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Boosting Austria's Innovation Performance

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BOOSTING AUSTRIA'S INNOVATION PERFORMANCE

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By Willi Leibfritz and Jürgen Janger

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Abstract/Résumé

Boosting Austria's innovation performance

Enhancing growth through more innovation has become a priority for Austrian policy makers in line with European policies as laid down in the Lisbon Agenda. This paper discusses Austria's innovation performance, its innovation policies, and general framework conditions for innovation and growth. Austria has increased its R&D spending as a share of GDP over the last ten years, largely reflecting more business R&D, and aims at increasing it further to 3% of GDP by 2010. Innovation activity as measured by output indicators has also improved in various fields, including the number of innovating SMEs. Furthermore, policy instruments and institutions have been improved and a culture of policy evaluation is developing. However, the paper identifies some weaknesses, particularly in general economic framework conditions, which may limit the creation and diffusion of innovation and productivity growth. It suggests focusing more on these framework conditions, notably by strengthening competition in non-manufacturing product markets, such as retail and professional services, reducing the cost of firm creation and improving human capital. It also argues that focusing on a numerical target for R&D spending as an end in itself is very unlikely to be cost effective. With its university reform in 2002, Austria has made a major step in improving the efficiency of tertiary education but more needs to be done.

This Working Paper relates to the 2007 OECD Economic Survey of Austria (www.oecd.org/eco/surveys/austria).
JEL classification: H2, J2, O30, O31, O33, O38, Q40, Q43, Q52
Keywords: Innovation, Research and Development, Technological Change, Economic Growth, Productivity, Subsidies, Tertiary Education, Competition.

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Comment améliorer la performance de l'Autriche en matière d'innovation

Dans le droit fil des politiques européennes prévues par la Stratégie de Lisbonne, le renforcement de la croissance par un surcroît d'innovation est devenu une priorité pour les responsables autrichiens de l'action publique. Nous abordons dans le présent document les performances et les politiques de l'Autriche en matière d'innovation, ainsi que ses conditions-cadres pour l'innovation et la croissance. En pourcentage du PIB, le pays affiche sur la décennie écoulée une augmentation des dépenses de R-D largement imputable à une progression de la R-D dans les entreprises, et s'est fixé pour objectif de l'accroître encore à hauteur de 3 % du PIB d'ici 2010. À l'aune des indicateurs de production, les activités d'innovation ont connu des améliorations dans différents domaines, et le nombre de PME innovantes notamment a progressé. Les autorités ont également fait évoluer les moyens d'action et les institutions publiques, et une culture de l'évaluation des politiques menées se met en place. Nous détaillons cependant quelques points faibles qui, en particulier sous l'angle des conditions-cadres économiques, sont susceptibles de restreindre l'éclosion et la diffusion de l'innovation, ainsi que la croissance de la productivité. Nous suggérons d'axer davantage l'action sur ces conditions-cadres, notamment en renforçant la concurrence sur les marchés de produits non manufacturés tels que le commerce de détail et les services assurés par les professions libérales, en diminuant les coûts liés à la création d'une entreprise et en valorisant le capital humain. Nous indiquons par ailleurs que l'assignation aux dépenses de R-D d'un objectif numérique considéré comme une fin en soi a très peu de chances d'être économiquement rentable. Avec la réforme universitaire engagée en 2002, l'Autriche a franchi une étape cruciale sur la voie de l'amélioration de l'efficience de son enseignement supérieur, mais elle doit encore fournir d'autres efforts.

Ce Document de travail se rapporte à l'Étude économique de l'OCDE de l'Autriche, 2007 (www.oecd.org/eco/surveys/autriche).
Classification JEL : H2, J2, O30, O31, O33, O38, Q40, Q43, Q52
Mots-clés : Innovation, Recherche-développement, Changement technologique, Croissance économique, Productivité, Subventions, Enseignement supérieur, Concurrence.

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IMPROVING INNOVATION

By Willi Leibfritz and Jürgen Janger[1]

Introduction

Austria belongs to the group of highly advanced OECD countries. It has achieved this position by raising productivity while at the same time preserving a relatively high employment rate. Historically, Austria has achieved its catch-up with relatively low R&D spending. Its industrial structure is biased towards sectors which are classified as medium-tech while the share of manufactures which are classified as high-tech in total manufactures is below the EU and OECD averages. This has caused people to talk of an Austrian "growth puzzle" or a "structure-performance paradox" (Peneder, 2001). It is not clear, however, if there is such a puzzle (see also Tichy, 2001a). First, Austria succeeded in raising its productivity largely through capital accumulation and improving the skill level of the workforce (mainly through expansion of secondary schooling and vocational training) while keeping wage levels lower than in other developed countries, notably neighbouring Germany and Switzerland (see OECD, 2007 and Aiginger *et al.,* 2006**)**. Second, while R&D spending was low, Austrian firms adopted and modified new technologies which were often developed abroad, suggesting that Austria was relatively successful at technology diffusion from abroad. Third, Austria was successful in modernizing its industrial structure which was originally dominated by large state-owned enterprises in heavy industries. Fourth, the classification of Austrian industry as mainly medium-tech may not do full justice to the reality; many medium-sized Austrian firms are very successful in niche markets with products and processes which are at or close to the technological frontier, even if they belong statistically to sectors which are not classified as high-tech.

While this "growth model" has been successful during the catch-up period, it may need to be adjusted to preserve Austria's position as a high income (and high cost) economy. Indeed, during most of the 1990s and so far this decade, Austria's growth of GDP per capita fell behind that of a number of other advanced OECD countries, including the United States and the Nordic countries, not to speak of fast growing Ireland**.** Like many other countries, Austria also has to cope with an ageing population and a declining workforce, and thus faces the challenge to sustain growth in living standards by further raising productivity while, at the same time, ensuring high employment of its labour potential.

Enhancing growth through more innovation has become a priority for Austrian policy makers in line with European policies as laid down in the Lisbon Agenda. A major measure to achieving this is a proposed increase in R&D spending to 3% of GDP by 2010 which would also meet the Lisbon target.

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1. At the time of writing Willi Leibfritz was Head of CS3 Division in the Economics Department of the OECD and Jürgen Janger was an economist, seconded from the Austrian National Bank. This paper draws on material originally produced for the *OECD Economic Survey of Austria*, published in July 2007 under the responsibility of the Economic and Development Review Committee. The authors are indebted to their former colleagues for valuable comments on earlier drafts, in particular to Val Koromzay, Andrew Dean, Mike Feiner, Rauf Gonenc and Gernot Hutschenreiter and to the Austrian authorities for providing important information. Special thanks go to Roselyne Jamin for technical assistance and to Nadine Dufour and Therese Walsh for technical preparation.

Increasing R&D spending can help boost total factor productivity (TFP) growth, which is one reason why the government has given high priority to such spending. However, setting numerical R&D spending targets also poses the risks of encouraging inefficient spending, in particular if these are to be reached in a relatively short time. Furthermore, providing more subsidies to business R&D may not be enough to raise growth as long as innovation and productivity are constrained by general framework conditions. Focusing too much on R&D spending may also overlook complementarities between R&D and framework conditions and may neglect innovation in areas which rely less on formal R&D, such as in some service sectors. Work by the OECD suggests that framework conditions and general policy settings that favour human capital formation, competition in product markets and efficient capital markets are essential for long-term growth and are as important, or sometimes more important, for innovation and productivity growth than science policies and specific R&D promotion (OECD, 2006a). *The government should therefore make sure that the objective of increasing R&D spending does not compromise the efficiency of government R&D support and it should also put more emphasis on improving framework conditions for the creation and diffusion of innovation in all areas of the economy.*

This paper first provides an assessment of Austria's innovation performance by looking at the various input and output indicators in international comparison. The second section discusses some areas of framework conditions which appear to be particularly important for innovation, such as product market competition, the conditions for the creation of innovative firms and human capital. The last section examines government policies to boost innovation and discusses how policies could be further improved to facilitate innovation. The paper concludes with a set of policy recommendations (Box 4).

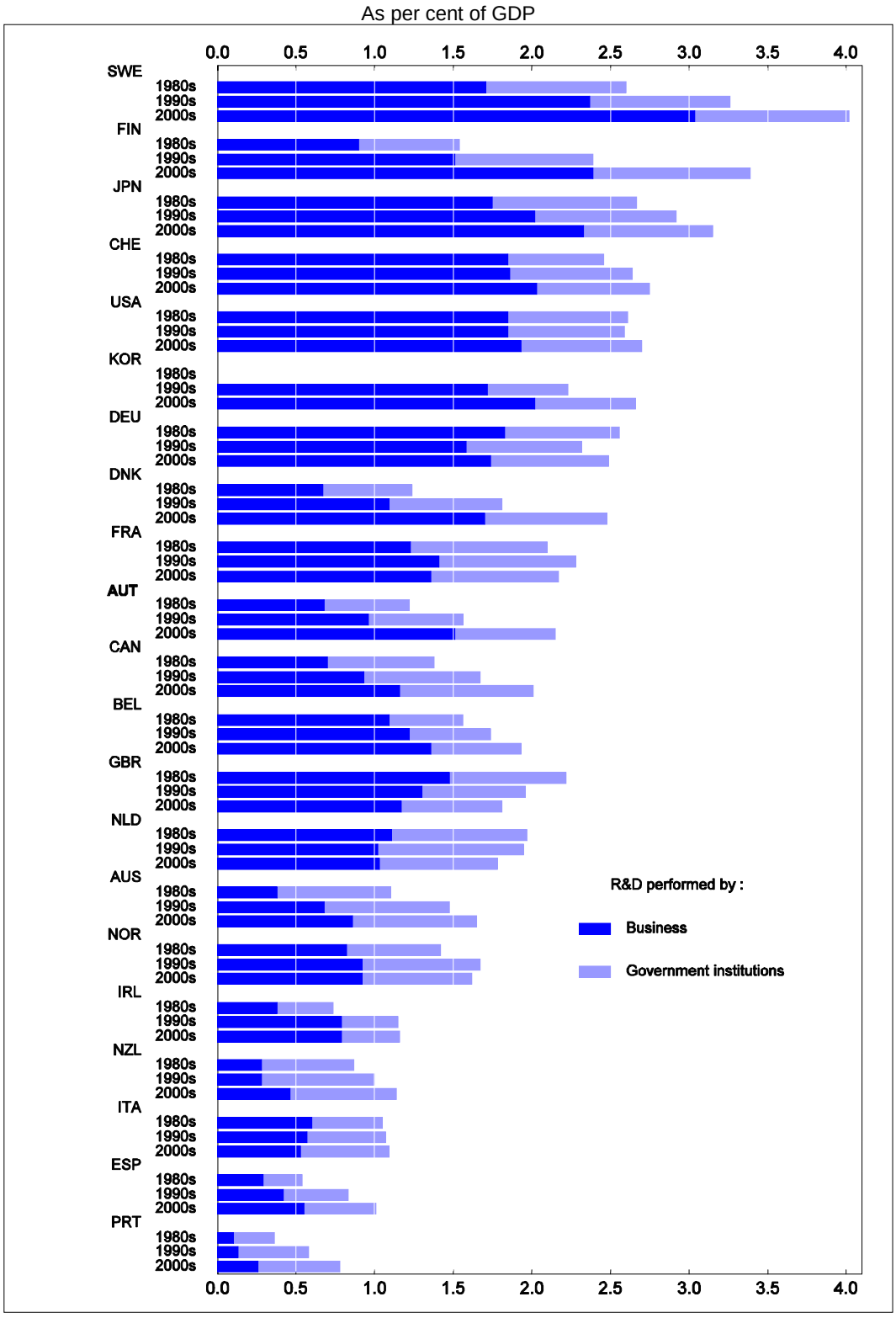
Assessing Austria's innovation performance

While innovation activity is increasing…

Austria has seen an impressive growth of its R&D spending over the last ten years from 1¼ per cent of GDP in the 1980s to 2¼ per cent in 2000-05, reaching 2.4% in 2006; even so, it remains considerably lower than in some other smaller European countries, notably Sweden and Finland, but also Denmark and Switzerland (Figure 1). The increase in Austria's R&D spending largely reflects greater spending by business while the share of government spending in total R&D spending has declined. This is a positive development as business R&D is generally thought to be more directly linked to economic performance (OECD, 2003), although there is also some evidence for positive effects of government funded research (Guellec and Pottelsberghe, 2004). The breakdown of business R&D spending by sectors indicates that the share of the service sector in business R&D spending is in line with the OECD average of about a quarter. However, a good part of this spending is targeted at raising productivity in the manufacturing sector.[2]

2. Austria has a relatively large "cooperative sector" which includes the so-called "competence centres", which are research organisations that are sponsored by both the government and business and aim to link science institutions and firms. This sector also includes public research organisations which carry out research commissioned by firms (Austrian Research Centres, ARC). The cooperative sector is fully included in the business service sector, all of its R&D spending is recorded there. Many competence centres and also ARC carry out manufacturing-oriented research in fields like electronics, metals, cars or wood. Out of 17 K-plus centres, more than three-quarters work in manufacturing related research fields (www.ffg.at).

