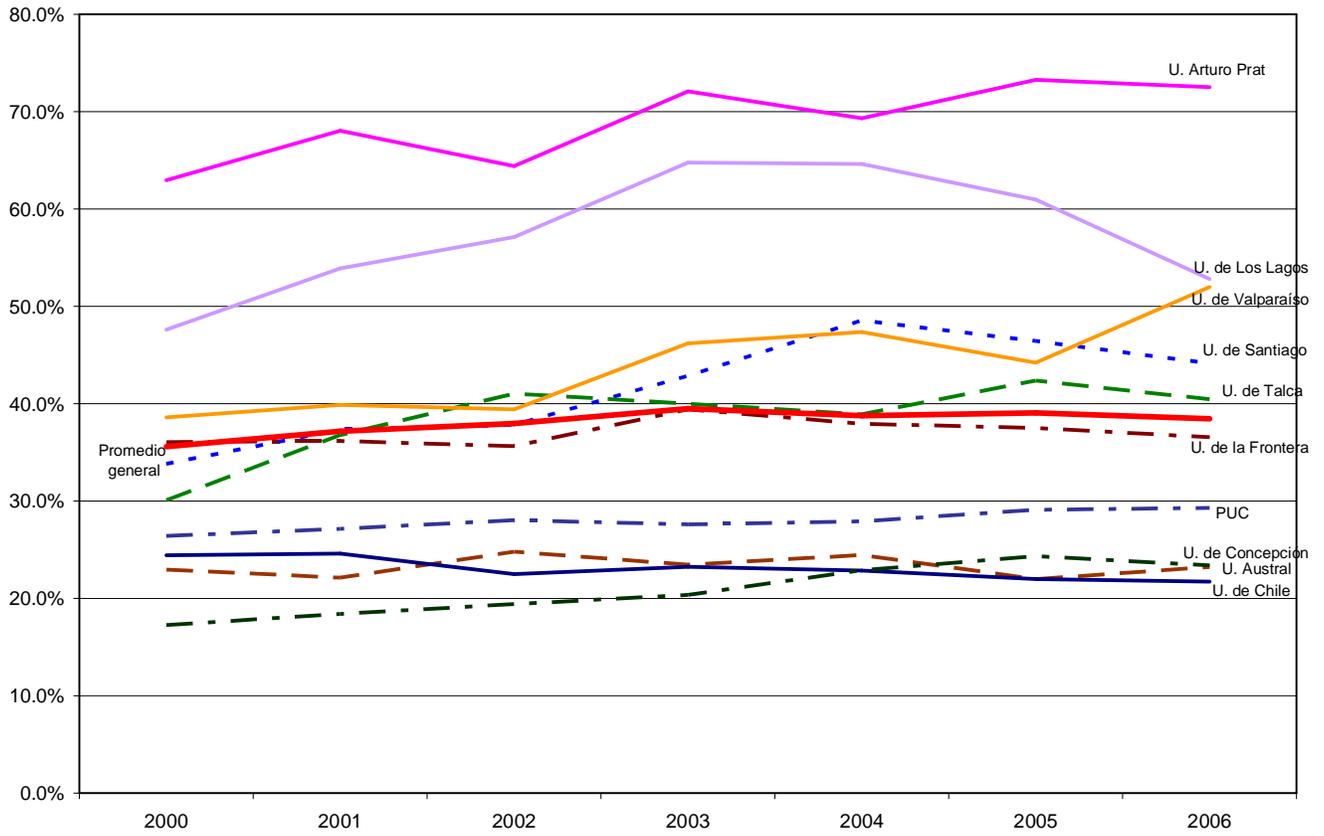
On the other hand, self generated funds represent a much lower proportion of total revenue in the cases of Universidad A. Pratt and in Universidad Católica de la Santísima Concepción, where they only accounted for 16% and 21%, respectively, in 2006.

On the other hand, the figures also reflect that different CRUCH universities do in fact follow different strategies in order to expand their access to resources. We notice that important changes obtained in the extent to which sources of funds varies among public universities in time. While the Universidad of Atacama exhibits a very large increase in its access to fiscal resources, the Catholic University of Chile, the Universidad de Valparaíso, Universidad de La Frontera and Universidad Los Lagos show a major reduction in the share of fiscal resources in total revenue. Concomitantly with the above, student fees increased as a source of revenue in most cases, but they clearly did so well above average in the case of University of Atacama, University of Valparaiso, University of Concepcion and University of Talca.. Contrariwise, student fees decreased as a source of revenue for University de Playa Ancha (-21%). Finally, self-generated funds increased quite strongly in the case of Universidad Católica de Valparaíso and also in the case of Universidad Católica del Norte, but they decreased quite significantly for Universidad Arturo Prat and for Universidad de Atacama.

The above figures confirm our a priori believe that sources of funds not only are significantly different across CRUCH universities, but also that public universities follow very different strategies to secure themselves of resources. This is reflected in the following three diagrams where we look at the evolution of student fees, fiscal resources and self-generated funds for a small number of universities at CRUCH over the period 200-2006.

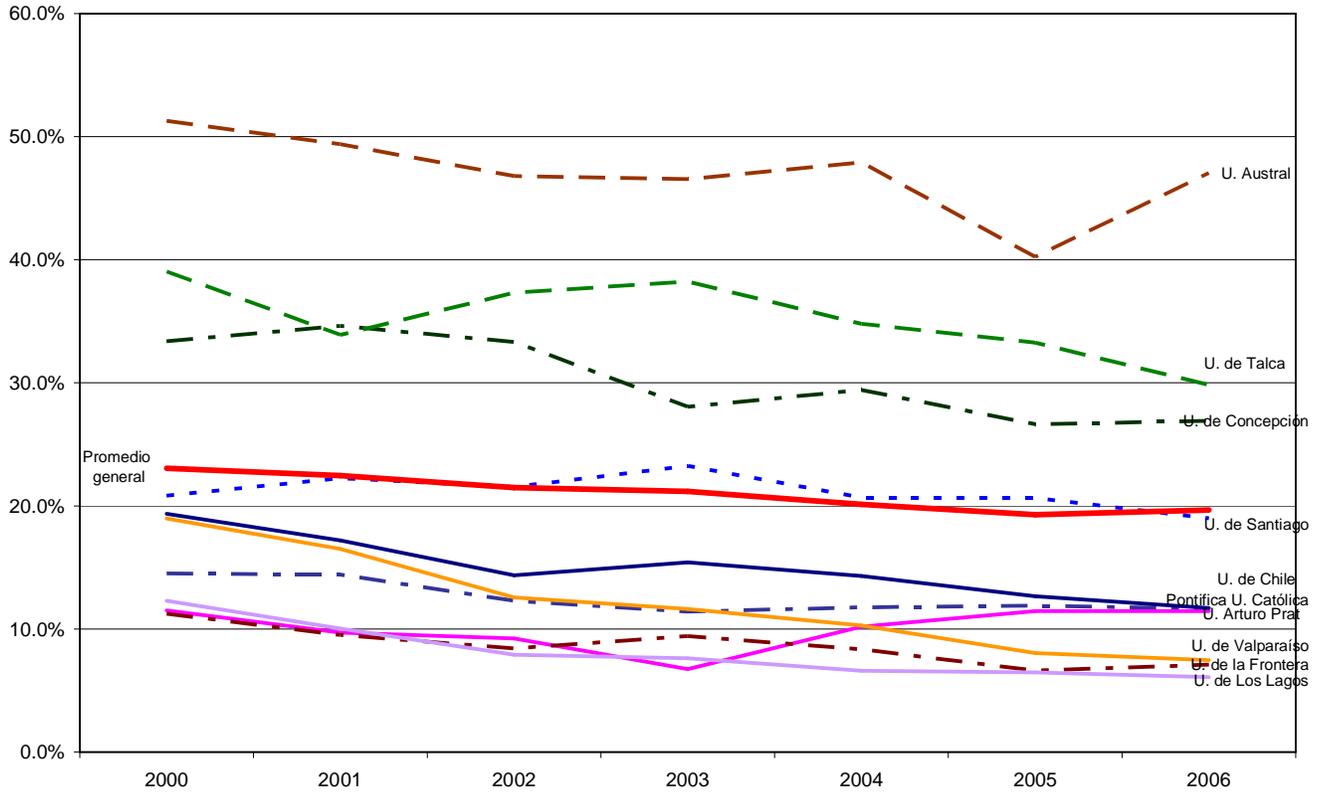
**Figure 4**  
Student Fees as source of Revenue for CRUCH Universities.

Student Fees as source of Revenue for CRUCH Universities



**Figure 5**  
Fiscal Resources as Source of Revenue for CRUCH Universities.

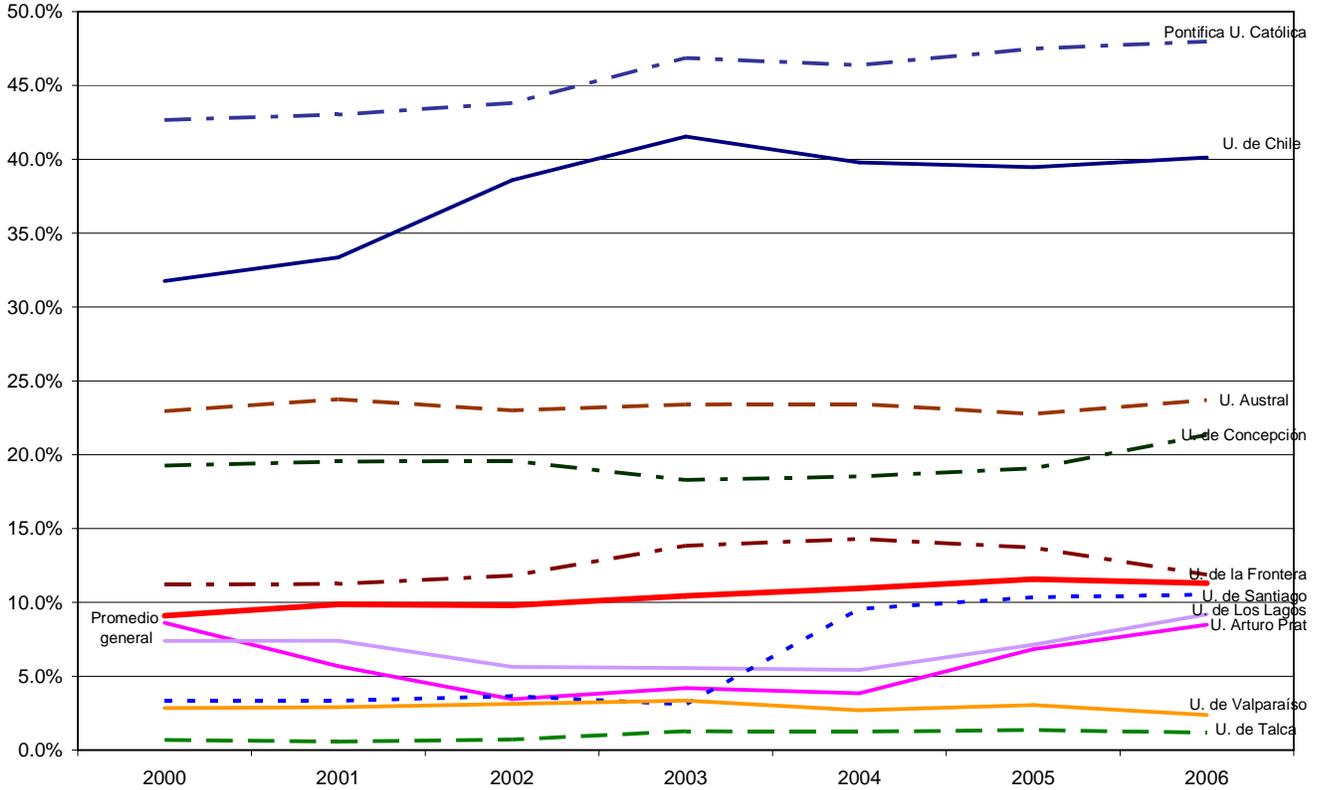
**Fiscal Resources as Source of Revenue for CRUCH Universities**



**Figure 6**

Self generated funds as source of Revenue for CRUCH Universities.