Figure 1. Austria's R&D spending in international comparison[1]



1. Ranked by the total expenditure on R&D in the 2000s (average 2000-05 or latest available data).

Source: OECD, *OECD Science and Technology Indicators*.

While overall R&D spending has increased, innovation activity as measured by output indicators has also improved in a number of fields. For example in trademarks, industrial designs and the number of innovating SMEs, Austria's performance is much above EU15 average. The latest European Innovation Scoreboard (EIS) includes Austria in the group of countries classified as "innovation followers" with a level and improvement of innovation (measured by the level and change of a summary index of innovation input and output indicators) close to the average EU25 performance. By contrast, four of the other smaller European countries, Sweden, Finland, Switzerland and Denmark are classified by EIS as "innovation leaders" (together with Japan and Germany) (Figure 2) (www.proinno-europe.eu/doc/EIS2006_final.pdf). Overall, Austrian firms and science institutions seem to be well integrated with international R&D activities as illustrated by their participation in the EU framework programmes and international co-authorship of patents (Bundesministerien, 2006). The fact that a third of business R&D expenditure is financed by foreign firms also shows that Austria is able to draw on the innovation activities of multinationals.[3] Furthermore, industry is also gradually shifting its structure towards medium-high tech sectors and is adopting more science and frontier technologies (Peneder, 2001; Bundesministerien, 2006).[4] In addition, small and medium-sized Austrian firms in niche markets have succeeded in upgrading their products and processes by enhancing their technological content, while remaining in their main area of activity.[5]

However, the international comparisons of framework conditions reveal a number of weaknesses which may limit the creation and diffusion of innovation and productivity growth in general. Three areas stand out where Austria's performance deviates most from best-performing OECD countries: *i)* lack of exposure to trade and restrictions to competition in parts of product markets, notably in several services, thus reducing productivity growth; *ii)* obstacles to the creation and growth of innovative firms including administrative barriers for firm creation and the underdeveloped venture capital market; *iii)* weaknesses in human capital at the lower and the higher levels. This is illustrated by large differences in the quality of education according to the social origin of pupils and types of schools, which creates pockets of low productivity,[6] and a low share of tertiary education of the population and relatively few graduates in science and engineering which may restrain innovation.

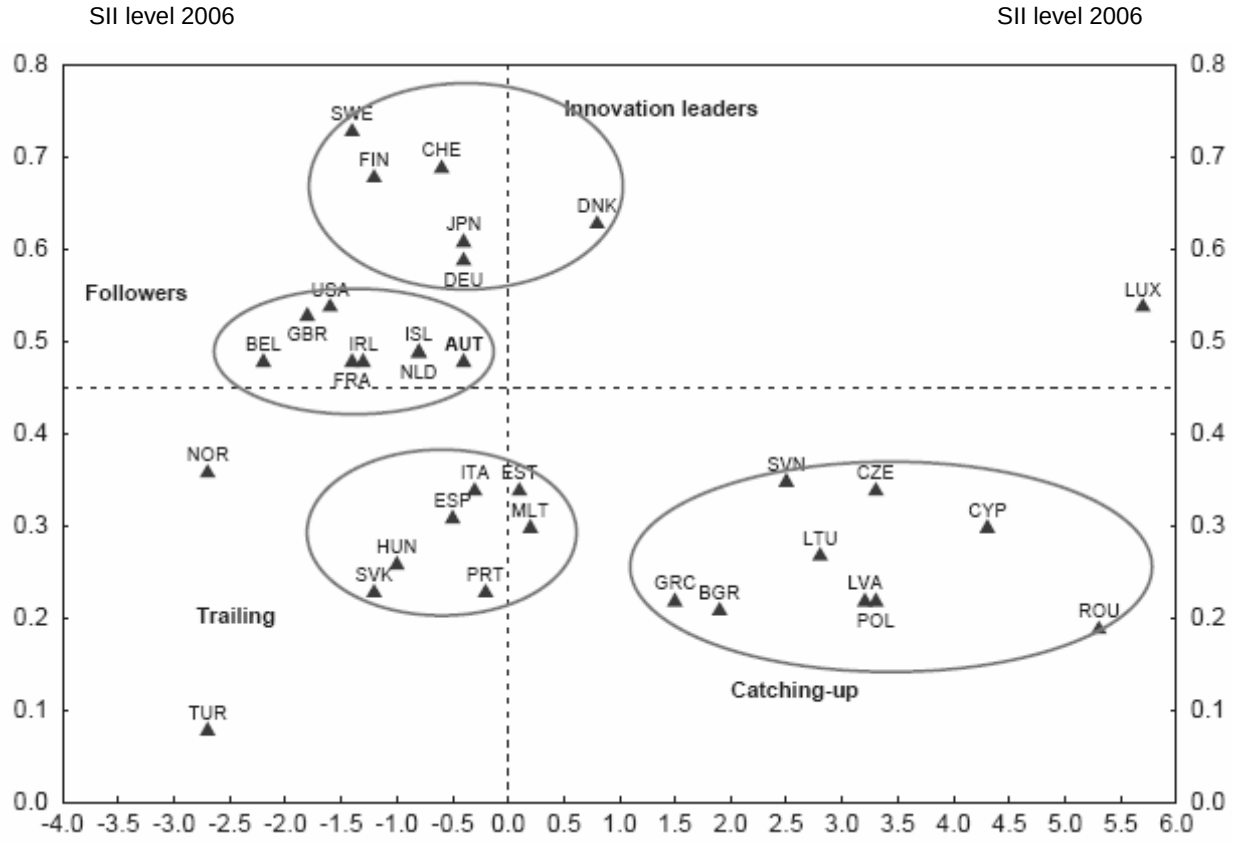
3. It has, however, been argued that this makes innovation activity in Austria more vulnerable to external influences than in countries where the share of domestic firms in innovation activity is larger. But the fact remains that Austria is an attractive location for innovative multinationals.

4. It has been argued, that innovation of Austrian firms tends to be incremental and modifying rather than radical (Tichy 2001b), a view which is also supported by the relatively low share of new products in overall Austrian firm sales. However, there is also some evidence that such innovation characteristics vary more between sectors than between countries (Breschi *et al.*, 2000), implying that sectoral specialisation determines to a large extent country results.

5. Examples for such niche firms include the manufacture of snow cannons, very low energy consumption housing, car parts for racing cars, airplane components and innovative use of wood for housing. Recently, a growing biotech sector based on spin-offs from excellent basic research institutes is emerging.

6. See Chapter 3 of OECD (2007), for a more detailed discussion.

Figure 2. Level and change in the Summary Innovation Index



Source: Maastricht Economic Research on Innovation and Technology, and Joint Research Centre of the European Commission, European Innovation Scoreboard 2006, Comparative Analysis of Innovation Performance.

… productivity growth has continued its moderate decline

Growth of total factor productivity (TFP) is generally used as a proxy for the growth effect of innovation (*i.e*. technical progress) although it has to be borne in mind that it is estimated as a residual in growth accounting frameworks by eliminating the growth contributions of changes in factor inputs and may therefore also include other effects that are not related to innovation. There is clear evidence that R&D investment has a positive impact on TFP growth although it takes time for the full effects to become visible (Guellec and Van Pottelsberghe de la Potterie, 2004; Griliches, 1992; OECD, 2003; Wieser, 2005).

Austria's TFP growth has remained lower than in a number of other high-income OECD countries and has continued its moderate downward trend over the past 15-20 years, while some other OECD countries including the Nordic countries have seen an acceleration of TFP in the mid-1990s (OECD, 2007). It is unclear to what extent exogenous factors have affected Austria's overall growth and its TFP growth. For example, the prolonged period of low growth of the German economy (which only ended recently) could have restrained Austria's output and TFP growth since the mid-1990s. On the other hand, Austria's EU accession and the opening up of central and eastern European countries appears to have increased its output and TFP growth in the 1990s, although these integration effects may have weakened in recent years. Nonetheless, the fact that Austria's trend TFP growth has remained flat during the 1990s while it accelerated in other benchmark countries points to possible weaknesses in Austria's innovation system,

and/or in its general framework conditions for productivity growth. It is noteworthy that the relatively weak trend TFP growth in Austria has been going hand in hand with low or even negative TFP growth in some service sectors (OECD, 2007 and Peneder *et al*., 2006).

Improving framework conditions for innovation

The analysis so far suggests that Austria's innovation performance is mixed, with some indicators showing clear improvements while others, including TFP growth, are pointing to weaknesses. This suggests that there is room for improving growth by raising productivity. For Austria as a small country with a number of large firms, including foreign multinationals and many small and medium-sized firms, it is of particular importance to facilitate innovation diffusion, *i.e.* the widespread and effective use of new technologies, being created either domestically or abroad. This section discusses some areas where innovation creation and diffusion may currently or in the future be restrained by unfavourable framework conditions.

Reducing product market restrictions

Competition is an important driver for innovation.[7] Restrictive product market regulations can slow innovation through restraining the diffusion of new products and best practice production techniques within the country and across borders. In times of rapid technological change, as since the 1990s, the detrimental effect of restrictive product market regulations on the diffusion of innovation, including Information and Communication Technologies (ICT), is particularly large.[8]

Austria has broadly followed the OECD-wide trend toward more liberal product market regulations, in line with EC Directives and the opening up of network industries, such as telecommunications which reduced prices and increased productivity. Overall, the OECD economy-wide product market regulation indicator suggests a middle of the road position. However, regulations in service sectors remain restrictive, in particular in retail (large outlet regulation, licenses and permits, opening hours), liberal professions and railways (see the 2003 and 2005 OECD *Economic Survey*s *of Austria*). These regulations reduce productivity not only in the respective sectors, but also in sectors which are economically linked with the regulated sectors. Recent OECD work suggests that in Austria the impact of restrictive regulations on ICT-using sectors has been particularly large (Figure 3).[9] Austria has made welcome steps to reduce entry

7. As is well known, the most famous Austrian economist, Josef Schumpeter, not only emphasized radical innovation and its effect of "creative destruction" as the main driver of growth, but also initiated a controversial discussion about the relationship between competition and innovation. He argued that large firms in monopolistic markets drive innovation as they have the financing means and are also able to reap the return of their invention which would not be possible in competitive markets. This view was rejected by later theoretical and empirical studies including work by the OECD (Jaumotte and Pain, 2005) which found a positive relationship between competition and innovation. Aghion et al. (2005) argue that the relationship between competition and innovation is not linear but shaped as an inverted U. The relation between firm size, market structure and R&D activity depends, furthermore, on a number of factors including the regime of property rights;. For a recent survey of the literature see Gilbert (2006).