**Self generated funds (Sales of Services) as source of Revenue for CRUCH Universities**



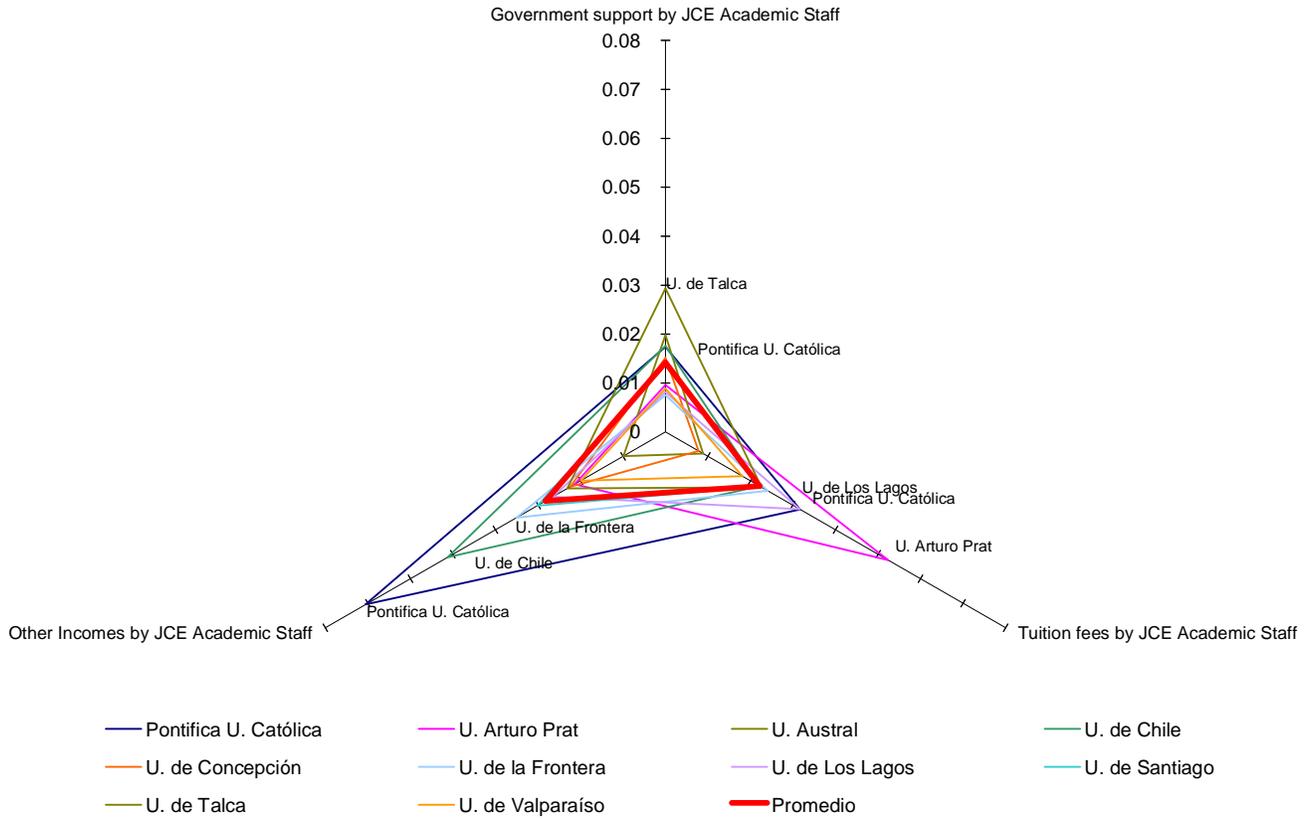
Looking at Figures 4, 5 and 6 we notice that self-generate funds constitute a high, and gradually increasing, component of total revenue both for the Catholic University and for the University of Chile. In these two cases self-generated funds represent three times as much, percentage-wise, as for the average CRUCH university. Contrariwise, both these universities exhibit a below average - and gradually falling - participation of fiscal resources in total revenue. As we shall see later on, this constitutes an important finding of the present enquiry, strongly related to major long term structural features of the Chilean university sector associated to the supremacy and pace-setting character of these two major actors of the system, the University of Chile and the Catholic University.

Figure 7 graphically show the above, comparing 2000 with 2006. We notice that the University of Chile and the Catholic University not only differentiate themselves from the rest of the group, but also that the gap between them and the remaining universities at CRUCH tends to be getting larger, rather than smaller, through time. We will return to this topic later on in the monograph.

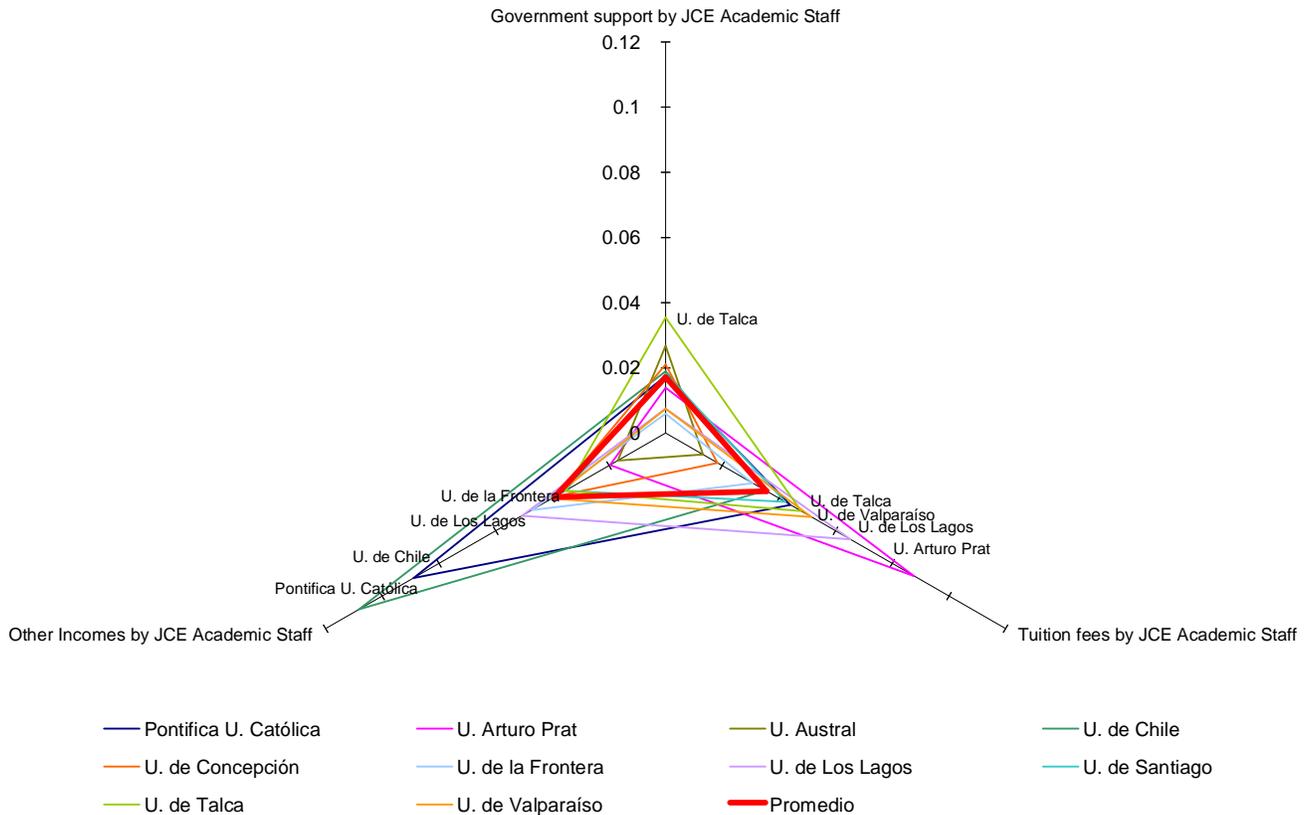
**Figure 7**

Alternative CRUCH university strategies as far as Sources of funds in concerned.

### Financial Model (2000)



## Financial Model (2006)

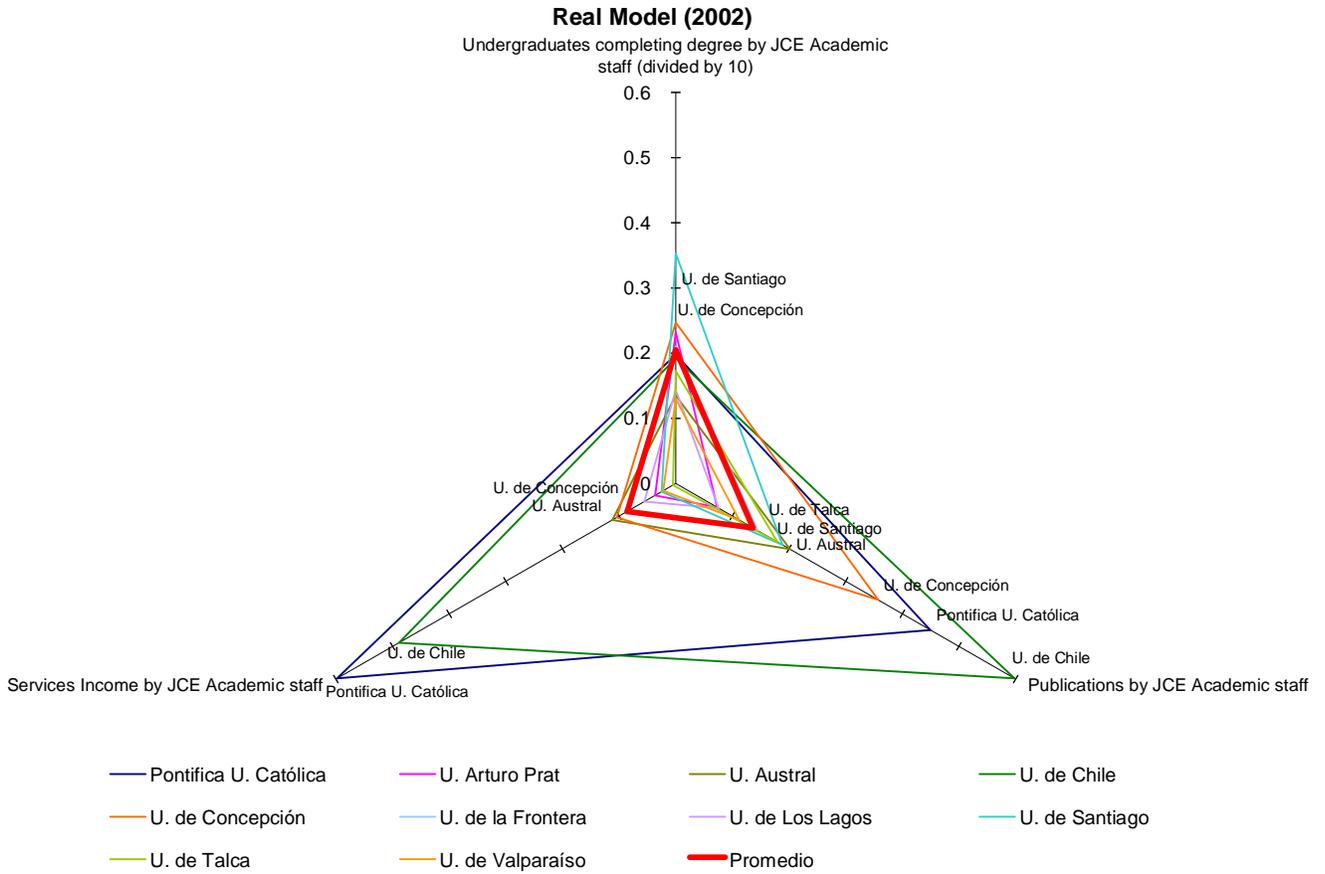


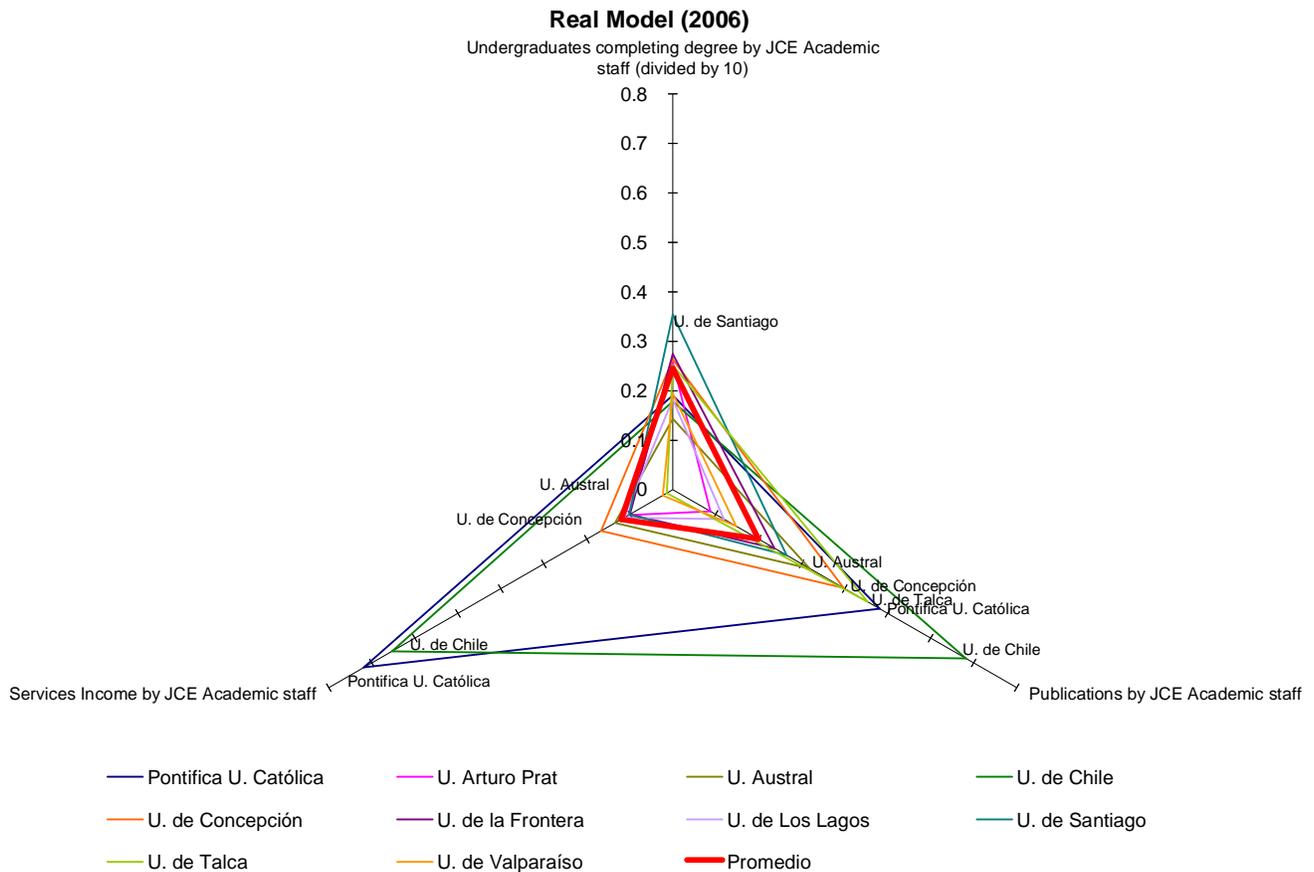
Having looked at sources of revenue we now turn to uses of funds, i.e. to the provision of services.