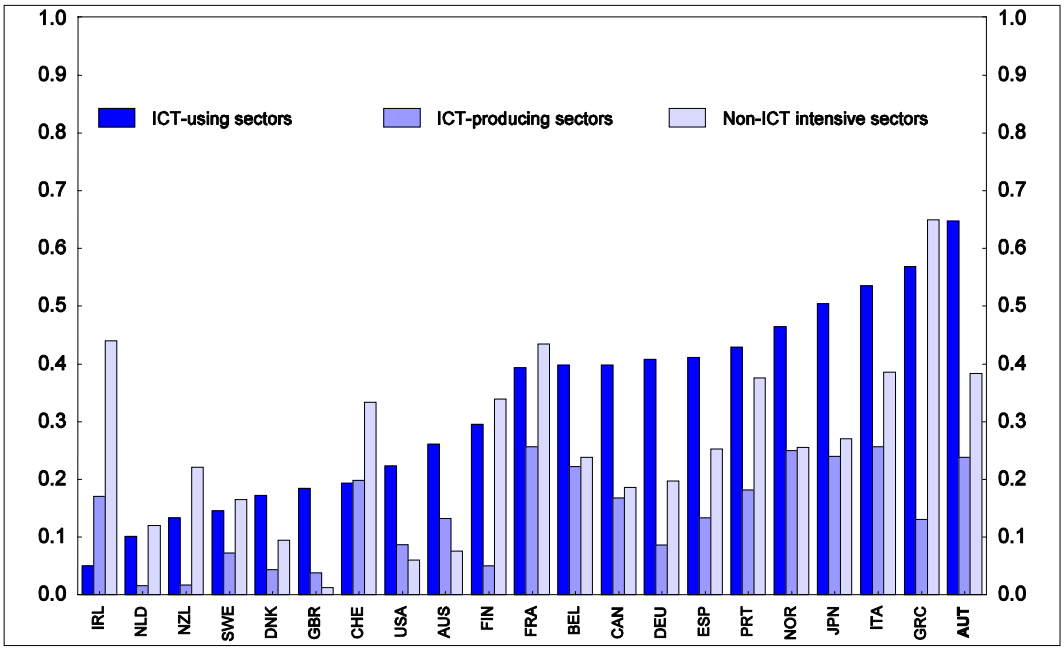
8. Conclusions in this sub-section are based on recent OECD work as presented in Conway *et al*., 2006; Conway and Nicoletti, 2006a; and Conway and Nicoletti, 2006b.

9. The regulation impact indicators as shown in this figure have been estimated for 21 OECD countries over the period 1975-2003 and reflect the "knock-on" effects of regulation in the following non-manufacturing sectors over this period: Airlines, Telecom, Electricity, Gas, Post, Rail, and Road. In addition, static indicators of regulation in the following sectors in 1998 have also been used in the construction of the regulation impact indicators: retail trade, financial markets (2005), and the professional services (accountancy, legal services, engineering, and architecture). The relatively high value of the regulation

barriers in service sectors, but much more remains still to be done, also keeping in mind that many other countries are moving ahead quickly in this area. As a result, Austria may still benefit much less from general purpose technologies than countries with less restrictive regulations.

Figure 3. The impact of non-manufacturing regulation[1]

2003



1. Scale normalised to 0-1 from least to most restrictive of competition. These data are the simple averages of the regulation impact indicators for the individual industries including in ICT-producing, ICT-using and non-ICT intensive sectors in 2003. In order to ensure comparability of data in some cases – including Austria – data from the 1998 questionnaire responses were used.

Source: OECD, Economics Department, Working Papers No. 530.

These findings may help to explain why Austria's ICT investment has been relatively low. Regulations also restrain complementary innovation which is necessary for reaping the full benefits of ICT investments in terms of productivity growth. This is confirmed by the analysis of the KLEMS database[10] which points to lacking complementary organisational changes in Austria to maximise the productivity impact of ICT investment (Peneder *et al.*, 2006). General competition law and policy have lagged, as shown by the new synthesis indicator that places Austria at the bottom end of the OECD (See OECD, 2007). To improve the overall competition framework, it is considered to simplify the institutional set-up by merging the competencies of the Federal Cartel Attorney with those of the Federal Competition Authority. With respect to the Authority's resources, an increase of staff is intended for the years 2007 and

impact indicators in ICT-using sectors in Austria *in part* reflects restrictive regulation in the professional services. Full details are given in OECD Economics Department Working Paper 530.

10. This EU database attempts to include the maximum number of factors of production that will be possible to take into account by integrating quantity and "price" data from the national accounts with other detailed information on outputs and inputs of capital (K), labour (L), energy (E), intermediate inputs (M), and services (S) (hence the acronym KLEMS). By analysing these data, one can assess the national policies aiming towards the European goals of competitiveness and economic growth as established by the Lisbon (2000) and Barcelona (2003) summits.

2008. It is also evaluated how the Authority's investigating capacities could be strengthened. These intentions go in the right direction. *Austria should improve its overall competition framework by simplifying the institutional set-up, giving more powers to the Federal Competition Authority to strengthen enforcement* (OECD, 2007a). *Austria should ensure timely transposition of EU directives relating to postal services and services in general.*

Reducing barriers to FDI inflows

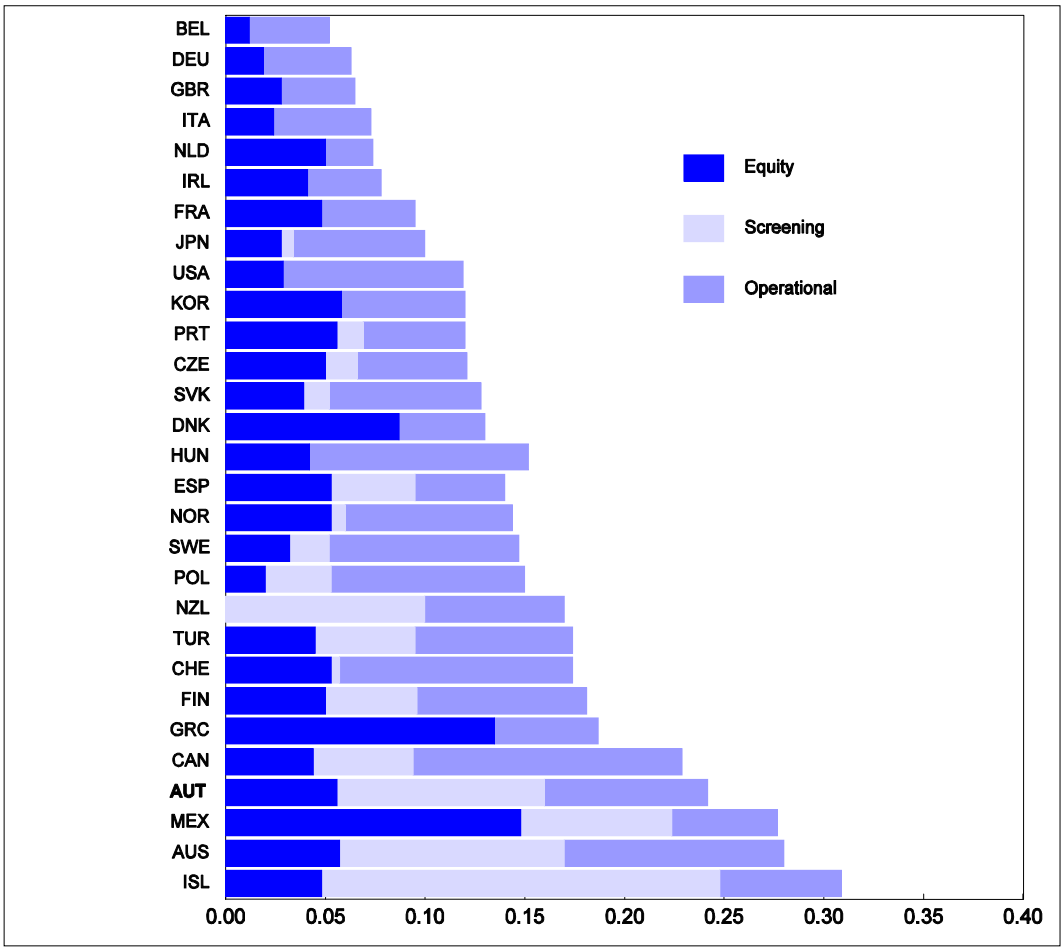
The establishment of foreign affiliates is generally considered to be beneficial for domestic productivity growth. Apart from direct productivity effects, foreign affiliates may also contribute indirectly to domestic productivity growth by generating positive spillovers for local firms. For example, foreign affiliates may speed the diffusion of new technology and management practices across borders or train labour that is subsequently employed by local firms. For services, in particular, FDI is also an important channel for exposure of domestic firms to foreign competition, when cross-border trade is physically impossible or limited. Regulatory policies that restrict market access or reduce the potential returns to foreign investment reduce inward FDI in OECD countries (Nicoletti *et al*., 2003).

In Austria, both inward FDI flows and stocks have been increasing but continue to be below the EU average and also below countries of similar size and level of development such as Finland, Sweden or Denmark.[11] One reason could be that until the early 1990s Austria was at the border of the "Iron Curtain" and thus a less interesting location for investors from Western countries while, after the opening, low-wage central and eastern European countries attracted most FDI from western European countries. However, Austria's relatively restrictive FDI regulations, esp., limits to foreign ownership in professional services and other restrictions, may also have restrained FDI inflows. In a welcome move, the government has recently dropped a screening requirement, which however is not yet reflected in the FDI regulatory restrictiveness index in Figure 4. *Likewise other, overly restrictive FDI regulations should be dropped, in particular limits to foreign ownership in the liberal professions and services more generally*.

11. Three-quarters of the total inward FDI stock is in services, particularly in trade, banking and insurance as well as business services, up from two-thirds ten years ago.

Figure 4. Nine-sector FDI regulatory restrictiveness by type of restriction[1]

2006



1. Scale 0-1 from open to closed sector. This aggregated index covers the following sectors and sub-sectors: Business (legal, accounting, architecture and engineering services); Telecommunications (fixed line and mobile); Construction; Distribution; Finance (insurance and banking); Tourism; Transport (air, maritime and road); Electricity and Manufacturing.

Source: OECD, *International Regulation* database.

Facilitating the creation and growth of innovative firms

Firm dynamics are an important channel for the adoption and use of new technologies. If new innovative firms enter the market and grow together with existing innovative firms while less productive firms exit the market, productivity increases. In services, particularly those related to ICT, firm dynamics are generally higher than in manufacturing, implying that the service sector is particularly vulnerable to restrictive entry and exit regulations (OECD, 2005a; Brandt, 2004).