### 3.2. Universities as service providing organizations.

Having so far examined the 'financial side' of university functioning we now turn to universities as service providing organizations. As from his perspective universities can be thought of as delivering teaching services – at the graduate and undergraduate level – R&D activities and consultancy services, both for firms and government agencies. Figure 8 indicates that also a great deal of variance prevails in this respect, with the University of Chile and the Catholic University clearly differentiating themselves from most of the other CRUCH universities as providers of teaching and R&D services. As before, differences in this respect vis a vis the CRUCH – with notable exception which will be examined shortly - also seem to be getting larger, rather than smaller, with the passage of time.

**Figure 8**  
Universities as service-providing organizations.





The above results support the hypothesis that the University of Chile and the Catholic University constitute a class in their own, followed at a considerable distance by other members of the CRUCH. We shall return to this issue later on in the paper.

### 3.3. Further statistical evidence concerning differences in structure and behaviour across CRUCH universities.

Further quantitative information is available on the web for the 25 universities at CRUCH on issues such as ISI and Scielo publications, Fondecyt R&D projects, faculty members with JCE (Jornada Completa Equivalente), JCE carrying a PhD degree, number of students matriculating per annum, and more. The data covers the period 2000-2007. On the basis of such data, we have carried out the statistical analysis we now present. Product moment correlation coefficients between different pairs of variables provide the departing point of our enquiry. These coefficients give us an initial picture of statistical association between pairs of variables (without implying causality). We get there the initial building blocks for a more articulated construction. Table 5 presents the cross section product moment correlation coefficients obtained from pooling the data for 25 CRUCH universities over the period 2000-2006. The variables we have selected appear as closely related 'proxies' for some of the variables we have identified before in Figures 7 and 8.

**Table 5**  
Product moment correlation coefficients for 25 CRUCH universities  
2000-2006

**Panel data 25 CRUCH Universities  
2000-2006**

	Total Publications	Fondecyt resources	JCE faculty members	Number of under graduates completing degree.	Fiscal block grants	Student fees.
Total Publications	1					
Fondecyt Resources	0,8905	1				
JCE faculty members	0,9538	0,8345	1			
Uundergraduates completing degree.	0,7869	0,6925	0,8912	1		
Fiscal block grants.	0,8996	0,7977	0,9149	0,8093	1	
Student fees.	0,8322	0,7777	0,8621	0,7863	0,7553	1

We notice a high degree of correlation to prevail between performance indicators – number of publications, number of students completing their undergraduate training or number of R&D projects under execution – and resource utilization indicators – such as JCE faculty, fiscal block grants or Fondecyt resources – when pooling the 25 CRUCH universities together over the period 2000-2006.

We will estimate two log-linear equations, one to estimate teaching outputs and the other to estimate research output. We will follow the model presented at Crespi 2007 for the UK knowledge production function. The following equation represents the model:

$$y_{it} = \alpha + \lambda x_{it} + \beta_1 k_{it}^1 + \beta_2 k_{it}^2 + \gamma q_i + \varepsilon_{it} \quad (4.3.1)$$

where  $y$  is the logarithm (natural log) of university output (publications or students completing undergraduate training),  $k^1$  is the share of competitive research funding in total university resources,  $k^2$  is the share of student fees in total university resources,  $x$  is the logarithm (natural log) of size, measured by the number of total full time professors (JCE), and  $q$  is a quality index, some of them time varying, some of them fixed over time.

Coefficients  $\beta_1$  and  $\beta_2$  represents the elasticities of university output with respect to university resources. Diminishing (constant or increasing) returns predominate at the university level when  $\beta < 1$  ( $\beta \geq 1$ ). This specification allows the effect of competitive funding and fees to differ from government support funding. The effect of competitive funding is larger than the effect of **student fees** funding when

$(\beta_1 - \beta_2) > 0$ , similarly the effect of student fees is larger when  $(\beta_1 - \beta_2) < 0$ . In other words if  $(\beta_1 - \beta_2) > 0$  there is a premium for this source of funding, while if  $(\beta_1 - \beta_2) < 0$  there is a discount.

A final comment concerning the error terms. While  $\varepsilon_{it}$  is the standard un-correlated random shock, there could be other unobserved, mainly fixed factors, at university level that might affect both research production and research inputs, for example, research ability or quality. Universities with higher than average research ability are expected to produce more research outputs and also to attract more research grants, ignoring this assumption would induce a spurious correlation between research incomes and results, overestimating the impact of competitive funding on research production. One way to control for this problem is to estimate the model using fixed effects. However, this could be a very demanding solution given our short panel and measurement problems. Another approach is to approximate the unobservables by using observables as a proxy variable, as we will do it in this case with the inclusion of the variable  $q$ . The dataset collected provides different set of quality related scores described in Table 9 and Appendix 2. Although there are other ways of including this observable, using a polynomial function of some degree for example, we use a log transformation (natural logarithm).

We used four different quality indexes; some of them were constructed using our dataset and other taken from external sources, to compare the results. Accreditation Index and Professors Quality Index from El Mercurio are constructed using quantitative data, while Quality Index from El Mercurio and Que Pasa are constructed using surveys. Results of these estimations are presented in Table 6 and 8.

However, these estimates do not consider the possibility of the relationship between resource availability and performance indicators resulting from a lagged association between the variables. Literature on this topic suggests that significant lag effects are normally present in regressions of this sort (G.Crespi, 2007). Although our data base is not long enough to allow us to test a four or five year lag effect being present affecting the relationship between resources and performance (as the literature suggests to be the case) we have tested the hypothesis of university behaviour in  $t(0)$  being affected by resource availability in  $t(-1)$ . Results of these estimations are presented in Table 7 and 9. All the equations were estimated using OLS.

### Results of the Publications Model

Variable	Dependent Variable: Number of Publications (Ln)			
	Accreditation Quality Index	Quality Index (El Mercurio)	Professors Quality Index (El Mercurio)	Quality Index (Que Pasa)
JCR size of faculty (ln)	1.371*** (0.190)	1.857*** (0.193)	1.741*** (0.130)	1.338*** (0.233)
Share of competitive funds over total income (shcf)	49.446*** (10.992)	73.987*** (16.282)	43.985*** (14.965)	53.597*** (13.249)
Shares of student fees over total income (shsf)	0.163 (0.500)	0.365 (0.510)	1.142** (0.502)	-1.305** (0.629)
Quality (ln)	0.654*** (0.152)	-0.367 (0.926)	2.988*** (0.794)	2.880** (1.133)
Constant	-6.485*** (0.946)	-7.392*** (1.127)	-19.334*** (2.864)	-8.614*** (1.447)
Obs	119	124	124	80
R-Squared	0.821	0.759	0.791	0.838

Robust standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 7**  
Results of the Publications Model with Lags