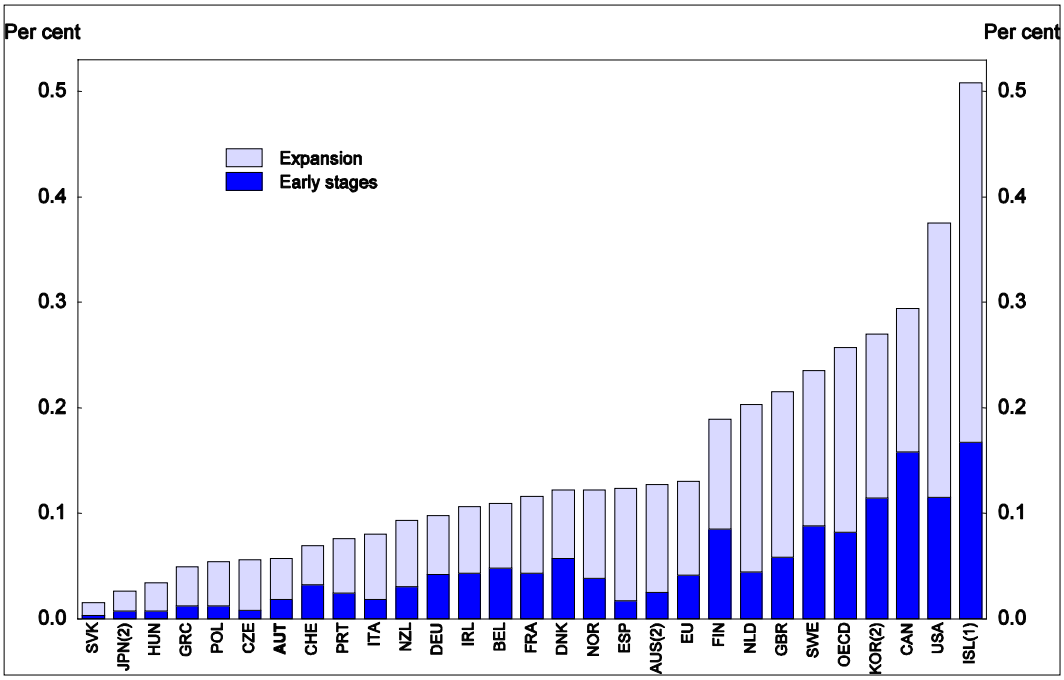
The government is fostering the entry of innovative and technology-oriented firms through a host of different policies. Besides the general promotion of SMEs and firm creation by granting reduced social security contributions and offering coaching programmes and other support, there is a relatively dense network of technology centres which provides cheap infrastructure and pooled services for new firms (see

below). But the effectiveness of these policies is likely to be diminished due to various obstacles to the creation of innovative firms. Although overall firm creation in Austria is average in international comparison (Hölzl *et al.*, 2006), there is some evidence that most of the new firms are not very innovative. In 2005, over 80% of all market entries have been one person firms which may have only limited innovative capacity. A major reason could be that entry regulations for limited companies are burdensome, in terms of administrative costs, minimum capital requirement and duration of procedures (see OECD, 2007 and 2007a)**.** The legal form chosen for a start-up may also impact on its growth prospects. Furthermore, post-entry performance of new firms is disappointing, although Austria shares this feature with many European countries – in contrast to the US.

The fact that venture capital investment in Austria is much below average also suggests a relative lack of innovative activity of newly created firms (Figure 5).[12] The underdevelopment of the venture capital market can be seen as a result of lack of finance for risky activities, structural inefficiencies in the market and/or lack of profitable innovative projects. According to the third Community Innovation Survey, more small firms in Austria are reporting financing shortcomings than in other countries, which points to the relevance of the first two factors. While rules governing the amount which pension funds and insurance funds can invest in venture capital funds are now sufficiently flexible, banks continue to dominate as the main source of funds and are often the mother companies of venture capital funds. As traditional banks may be relatively risk averse, their venture capital funds may also have a bias towards funding less risky firms and projects.

Figure 5. Venture capital investment, 2000-03

Per cent of GDP



1. Data from 2000-02.

2. Data from 1998-2001.

Source: OECD (2005), *OECD Science, Technology and Industry Scoreboard*

12. Venture capital and equity financing matter more for risky innovative start-ups in the service sector because they generally have little collateral for bank loans (OECD, 2001).

Austria created its own legal form for venture capital funds in the mid 1990s which prevents double taxation of dividends. However, as this form is not compatible with EU state aid rules, it has been changed. *The government should thus create new fund structures which are compatible with EU rules and in line with international best practice so as to facilitate the operation of venture capital funds (see e.g. Brandner et al. 2007).* In addition to fund structures, skills of national venture capital fund managers are very important. Although the Austrian venture capital industry is still relatively young, there is some evidence that its efficiency is improving. More openness to international venture capital investors may contribute to the further diffusion of this very special "know how".

At the downstream level, liquid exit markets are important to enable the selling of the stake in the firm. The Austrian stock market is gradually catching up to the more developed markets in some neighbouring countries which should facilitate such selling of stakes. Nevertheless, the fact that family-owned SMEs are often reluctant to accept private equity investment and then initial public offerings (IPOs), which are often tantamount to some loss of control of the firm, remains as a major hindrance for a more dynamic venture capital market.

Deepening of the capital market by further developing the stock market would generally facilitate equity financing, which is of particular importance for the financing of more fundamental innovation and the development of young innovative firms (Müller and Zimmermann, 2006). Although stock market capitalisation has grown impressively over recent years from 15% of GDP in 2002 to 57% in 2006, Austria still shows lower levels than the EU25 (90%) or other small open economies such as Sweden at 100% or the Netherlands at 111%. Austrian firms continue to raise relatively limited funds by issuing new shares and have a relatively high share of debt financing (ECB, 2007). Low equity ratios, in particular of small firms in Austria, are most probably explained by the nature of creditor protection and not different taxation rules for loan and equity financing (Dirschmid and Waschiczek, 2005). *The government should thus strengthen legal protection of minority equity holders and creditors.* Further development of the Austrian stock market would be facilitated through further privatisations, *e.g.* of the former state monopolies in post and telecommunications. A survey among Austrian firms concludes that, overall, the number of firms using the stock exchange as a financing instrument could significantly increase (Schneider *et al.*, 2005).

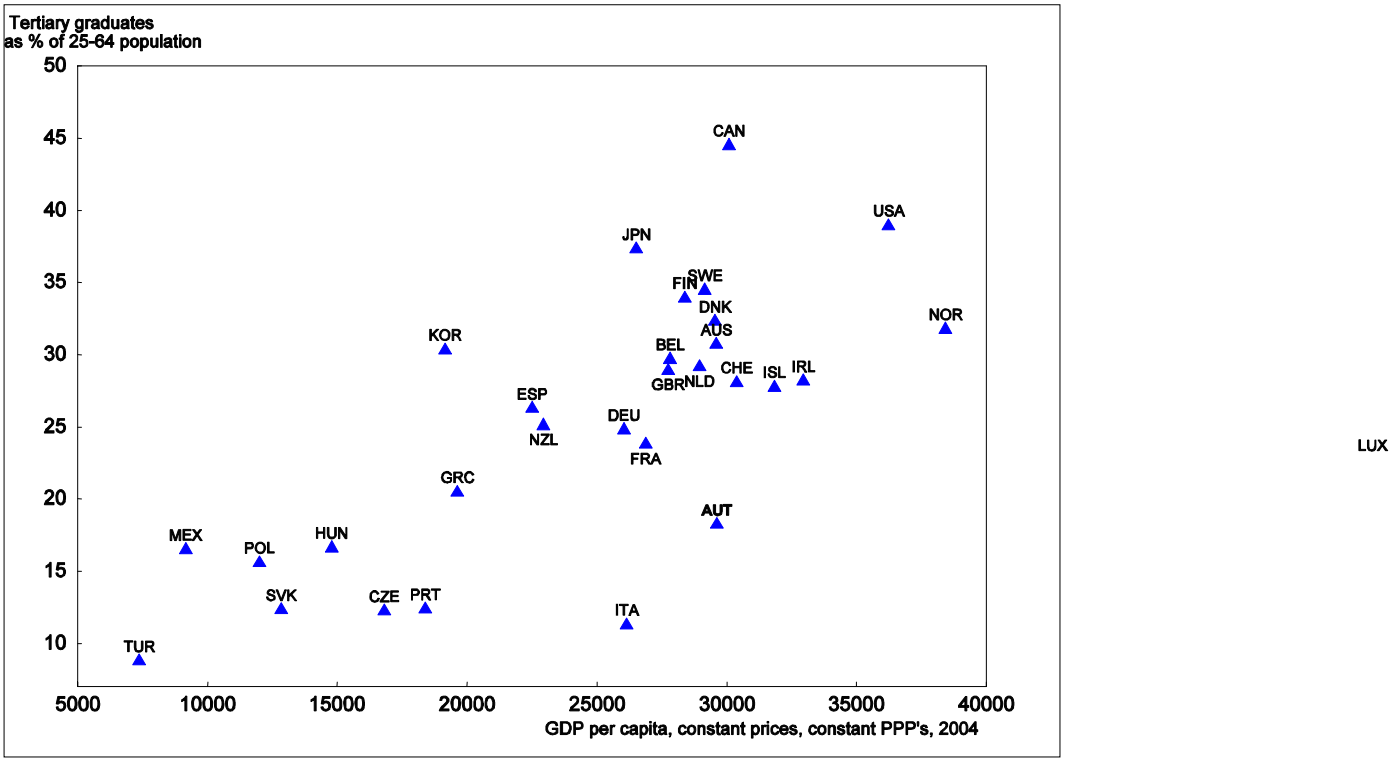
Improving human capital formation

There is much evidence that human capital plays a key role for growth. During the period of catch-up, Austria's education system obviously made a major contribution to growth by providing the labour force with appropriate skills. Traditionally, Austria's education has put much emphasis on primary/secondary and vocational education, which was sufficient at the time when a good part of productivity growth was achieved by capital deepening and the adoption and modification of existing technologies, notably in manufacturing sectors. However, as more firms approach the technological frontier and have to adopt highly advanced technologies, more workers and researchers with tertiary education may be needed. A more highly skilled workforce also helps to improve innovation in services and encourages the adoption of new general purpose technologies such as ICT (Krueger and Kumar, 2003; Wölfl, 2005). Austrian firm level studies also find that tertiary graduates are complementary with ICT investment (Falk, 2004).

Measuring the impact of human capital on growth is a difficult task (see Vandenbussche *et al.*, 2006; Krueger and Kumar, 2004; Ciccone and Papaioannou, 2005) and caution is needed when using such estimates, but they may at least provide a rough idea. For Austria, it has been estimated that the contribution of the increase in the quality of human capital to annual growth amounted to only 0.2 percentage points over the period 1990-2004 (Peneder *et al*., 2006), which is lower than for many other developed countries but may also reflect that there was only a small change in human capital parameters during this period.

As to the level of human capital, it is interesting to note that Austria has achieved its relatively high GDP per capita level with a relatively low share of tertiary education, both in terms of a relatively low share of tertiary graduates in the working-age population (Figure 6) and relatively low spending on tertiary education (Figure 7). The number of business researchers is also low (Figure 8) as is the share of the highly skilled workers in services.[13] Austria is also the only country in a range of OECD countries examined by Wölfl (2005) where the manufacturing sector shows higher employment intensity of tertiary graduates than the services sector. *Looking forward, and considering the prospective further shifts in labour demand towards high-skilled workers as well as the higher investment in tertiary education abroad, Austria is well advised to invest more in tertiary education. Increasing the share of workers with tertiary education would facilitate the creation and diffusion of new technologies and raise Austria's growth potential.*

Figure 6. Human capital with tertiary education in international comparison

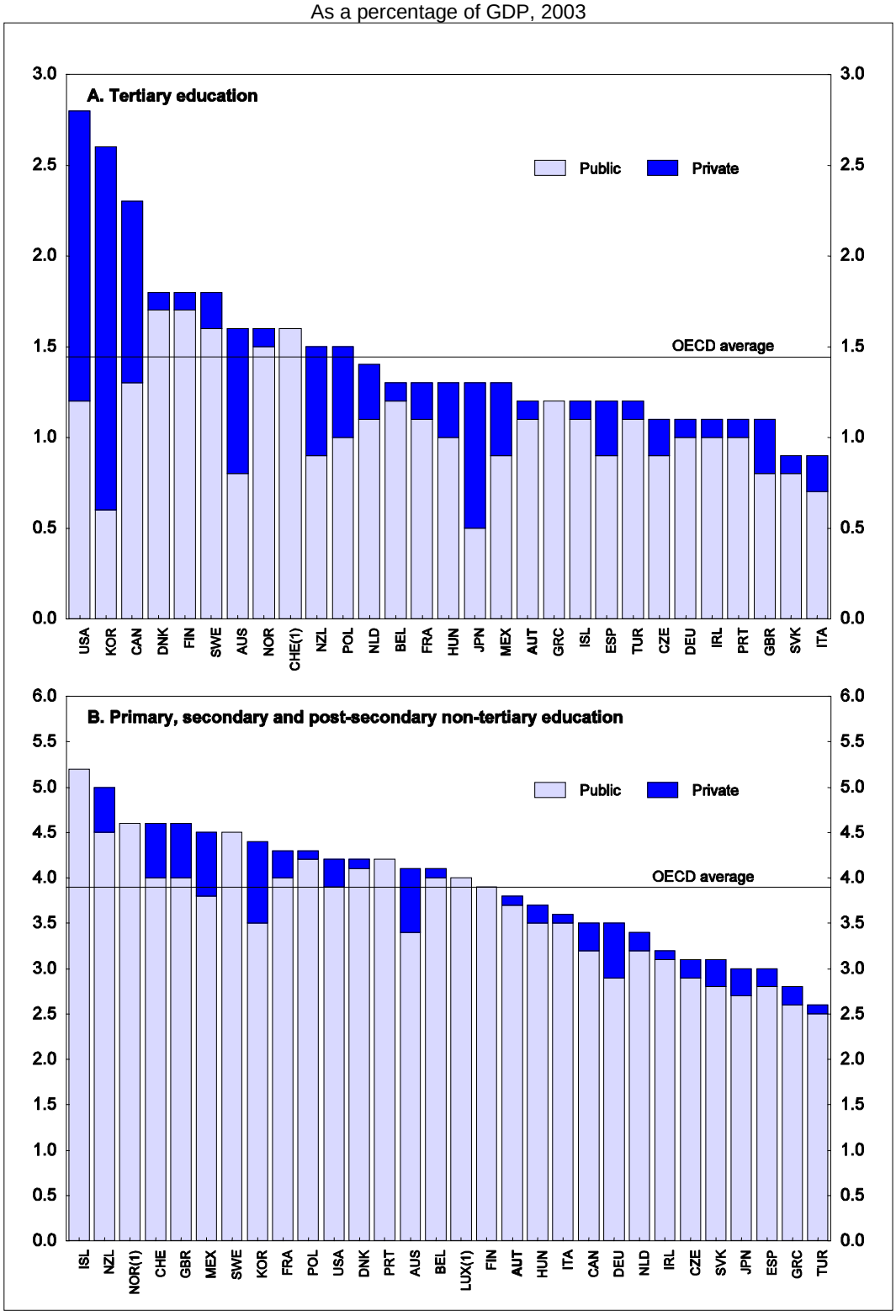


Source: OECD (2006), *EAG* database and *National Accounts*.

13. In several individual service sectors such as retail and banking Austria has fewer highly skilled workers than in benchmark countries (see Wölfl, 2005).

Figure 7. Education expenditures

As a percentage of GDP, 2003

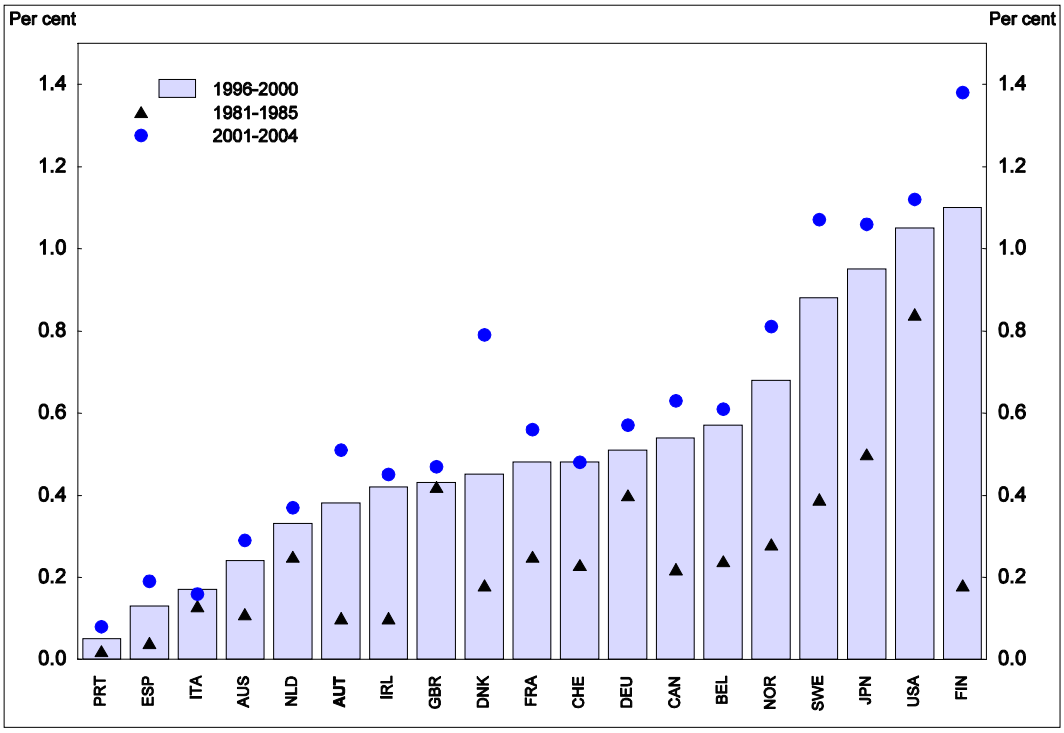


1. Public expenditure only.

Source: OECD (2006), *Education at a Glance*.

Figure 8. Business sector researchers

Per cent of total industrial employment, average *per annum*



Source: OECD (2006), *Main Science and Technology Indicators* database.

Austrian authorities have often argued that Austrian pupils leave upper secondary vocational schools (*e.g.* HTL for technical fields, HAK for commercial fields) at the age of 19 with skills similar to tertiary graduates in other countries[14] and that the share of students in longer duration studies is well above the OECD average.[15] It is true that the skill mix of Austria's workers is largely oriented toward vocational skills, both at the apprenticeship and at the upper secondary vocational school level. If one includes upper secondary vocational schools in tertiary education, the share of tertiary graduates as a percentage of the 25-64 population would increase from 18% (as shown in Figure 6) to 27%, which is slightly above the OECD average; and in the 25-34 age group, tertiary education attainment would increase from 20% to 30%, which is slightly below the OECD average. However, this would still be much lower than in some other OECD countries, notably Canada, Japan, Korea, Sweden, Finland, Norway, Ireland, Belgium and Spain where, in the same age group, tertiary education attainment is between almost 40% and above 50%. Furthermore, with this wider definition of tertiary education the numbers for some other countries would also increase. Finally, treating all graduates from upper secondary vocational schools as highly skilled and similar to university graduates may overestimate their qualifications, as their focus of training is on vocational, and not on general, skills. As discussed above, for the diffusion and adoption of general purpose technologies such as ICT or advanced technologies, it may be important to have a relatively broad

14. Austria would reach the European average of graduates in Science and Engineering (S&E) fields if HTL graduates which are counted as upper secondary graduates were counted as tertiary S&E graduates.

15. In Austria, there is also a discussion on the appropriate classificiation of teachers for primary and lower secondary schools, who in Austria are not trained at university but in specialized academies. However, these academies are included in tertiary education institutions as they are classified as ISCED 5B (shorter and more vocational oriented tertiary education) (OECD, 2004a).

distribution of high general skills as gained in universities, even with shorter duration studies, rather than having relatively few people who receive university degrees often after many years of study. In this respect, the introduction of Bachelor studies following the Bologna Process appears to be an improvement.

Training is another lever for boosting the skill level of workers and for adjusting it to the needs of firms. In Austria, business investment in human capital through training is promoted by a tax credit of 20% or alternatively a premium of 6%. Nonetheless, firms and workers appear not to give a high priority to training for certain disadvantaged groups of workers such as older and less-skilled workers (Bock-Schappelwein *et al.*, 2006). Participation in lifelong learning in terms of expected hours in non-formal job-related training over a typical working life is at the EU average, but far below levels in Switzerland, Finland, Sweden or Denmark. Particularly important would be efforts to strengthen participation in training for non-tertiary graduates including inter-company training to foster general skills. However, there are limits for governments to influence training activities directly. Simply providing employers with subsidies may be ineffective as long as other barriers remain. For example, reducing the length of working life through early retirement reduces the rate of return of such training and thus firms' and workers' incentives in offering and participating in such programmes.

Conclusions

The discussion so far suggests that there are potential complementarities between general framework conditions for growth and R&D support policies. While Austria's overall framework conditions for growth are quite favourable and have contributed to Austria's good economic performance, in a few areas which are particularly relevant for innovation, some weaknesses remain. In particular, restrictive product market regulations (including barriers to FDI and entry barriers) and financing constraints for new innovative firms may restrain the creation and diffusion of innovation in Austria, in particular in services. This may, perhaps, explain why Austria benefited less than some other countries from the ICT productivity boom of the 1990s. As the use of ICT has become more universal, Austria's disadvantage should fade away. However, unless the above mentioned framework conditions are improved,, barriers to innovation and diffusion, in particular for services, will persist.

A highly skilled labour force is another important framework condition for innovation and growth. It appears that in the past, Austria's relatively low level of tertiary education was probably not a major constraint on its growth performance. However, looking forward and also considering the education performance in some other highly developed countries, Austria would be well advised to expand its tertiary education and also improve its efficiency. The recent university reform is a step in the right direction but there is room for further improvements as discussed below.