Variable	Dependent Variable: Number of Publications (Ln)			
	Accreditation Quality Index	Quality Index (El Mercurio)	Professors Quality Index (El Mercurio)	Quality Index (Que Pasa)
JCR size of faculty (ln) (1 year lag)	1.337*** (0.199)	1.789*** (0.206)	1.710*** (0.144)	1.341*** (0.237)
Share of competitive funds over total income (shcf) (1 year lag)	53.991*** (15.043)	83.313*** (22.739)	48.357** (19.484)	52.201*** (16.899)
Shares of student fees over total income (shsf) (1 year lag)	0.178 (0.518)	0.351 (0.513)	1.246** (0.486)	-1.452** (0.665)
Quality (ln)	0.680*** (0.151)	-0.057 (0.908)	3.139*** (0.765)	2.913*** (1.088)
Constant	-6.295*** (1.003)	-7.435*** (1.209)	-19.731*** (2.764)	-8.525*** (1.491)
Obs	119	124	124	80
R-Squared	0.814	0.746	0.781	0.823

Robust standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 8**

## Results of the Students Model

Variable	<b>Dependent Variable: Students completing Undergraduate Degrees (Ln)</b>			
	Accreditation Quality Index	Quality Index (El Mercurio)	Professors	
			Quality Index (El Mercurio)	Quality Index (Que Pasa)
JCR size of faculty (ln)	0.967*** (0.059)	1.134*** (0.060)	1.053*** (0.045)	0.944*** (0.079)
Share of competitive funds over total income (shcf)	-10.741** (4.633)	-10.454** (4.706)	-6.634 (5.208)	-6.446 (5.222)
Shares of student fees over total income (shsf)	0.079 (0.322)	0.106 (0.295)	-0.003 (0.299)	0.174 (0.447)
Quality (ln)	0.089* (0.053)	-0.841** (0.356)	-0.352 (0.257)	0.906* (0.532)
Constant	0.741** (0.318)	1.370*** (0.427)	1.865* (1.009)	-0.407 (0.753)
Obs	144	150	150	96
R-Squared	0.751	0.745	0.739	0.814

Robust standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 9**  
Results of the Students Model with Lags

Variable	<b>Dependent Variable: Students completing Undergraduate Degrees (Ln)</b>			
	Accreditation Quality Index	Quality Index (El Mercurio)	Professors	
			Quality Index (El Mercurio)	Quality Index (Que Pasa)
JCR size of faculty (ln) (1 year lag)	0.949*** (0.062)	1.111*** (0.063)	1.028*** (0.047)	0.890*** (0.084)
Share of competitive funds over total income (shcf) (1 year lag)	-7.943 (5.205)	-7.397 (5.139)	-2.010 (6.009)	-3.753 (5.999)
Shares of student fees over total income (shsf) (1 year lag)	0.273 (0.313)	0.332 (0.291)	0.172 (0.284)	0.383 (0.501)
Quality (ln)	0.073 (0.058)	-0.903** (0.402)	-0.482 (0.295)	1.293** (0.604)
Constant	0.838*** (0.317)	1.551*** (0.476)	2.488** (1.147)	-0.776 (0.854)
Obs	120	125	125	80
R-Squared	0.730	0.731	0.726	0.816

Robust standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Regressions' results suggest that:

- (I) There seems to be evidence of increasing returns to research in Chile. This could explain why only few players (no more than five universities) dominate research performance and that probably any attempt to “democratize” research allocations in this context could lead to a serious loss in research efficiency.
- (II) There are almost constant returns to scale with regards to teaching activities. In other words, in regards to teaching small universities are as competitive as large universities.
- (III) There is a strong premium from competitive funding for research activities but not for teaching activities, while there is no premium from teaching funds in research, suggesting that specialized funding for research matters for research productivity and this can not be replaced by cross-subsiding from student fees.
- (IV) Quality matters for research activities, however results for teaching model are mixed and not conclusive regarding sign and significance. It is not clear which quality index could be better to use. However, from estimations of the research model, it could be possible to say that indexes made using quantitative data performs relatively better than survey indexes.
- (V) Results suggest evidence in favor of a two tier system for current Chilean universities, where there are few research (with centres of excellence) oriented universities co-evolving with a large set of more teaching (practical) oriented universities.

The above estimates confirm the a priori hypothesis that research-oriented universities within CRUCH constitute a league of their own, attaining patterns of behaviour which are significantly different from those of the CRUCH as a whole. This is indeed an interesting finding worth exploring further. This we do in our next section.

#### 3.4. A further look at research-oriented CRUCH universities.

Although the number of Chilean universities carrying out research activities is gradually expanding, the largest three public universities – U.de Chile, The Catholic University and the University of Concepcion – clearly dominate the scene when we consider the number of ICI and Scielo publications, and the number of R&D projects under execution.

A recent publication by the Chilean Academy of Science indicates that out of 9156 papers published by CRUCH universities over the period 2001-2004, 34% came from the University of Chile, 21% from the Catholic University, 13% from the University of Concepcion – i.e. these three universities taken together absorb 68% of the research output emerging from Chilean public universities between 2001 and 2004. They are being followed, at a long distance, by University of Santiago (7%), Universidad Austral (5%), Universidad Federico Santa Maria (3%), and a list of even smaller players among which we find the Catholic University of Valparaiso, Universidad Catolica del Norte, Universidad de Valparaiso and others.

**Table 10**  
Publications 2001-2004.

University	Publications
University of Chile	3123
Catholic University of Chile	1975
University of Concepción	1237
University of Santiago	725
Austral University	527
Federico Santa María University	293
Catholic University of Valparaíso	247
Católica del Norte University	226
University of La Frontera	216
University of Valparaíso	131
University of Antofagasta	139
University of Talca	99
University Andrés Bello	82
University of Los Lagos	66
University of La Serena	70

*Source:* Chilean Academy of Science, "Análisis y Proyecciones de la Ciencia Chilena" 2005

Considering the first five universities in Table 10 we now look at the relationship between size and performance, measured in terms of number of students, JCE faculty members, projects and publications. The results are presented in Tables 11 and 12.

**Table 11**  
Profile of the five biggest research-oriented universities in Chile, 2006

Indicator	University of Chile	Catholic Univ. of Chile	University of Concepción	University of Santiago	Austral University	Average
<i>Students</i>						
Numbers <sup>a</sup>	28,549	21,374	21,500	18,671	10,790	20,177
High scores (High school grades) <sup>b</sup> (%)	15.1	15.8	15.7	14.3	10.7	14.3
High scores (PSU score) <sup>b</sup> (%)	16.7	17.4	10.9	11.9	6.5	12.7
Graduates <sup>c</sup> (%)	13.4	16.8	12.4	17.5	10.8	14.2
PhD conferred <sup>d</sup>	85	56	44	25	15	45
<i>Faculty</i>						
Numbers <sup>e</sup>	3,589	2,615	1,466	1,983	948	2,120
Fulltime <sup>f</sup> (%)	49.1	62.8	81.0	42.0	69.8	60.9
PhDs <sup>g</sup> (%)	20.5	50.0	31.4	16.1	23.5	28.3
Fulltime PhDs <sup>h</sup> (%)	71.2	79.8	96.5	76.6	95.5	83.9
<i>Research</i>						
Projects <sup>i</sup>	384	280	134	108	55	192.2
Publications (ISI+SCIELO) <sup>j</sup>	3,244	2,233	1350	625	600	1,121

*SOURCES:* <sup>(a)</sup>, <sup>(c)</sup>, <sup>(d)</sup>, <sup>(e)</sup>, <sup>(f)</sup>, <sup>(g)</sup> and <sup>(h)</sup> (data for 2006) from CRUCH (2006); <sup>(b)</sup> Departamento de Medición, Registro y Evaluación (DEMRE), Universidad de Chile (2006), for the class entering university in 2006. High scores are students with more than 600 points out of 800 in the selection test.; <sup>(i)</sup> and <sup>(j)</sup> El Mercurio (2006)

**Table 12**  
 Graduates, R&D projects and publications per JCE faculty. Five biggest  
 research-oriented Chilean public universities.