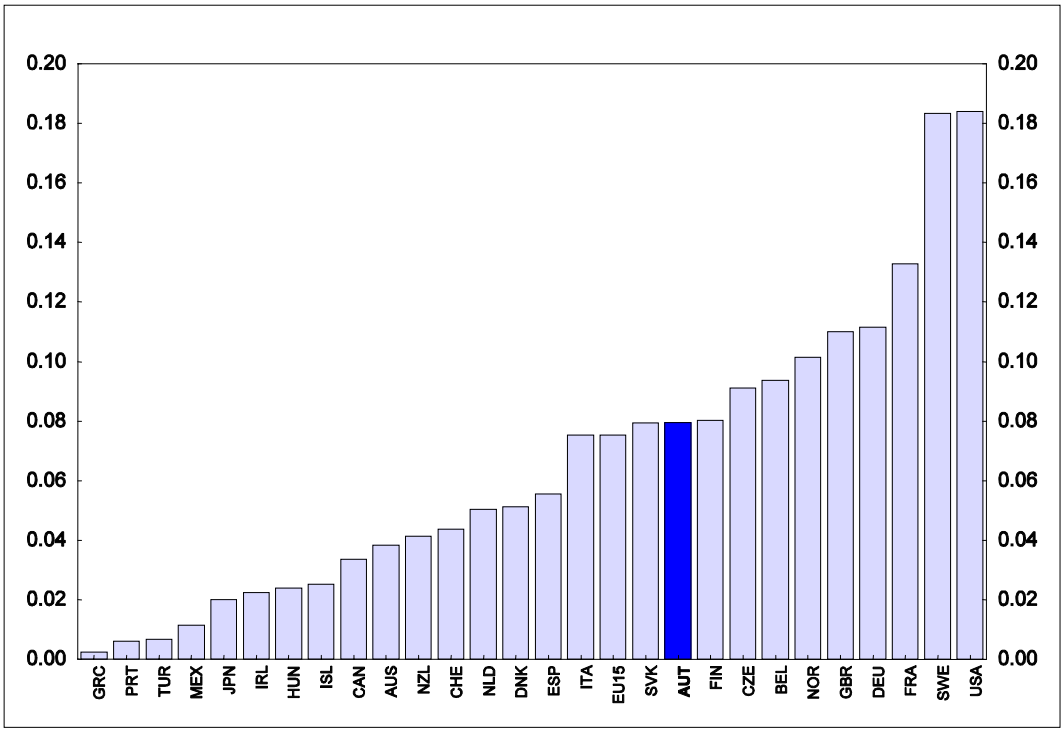
Recent innovation policy initiatives and suggestions for further reform

R&D promotion has been strengthened

As discussed above, Austria has significantly increased its total R&D spending in recent years, and the government aims to further raise it to 3% of GDP by 2010. To raise innovative activity, a variety of policies is used, such as direct subsidies and tax incentives. Direct government funding to business R&D is about EU 15 average (Figure 9). It is planned that in the coming years, the annual increase of Federal Government R&D expenditure will amount to about 10% and that in the end about two thirds of total R&D will be funded by the private sector (up from currently 62%) and one third by the public sector (down from currently 38%).

Figure 9. Direct government funding of business R&D

Average 2001-03, as a percentage of GDP



Source: OECD (2006), *Going for Growth*.

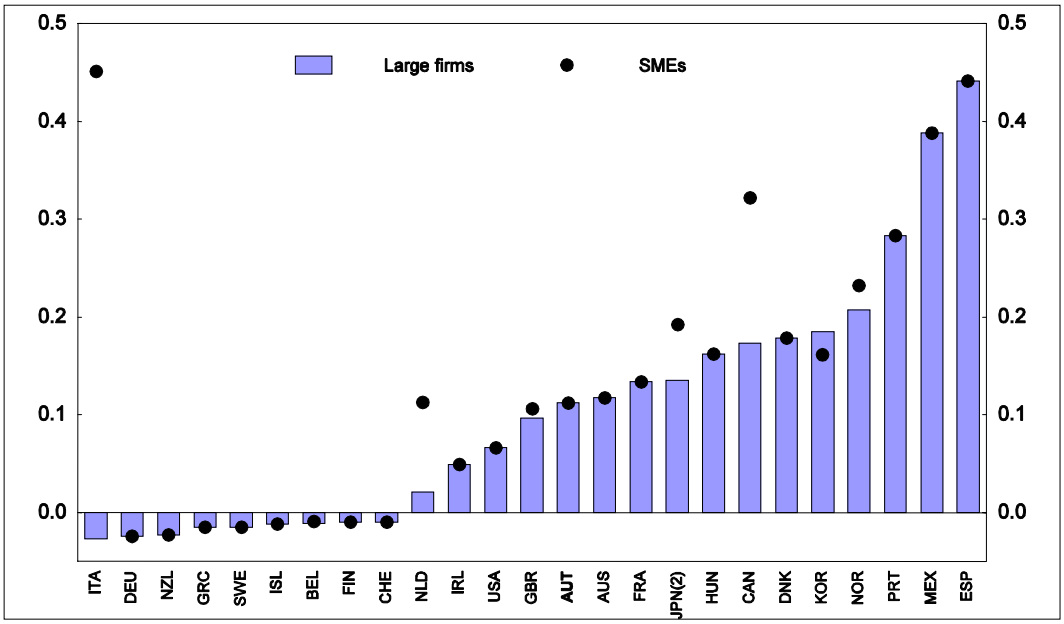
Among the direct subsidies, there has been a long tradition of providing grants and loans to individual firms that apply for R&D subsidies to support their planned research and innovation projects (project-based firm level funding). Since the 1990s, more emphasis has been put on linkages between academics and industry and science-based industrial research which led to new innovation support programmes. Examples include the science-industry linkage programme K-centres[16] and initiatives to foster generic technologies such as biotechnology, nanotechnology and ICT. Since 2002, the company sector has raised its R&D expenditures by 33%.

The tax treatment of business R&D spending is relatively generous although lower than in a number of other OECD countries (Figure 10).

16. See OECD, 2004b.

Figure 10. Tax treatment of R&D in OECD countries[1]

Rate of tax subsidy for one unit of R&D in 2004



1. Tax subsidies are calculated as 1 minus the B index, which is defined as the present value of before-tax income necessary to cover the initial cost of R&D investment and to pay corporate tax.

2. The 2004 B index for large firms in Japan applies to firms with a ratio of R&D to sales of less than 10%. The B index for large firms with an R&D to sales ratio above 10% is 0.831. The B index for research conducted in collaboration with universities is 0.782.

Source: OECD (2005), *OECD Science, Technology and Industry Scoreboard*.

For R&D expenditures which are assessed to be "leading to an economically valuable invention", a tax credit of 25% can be deducted from pre-tax profits, and it increases to 35% for additional R&D expenditures (as compared with the average of the last three years). The Ministry of Economics and Labour (BMWA) has to certify the economic value of the invention unless it has been patented already. Furthermore, since 2002 the 25% tax credit is also granted for R&D expenditures as defined by the OECD Frascati Manual.[17] Alternatively, since 2004, an 8% R&D grant (research premium) can be obtained, intended for firms which are not yet profitable, notably start-ups. In 2005, this regulation was extended to subcontracted research. After the reduction of the corporate tax rate from 34 to 25% in 2005, which has reduced the subsidy value of the tax credit, more and more profit-making firms also prefer the research premium to the tax credit. This implies that direct government funding of business R&D will rise considerably as R&D cash grants are counted as direct funding of firms.

There are different views on how successful direct and indirect R&D promotions are. In general, the rationale for subsidising research activities is that these are thought to have positive spillover effects which raise the social above the private rate of return so that, without government intervention, there would be under-investment in R&D. Both direct firm subsidies and tax incentives support a broader and more market-driven range of research activities. By providing direct funding, the government can gain valuable

17. This definition covers activities leading to the acquisition of new knowledge through basic and applied research as well as the development of new or substantially improved production processes or products. See OECD, 2002.

knowledge about firms' innovation activities which can feed back into innovation policy design. However, applying for R&D support and going through the evaluation process may be burdensome and costly for small firms (although there currently exists no empirical study on the size of such costs). By contrast, tax incentives or R&D grants are relatively easily accessible also to smaller firms. They also require less administrative work for the government. Both direct firm funding and tax incentives can, however, involve considerable deadweight losses, *i.e.* investment is supported which would have been carried out anyway.

Direct subsidies other than "demand-driven" firm subsidies to individual firms, such as science-industry linkage programmes or generic technology development programmes, can improve access to external knowledge for firms, enhancing their innovative capacity. They also allow tailoring the allocation of funds towards projects or areas that are thought to offer the highest social return such as anti-pollution technologies, and they can also enhance the diffusion role of general purpose technologies.

One criticism of the Austrian R&D support system is that it is based on "demand driven" subsidies focusing too much on projects which arise out of firms' routine innovation activity and does not really speed up structural change. Indeed, most of public direct and indirect R&D support is allocated to individual firms – in 2003, almost 80% – with the remainder allocated to specific research fields, personal grants and international networks (Schibany and Jörg, 2005). By contrast, neighbouring Switzerland achieved its strong innovation performance without subsidising research activities of individual firms but supported R&D through innovation networks (OECD, 2006b; OECD, 2006c). Some re-balancing of public support thus seems reasonable, in particular towards fostering networks between SMEs and research centres. However, the success of this policy depends on how it is pursued in practice, while giving undue emphasis to specific sectors or areas could also lead to government failure to choose the right ones, which is a systemic risk of winner-picking strategies.

According to various evaluations, the "direct firm programme" administered by the former business research fund (FFF) and the K-centres have been successful and have induced additional private spending, increased innovation and output of firms, as well as increasing the number of firms engaged in R&D (Arnold *et al.*, 2004; Falk, 2006; Steyer, 2006; Bundesministerien, 2006).[18] Direct funding through traditional FFF grants has, however, focused on "good projects in good firms" which suggests a large element of deadweight loss and also focused on incremental innovation projects with relatively few risks involved, implying that such spending could be cut without loss of innovation. By contrast, establishing K-centres and their K-plus programme was a step forward with R&D funding being reallocated more towards fundamental research; the new COMET programme is continuing this approach (Hutschenreiter, 2005).

The system of tax incentives and R&D cash grants has not been evaluated up to now. It seems that in the past, tax incentives given for so-called "economically valuable inventions" have mainly benefited larger firms.[19] This tax credit also requires administrative screening by the BMWA, reducing one of the advantages of this instrument. As mentioned above, the reduction of the corporate tax rate has reduced the subsidy value of the tax credit, and many firms are now shifting towards applying for direct subsidies. Ministry of Finance data show a sharp increase in R&D cash grants, leading to an increase of direct government funding of business research. *An evaluation of this system is thus necessary with a view to cutting back expenditure to the point where its efficiency can be demonstrated.*

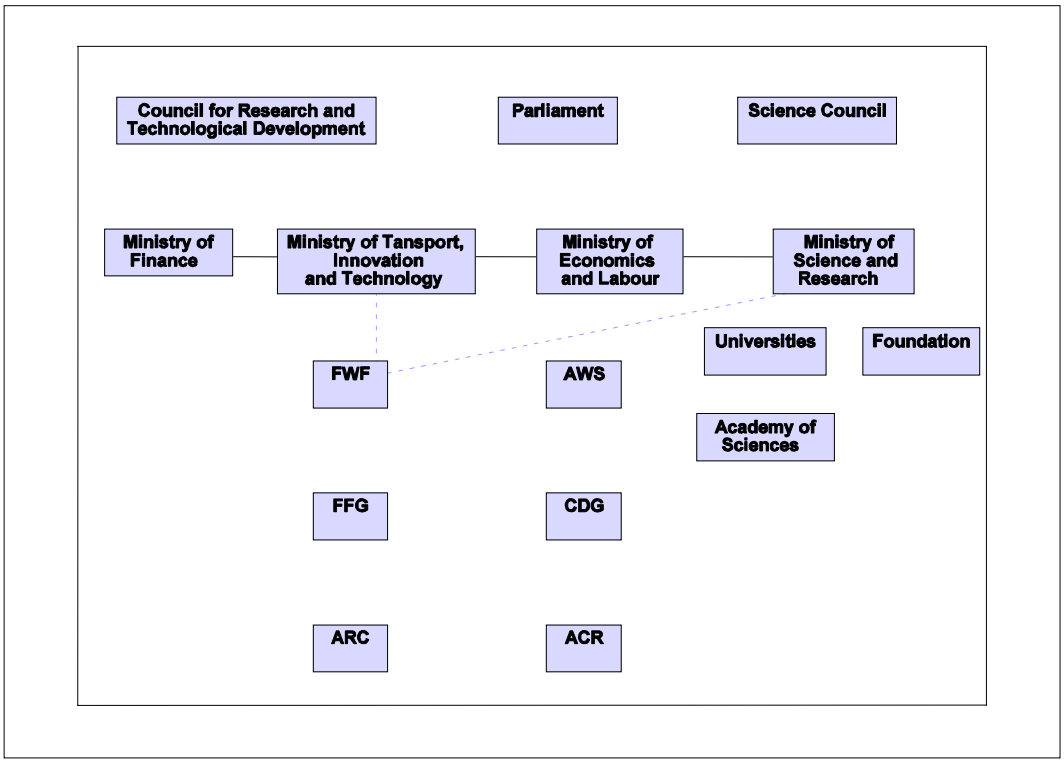
18. The public subsidies distributed as direct grants or loans to firms were shown to cause a crowding-in effect of about 40%, *i.e.* one additional euro of funding induces firms to contribute an additional 40 cents of their own money (Streicher *et al.*, 2004). Output effects in terms of additional cash flow (Klement, 2005) or additional innovative sales from new products (Mohnen and Garcia, 2004) were also found to be positive.