	University of Chile	Catholic University	University of Concepción	University of Santiago	Universidad Austral
Students per JCE faculty	16.21	13.02	18.10	22.44	16.30
Publications per JCE faculty	1.84	1.36	1.14	0.75	0.91
Research projects per JCE faculty	0.22	0.17	0.11	0.13	0.08

We notice that the lion share of the R&D efforts performed by Chilean public universities is done by the five larger research oriented CRUCH universities, i.e. University of Chile, Catholic University, Universidad de Concepcion, Universidad de Santiago and Universidad Austral. We also notice that there is a slight indication of diminishing returns underlying the numbers hereby examined.

Having stated the above; however, we also notice that a number of smaller players is gradually joining the league of R&D performing universities. Although this appears to be yet a very incipient phenomena, the evidence indicates that UTalca, Federico Santa Maria, Universidad Catolica de Valparaiso, within the CRUCH group, and Andres Bello, Universidad del Desarrollo, Adolfo Ibañez and Diego Portales, among privately-owned universities, belong in this second 'tier' of R&D-performing Chilean universities. Looking further into this topic we have found evidence indicating that some of the newly arriving members of the R&D club have erected 'in house' R&D facilities in recent years – such as it is the case with the University of Talca which we examine in Section 5 – while other R&D performing CRUCH universities have joined the R&D league by subcontracting out research activities to external firms and professionals. This second entry strategy to the R&D league seems to reflect a short term maximization behavior intended to capture available fiscal resources for R&D activities without firmly committing resources from the university to the building of a costly 'in house' R&D infrastructure. The two strategies for entering the field of R&D seem to reflect quite different long term attitudes as far as developing and accumulating technological capabilities within the organization. This clearly constitutes an interesting finding deserving further future investigation.

We now close the present section with a final overview on market structure and performance.

### 3.5. A final overview: two dominant players and a fringe of (increasingly sophisticated) smaller competitors, fighting for market share.

Universities operate in highly competitive markets attempting in various different ways to expand their market share. This they do on the basis of product differentiation efforts of various sorts, enrolling more students, expanding the mix of academic disciplines they impart instruction, or do research, upon, opening up new branch campuses, and more. They use advertising expenses, gifts, and grants to attract students, much as producers of ordinary commodities do in conventional markets for goods and services.

They do operate in imperfectly competitive scenarios in which information asymmetries, a frail regulatory environment and lack of government control over quality of services and accreditation routines leave ample room for monopolist practices. Said practices end up negatively affecting consumers of university services and will have to be redressed in the forthcoming future.

Chilean university markets exhibit an overwhelming presence of two major players – U.of Chile and the Catholic University – which strongly dominate the scene differentiating themselves from the rest of CRUCH Universities. Their dominance is, however, increasingly challenged in present days by a fringe of rapidly growing smaller universities, both from CRUCH as well as from the private sector. Although the University of Chile and the Catholic University face an increasingly tough competition for students as well as for research funds from smaller universities they still belong in a class of their own, benchmarking their activities with ‘world-class’ universities operating in more developed countries. They act as with reference to a universal ‘meta production function’ for university activities, using number of publications in reputed journals, international citations and more to grade their professorial staff and teaching services vis a vis international standards.<sup>5</sup> In spite of the above, however, their market position is increasingly challenged by smaller public and private sector universities, which continue to open new campuses across Chile and also invading (as of recently) their own turf, i.e the metropolitan area of Santiago.

In actual fact a rapid proliferation of branch campuses has allowed many of the smaller public universities (and also quite a few private ones) to gain market share in recent times. This explains why the long term competitive situation of the dominant players has become increasingly complex in recent years. They no longer monopolize the scene and find that they have gradually to adapt to a tougher competitive environment.

As in any other area of economic activity in which imperfect competition prevails, location, product differentiation and economies of scale play a significant role explaining changes in firm strategy, structure and performance. In effect, we notice that falling unit cost of imparting education services tend to prevail in the initial stages of university expansion, as the professorial staff and the physical infrastructure appear as quite flexible and capable of absorbing more students and R&D projects. It is important to understand, however, that there is a limit to such flexibility and that a ‘saturation’ effect eventually sets in once the infrastructure and professorial staff reach a high level of utilization. University professors can work long hours, but they can not be asked to put with more than 50-52 hours work per week. R&D facilities might be shared by different researchers, but crowding out eventually appears affecting productivity. At that point further growth seems to require the appointment of new professors, the opening up of new teaching and research facilities, expanding the number of disciplines and programs being taught at the university, and so forth. These options involve complex changes in university structure and strategy. New branch campuses demand investment in buildings and infrastructure, (even if some universities have managed in recent years to get away with temporarily renting available commercial office space). As more students are admitted and new branch campuses are open in more distant regions, universities might be forced to enrol students with lower PSU examination scores, and this normally involves higher unit production costs, as remedial courses have to be taught. Thus, we could expect unit production cost to show discontinuous jumps as output capacity is expanded.

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<sup>5</sup> It is interesting to notice that both the U.of Chile and the Catholic University think of themselves as part of the rank of the best 500 universities world-wide, published yearly by the New York Times. No other Chilean public university sees itself as part of such league so far. Even though they compete fiercely for students and research funds in local markets they do not benchmark their operation by international indicators.

Hiring less expensive, or part time, professors might appear as an option, but that might have unknown implications in terms of quality of services. On the other hand, the regulatory environment in which universities operate strongly conditions the strategy universities decide to follow.. If accreditation requirements are not strong enough, universities might opt for catering for more students without strongly caring for quality. In such circumstances they might choose a 'low market entry' strategy which will allow them to maximize revenue in the short run, permitting them to generate the cash flow for further growth in the future. Situations of this sort have not been uncommon in Chile in recent years.. Given that university markets are plagued with information asymmetries and sunk costs affect student mobility across universities, short term profit maximization strategies have made possible a rapid rate of expansion of poor quality service providers. We notice that market outcome is the complex result of economic and institutional forces that co-evolve and retrofit on each other in the course of time.