19. It has been estimated that 75% of revenue losses through R&D tax incentives were granted to approximately 20 firms.

The institutional framework for innovation policies has been rationalized but further reform is needed

Austria's first innovation support policies which were introduced with the Research and Promotion Act of 1967, reflected a concept of innovation emerging from research laboratories of firms and generating positive externalities for the economy, which justified subsidizing firms' R&D activities. Innovation policies were later broadened to other types of support, including for specific research fields and networks. Over the years, a highly fragmented research promotion system has emerged with a multitude of support agencies and overlapping programmes. After an in-depth review of the structure of agencies and programmes (Arnold *et al.*, 2004,), the system was rationalized in 2004 by merging some promotion agencies and programmes, although the system still appears to be complex (see Figure 1 and Box 1). Considerations *should thus be given to reducing the number of promotion agencies and clarifying the roles of those remaining.*

Figure 11. The organisation of innovation policy in Austria



Source: OECD.

At the government level, three ministries (Ministry of Transport, Innovation and Technology (BMVIT), Ministry of Economics and Labour (BMWA) and Ministry of Science and Research (BMWF) have been in charge of formulating, supervising and coordinating innovation support schemes while the Finance Ministry also monitors the allocation of public spending and participates in designing any new programmes. The division of responsibilities between ministries has led to some competition about the "best policies" but has also reduced cost-efficiency (high administrative cost in relation to the support volumes), as well as cutting down the sometimes unclear relations with the funding agencies (Arnold *et al.*, 2004; Jörg, 2005). It has therefore been suggested by the Council for Research and Technology (RTD) to reduce the number of ministries which are directly responsible for innovation policies from three to two. The new government has, however, not followed this advice. There has been some re-organisation of responsibilities between ministries: the Science Ministry (BMWF) now shares

responsibility for the basic research fund FWF with the Ministry of Transport and Infrastructure (BMVIT) while the Ministry of Economics and Labour (BMWA) shares responsibility for the AWS with the BMVIT.[20] Overall, it appears that at the government level innovation policy is much too fragmented. It has also been suggested that ministries should basically only deal with designing innovation policies but not interfere in the operation and staffing of the various agencies (Arnold *et al*., 2004) although it appears that this recommendation has not been implemented so far (European Commission, 2005). *Hence, the division of tasks between ministries and agencies should be better clarified such that ministries focus on strategies and agencies on implementation.*

Box 1. R&D promoting agencies

There are three key R&D promotion agencies: *i)* the Austrian Science Fund FWF (*Fonds zur Förderung der Wissenschaftlichen Forschung*) which is funding basic research; *ii)* the FFG (*Forschungsförderungsgesellschaft*), which has been newly created by merging a number of formerly separate agencies and which deals with most support programmes for business R&D; and *iii)* the AWS (A*ustria Wirtschaftsservice*), which provides special loans to innovating firms to adopt new technologies and seed capital for start-ups. Furthermore, the National Foundation for Research, Technology and Development (*Nationalstiftung für Forschung, Technologie und Entwicklung*) has been set up by using funds from the Austrian National Bank and the ERP fund to ensure a steady financing of the existing programmes of the various agencies. There exist also a number of partly publicly funded research organisations such as: the Austrian Research Centres (ARC) which carry out research that is linked to business demands; the Christian Doppler Research Association (CDG) which focuses on science-industry cooperation (both CDG and ARC cover 50% of costs with business receipts); and the Austrian Cooperative Research (ACR), which promotes R&D of SMEs. Since mid-2006, the FWF, the FFG, the CDG and the ACR are located in the same building in Vienna which also should facilitate their cooperation.

While some progress has been made in better defining responsibilities and streamlining programmes, there are still programmes that overlap but are run by different agencies. For example, programmes to improve links between science and business are run both by FFG and CDG.

Given the multitude of agencies and programmes, efficiency could be increased by further rationalization. Furthermore, programmes should be regularly evaluated so as to prevent deadweight losses and the crowding out of private seed capital.

There are two advisory bodies helping the government in developing science and innovation strategies and coordinating of policies: the Austrian Council for Research and Technology Development (*Rat für Forschungs- und Technologieentwicklung, RTD*) and the Austrian Science Board (*Wissenschaftsrat*). Both provide advice on general R&D policies but the RTD is more active in advising on the allocation of funds while the Science Board is mainly an advisory body to the Science Ministry (BMWF). It has been suggested that these two advisory bodies should be merged or at least cooperate closely since both develop strategies and make recommendations in overlapping areas (Arnold *et al*., 2004). This has been confirmed by their recent recommendations with respect to human capital formation and the promotion of research excellence (Austrian Science Board, 2006; Austrian Council for Research and Technology Development, 2005). Furthermore, it has been recommended that the role of the RTD be strengthened by extending its mandate. Currently it is an independent advisory body, not formally under the control of government or parliament, and its proposals are not binding (OECD, 2005c). Nonetheless, the RTD appears to have some influence on the distribution of funds across programmes. There are currently two innovation strategies: one by the Council (2006) and the other elaborated by the ministries and agencies in the framework of Austria's National Reform Programme for the European Union (2005). It is clear that the

20. The new government has split tertiary education from secondary education, thus adding a fourth Ministry – the Ministry of Education – to relevant innovation policy actors, as the Ministry of Education is in charge of the HTL upper secondary vocational schools, important providers of advanced technical skills. Furthermore, the Ministry of Agriculture is also responsible for some research projects in this field.

second strategy is more binding as it has been discussed and voted by Parliament. In some other OECD countries, innovation councils include government ministers or are even headed by the Prime Minister, such as the powerful Finnish Council for Science and Technology Policies (OECD, 2005b) or the Japanese Council for Science and Technology Policy (CSTP) (OECD, 2006d). However, this is not the case in Austria. *Therefore, the effectiveness of the two existing Councils should be increased by better clarifying their role to avoid overlap and by giving their reports more weight as independent advice to increase spending efficiency.*

The R&D policy advisory body should also broaden its approach by considering the interactions between science and technology policies and general economic policies and framework conditions which – as discussed above – have been found to be as important, or even more important for R&D development than specific science and technology policies. In particular, removing barriers to competition can be an important driver for innovation and growth. This also means that the Federal Competition Authority (FCA) has an important role to play in improving framework conditions for innovation and growth and should take a pro-active role in improving competition through enforcement.

Initiatives to improve university research

The Austrian government plans to increase the quality of scientific research and its linkage with business via three main policies: *i)* the establishment of a new top research centre, called the Institute of Science and Technology – Austria (IST-A), which will focus on excellent basic research; *ii*) the Graduate Schools for improved research training; and *iii)* clusters of excellence, which will establish centres of excellence at existing universities. These initiatives are supposed to be coordinated with other programmes, such as the new business-science bridging programme COMET. They will be mainly funded by the Austrian Science Fund (FWF), although IST-A will also receive contributions from industry. In addition, existing programmes targeted at fostering research excellence are the programme START which provides funding for excellent young scientists and programmes to bring back Austrian scientists who have emigrated abroad (Brainpower Austria). The overall goal of these policies is not only excellence in science, but also economic, in that they should foster Austria's structural change towards high-tech sectors (Austrian Council, 2006; Austrian Government, 2007).

While aiming for research excellence is important in itself, some caution is needed when it comes to government funding. According to public universities' development plans, nearly all of them want to increase their research (Bundesministerien, 2006). Next to IST-A and the traditional public universities, there is also the Austrian Academy of Sciences with several well known research institutes such as the biotech institute IMBA. There is thus a clear risk of fragmentation with projects and research centres failing to achieve a critical mass as well as an appropriate balance between basic and applied research. *It is therefore important to enhance competition between research centres for public funds which could also lead to some rationalisation as the least efficient may not survive. For competition to be able to work, the Science Fund should be allowed to finance not only direct project costs, but also administrative overheads, as mentioned in the recent Government Programme.*

Facilitating immigration of highly-skilled workers and researchers

Excellence in research also depends on access to worldwide scientific talent which is becoming increasingly mobile. There are no legal restrictions for university professors and researchers, even from outside the European Union, to work in Austria provided that they have a contract with an Austrian university or research institution. However, they need a residence permit which appears to be easy to get for temporary residence but more difficult for permanent residence. Their family members can, however, only get temporary stay permits and they also face restrictions if they want to work in Austria. The granting of work permits is, however, eased for family members (or support staff) of high level researchers

(and managers) earning more than €4 500 per month while spouses of other researchers are allowed to work only if they qualify as "key workers". They must earn at least €2 300 per month and must apply for a place within the so-called "key workers quota" which currently stands at 1 250 per year, distributed across Austrian regions according to fixed shares. The same restrictions currently apply to foreign researchers from outside the EU if they want to switch from their Austrian research institution to work for an Austrian firm, but are scheduled to be dropped. This inhibits potential technology transfer from universities to firms and may harm innovative capacity of firms. The quotas for "key workers" are also a barrier to the immigration of highly skilled workers from outside the EU (Miljkovic, 2006). *Authorities should simplify administrative procedures for researchers' immigration and should facilitate their entry into firms. Barriers to work for spouses of researchers should also be removed as these barriers are an increasingly important obstacle to researcher mobility. Furthermore, immigration of highly skilled workers should generally be eased.*