#### **4. A SUMMARY OF FINDINGS .**

This final section of the paper presents in a sequential order some of the main findings of this enquiry. There is no attempt here to rank our results according to hierarchical importance or policy significance. Rather, what follows is a list of 'stylized' features of the Chilean university sector as emerged from our study.

1. The enquiry describes the transition of the Chilean university industry from a 'State-regulated' to a 'market-driven' policy regime. Such transition involved the best part of three decades and many new institutions and patterns of micro behaviour developed in the course of the process.

2. Throughout these thirty years the industry attained a remarkable success as far as growth is concerned. 60 universities now operate in Chile catering for a student population of more than 600.000 students. When the transition process began – early 1980's – Chile had less than 200.000 tertiary education students and two dozen universities catering for them.

3. The above indication of success is further stressed by the fact that it is in the lowest two quintiles of the distribution that entrance to university has been the largest. In effect, in the lowest quintile the percentage of youngsters aged 19-24 going to university has increased from 4 to 15% while in the next quintile it has done so from 8 to 21%. The average for the country is still in the region of 31% significantly below developed industrial nations where, on average, it doubles the above rate.

4. Both, a fast rate of GDP expansion – particularly so between 1984 and 1998, in which the Chilean economy grew at an average annual rate of 7% - and various different forms of credit and public subsidy account for the fast rate of expansion of the percentage of population accessing university education. The counterpart of the above is a fast rate of social upward mobility which obtained pari pasu with the expansion of a more sophisticated production structure in which many natural resource processing industries were started up and fastly moved closer to the international technological frontier. 'World-class' manufacturing enterprises came on stream in many of these industries demanding a wide variety of highly qualified human personnel.

5. The above process suffered a significant 'slow-down' in recent years, with the economy now expanding at a much lower rate per annum – in the region of 4% - than before, and with less new manufacturing plants annually opening up in the economy. There are also signs of a reduction in the pace of upwards social mobility.

6. The Chilean university sector strongly relies on private financing. Families end up absorbing as much as 80% of the cost of sending their youngsters to university, even if there are various sort of supporting mechanisms through which credits and public grants could be attained. This probably explains why the rate of morosity is quite high, placing Chile as an outlier in international comparisons.

7. Many new universities, particularly private ones, entered the market after the university industry was de-regulated in 1981, admitting private tertiary education service providers to join the market. From 178 in 1986 they grew to around 300 in 1990, falling down to 206 in more recent years. The pattern of expansion of the industry closely reflects the conventional 'life-cycle' path many industrial sectors have been shown to exhibit. An initial stage of very rapid expansion, followed by a 'slow-down' period in which fewer firms enter the market and by a third stage in which market structure attains the morphology of a mature oligopoly in which the rate of expansion of demand determines the rate of expansion of installed capacity.

8. Turning to quality aspects we notice that the university industry exhibits weak signs of progress. Only a small number of Chilean universities have attained accreditation in all six of the categories which demand 'peer evaluation' for 'full accreditation, and for period of seven years, which is the maximum allowed by law. The large majority of universities – including many public ones – has only attained institutional accreditation for a few years, but has not yet made visible progress in the accreditation of the full range of disciplines and teaching and research activities in which they operate. Much remains to be done on this front if quality of services and 'peer review' are to attain progress in the near future.

9. Total enrolment into university education is presently divided in a 40-60% proportion between public and private universities. It is the later – 35, out of 60 universities in total - which are growing much faster at present time. The 25 'public' universities that belong in CRUCH include 6 universities which in spite of receiving public fiscal support do in fact operate as private organizations in the sense that they do not have to respond to the Contraloria General de la Republica for their actions. This reflects a major institutional difference strongly affecting market behaviour and long term competitive strategy in both segments of the CRUCH group.

10. There is a great deal of variance among CRUCH universities in size, output mix (teaching, research and consultancy), number of disciplines in which they operate, regional diversification, quality of services, accreditation status and more. Some of them exhibit a low figure of students per JCE faculty (a 'proxy' hereby taken as an indication of 'quality') in the region of 13 or 14, while others double such figure and operate in the region of 30 or more students per JCE faculty.

11. Chilean university markets have become highly competitive, with universities fighting each others for students, research funds, fiscal resources and more. This they do on the basis of advertising, gifts, grants and so forth, as in any other market in the economy. It is important to notice, however, that the nature of competition in the market for education services is not really close to the 'conventional' image we have as to what a competitive market is all about. Asymmetric information between supply and demand for education services, sunk costs affecting consumer choice, highly different 'initial

entitlements' among students reflecting income and cultural differences among different segments in society and more clearly influence market outcome. This is why the idea of an un-regulated market for education services is far from realistic. Competition among service providers is not a sufficiently strong disciplinary instrument for market governance.

12. Two large CRUCH members – The University of Chile and the Catholic University of Chile – dominate the market for education and research services. Although their market position is increasingly being eroded by a small group of public and private universities 'climbing the ladder' as far as teaching and research is concerned, they still control much of the action on both fronts, teaching and research. This conclusion is supported by econometric results of research and teaching models presented in Section 4.3.

13. Econometric estimations of the models suggest that there are increasing returns to research in Chile. This could explain why only few players (no more than five universities) dominate research performance and that probably any attempt to "democratize" research allocations in this context could lead to a serious loss in research efficiency. For the teaching model there are almost constant returns to scale. In other words, in regards to teaching small universities are as competitive as large universities. Additionally, there is a strong premium from competitive funding for research activities but not for teaching activities, suggesting that specialized funding for research matters for research productivity and this can not be replaced by cross-subsiding from student fees. Quality matters for research activities, however results for teaching model are mixed and not conclusive regarding sign and significance.

14. Previous results also present evidence in favor of a two tier system for current Chilean universities, where there are few research (with centres of excellence) oriented universities co-evolving with a large set of more teaching (practical) oriented universities, supporting our prior hypothesis.

15. Five CRUCH universities - the University of Chile, The Catholic University, University of Concepcion, Universidad de Santiago and Universidad Austral – control around 80% of total university expenditure in R&D activities. These five universities are the recipients of a similarly large fraction of the R&D projects annually accepted by Conicyt for support, as well as of the student grants for graduate and post graduate training.

16. A second 'tier' of smaller universities – both public and private – is currently joining the league of R&D performing universities even if their involvement in the above is still small in absolute terms. Different strategies seem to prevail among universities in order to enter the R&D club.

17. As far as 'climbing the ladder' is concerned we notice that different business models have emerged in recent years. 'Initial conditions' and 'path dependency' play a major role affecting the way in which universities deploy their efforts searching for a workable combination of 'mission' (quality of services) and resource availability. History and traditions and 'embeddedness' in the country's political thread influence the set of opportunities and constraints each university has to deal with in the quest for quality. No doubt this is part of the explanation of why university markets in Chile show such a strong dominance of the University of Chile and of the Catholic University. They can regulate their admission policy capturing among both of them nearly 40% of the 27.500 AFI students yearly selected by their best entrance examination scores

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