Improving higher education

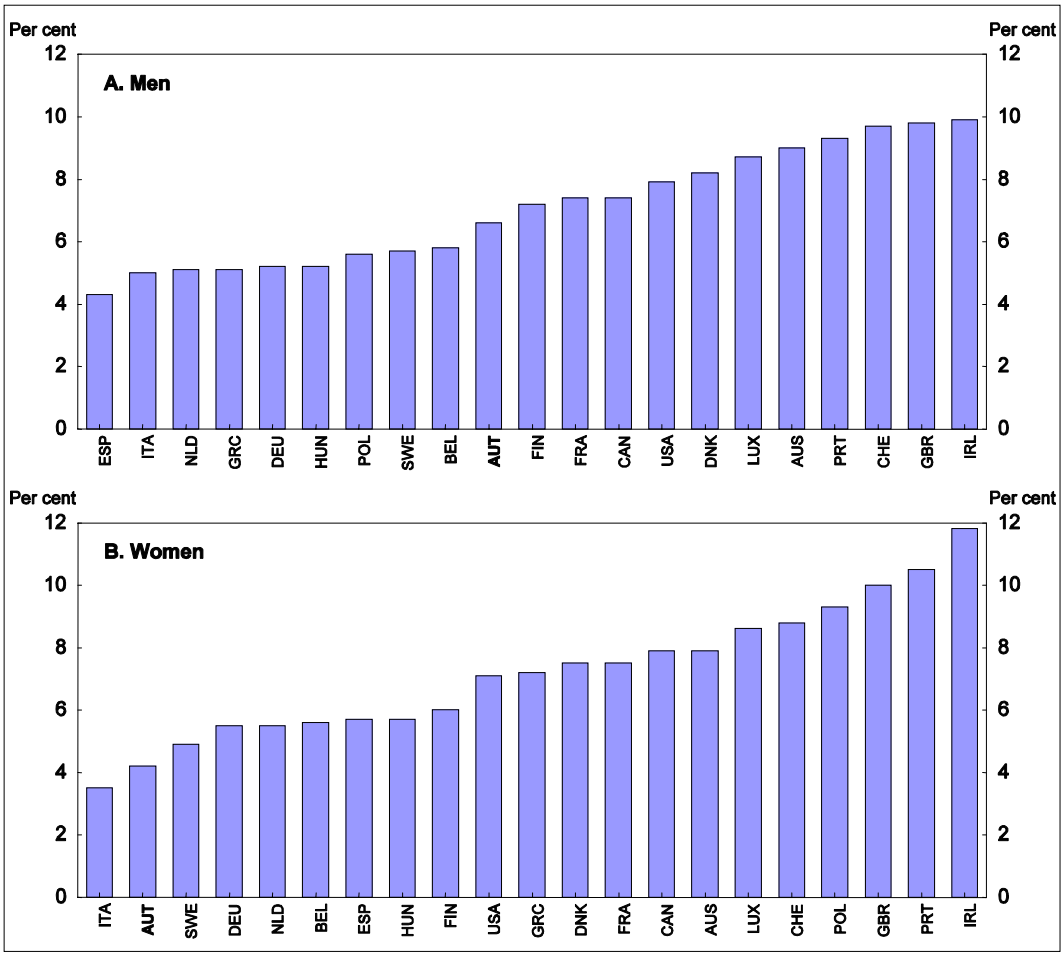
Given Austria's relatively low share of workers with tertiary education (as mentioned above), the government intends to increase the number of tertiary graduates. According to official long-term projections graduates from universities of applied sciences (*Fachhochschule)* are projected to more than double between 2003 and 2020 from below 3 000 to almost 7 000 while general university graduates are projected to rise from 14 500 to 15 500 (BMBWK, 2005). However, the decisions of individuals to invest in tertiary education are voluntary and also depend on factors outside the sphere of government influence, such as socio-economic behaviour, insufficient wage dispersion between different skill levels or relatively low demand for university graduates as compared with other workers; the latter, however, also depends on how responsive universities are to business-specific needs for higher skills. Government intervention outside the education sector also affects the decision to go to university, such as a highly progressive income tax which reduces the net return from higher education. Within the education sector, the size of tertiary education depends not only on the efficiency of universities but also on how well basic and secondary education are in equipping students of all groups of the population with the necessary skills to successfully participate in tertiary education if they so wish. All this implies that a broad approach is needed to raise the share of highly skilled labour, including addressing the problems with very early selection/tracking of students into academic/vocational streams (OECD, 2007).

With its university reform in 2002, Austria has made a major step in improving the efficiency of the university system (Box 2). However, it is still too early to fully assess the impact of this reform as some measures have only been implemented very recently. Nonetheless, OECD work on tertiary education which includes Austria, and has been carried out after the university reform, suggests that Austria's education system needs further upgrading (OECD, 2007b)[21]. According to this analysis, Austria's universities continue to have less autonomy and flexibility to decide on inputs and outputs than in a number of other OECD countries, such as Japan, Finland, the United Kingdom and most states of Canada. This reduces the efficiency of universities and their possibilities to adjust their supply to student's needs. The OECD study also found that in Austria the economic incentives to go to university (as measured by the rate of return of tertiary education) are not particularly high for males and very low for females (Figure 12).

21. Further information on the autonomy, flexibility, and accountability in this sector is also provided by OECD (2006e).

Figure 12. Estimates of the internal rates of return to tertiary education

2001

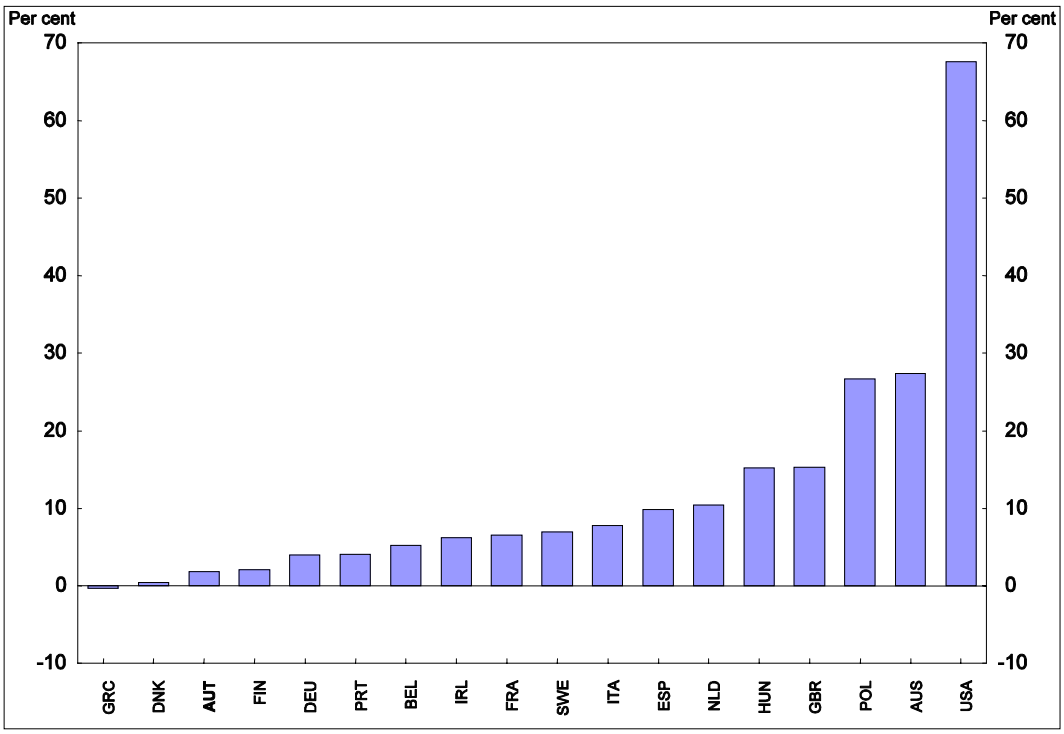


1. Uniform labour productivity growth across countries assumed to be 1.75% per year.
2. Poland and Switzerland in 2000 and Hungary in 1997.

Source: OECD.

This is not because of the recently introduced student fees, which are relatively low compared to many other countries (Figure 13), but rather because of a relatively long duration of studies, a high top marginal income tax rate (compared with the average tax rate) and the relatively small positive effect of tertiary education on employment probability, in particular for females (Figures 14). The relatively low rate of return could be an explanation (among others) of why Austria's tertiary education has remained smaller than in most other highly advanced countries.

Figure 13. Tuition fee costs in international comparison[1]

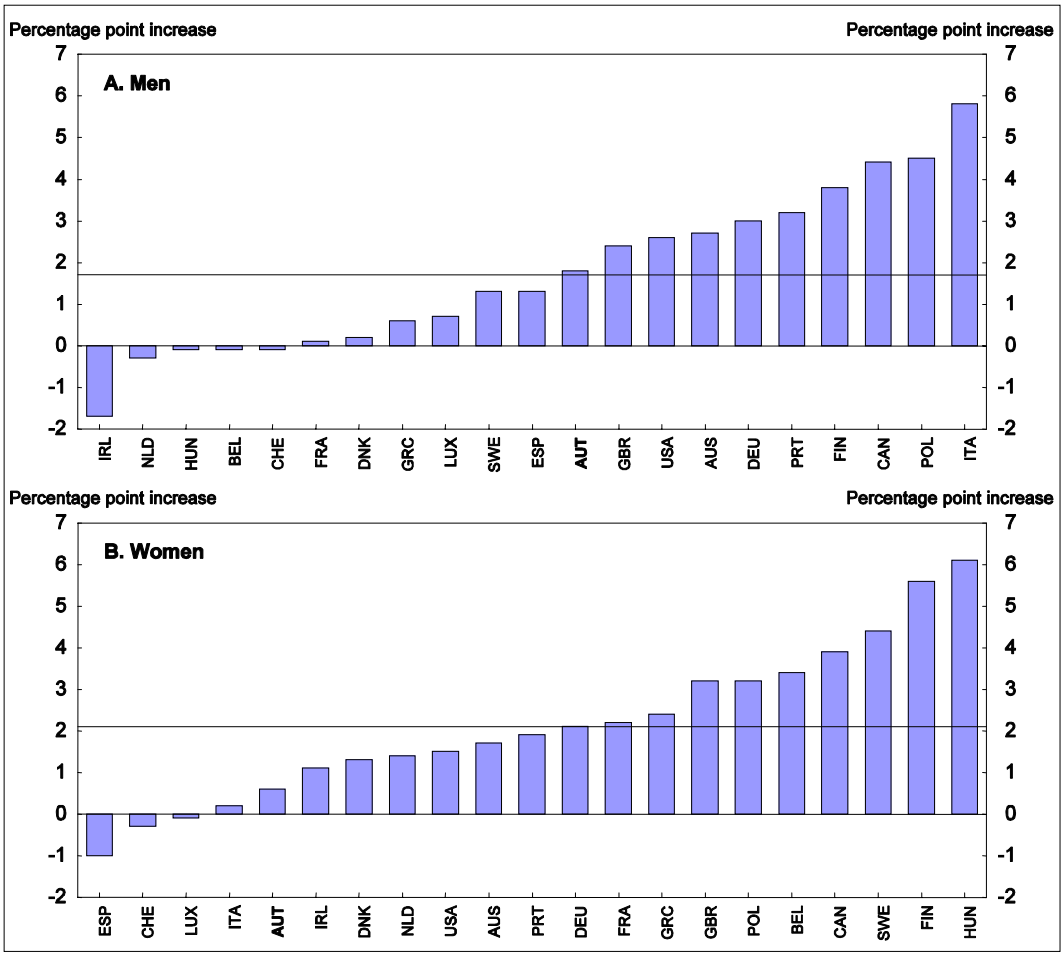


1. Tuition fees of tertiary education as a percentage of gross annual wages of an upper secondary degree holder.

Source: OECD.

Figure 14. Marginal effect of higher education on employment probability[1]

2001[2]



1. Increase in probability of employment: tertiary degree holders relative to upper secondary degrees.
2. Hungary in 1997, Poland and Switzerland in 2000.

Source: OECD.

The following subsections briefly discuss two policies which may further improve the ability of Austria's universities to offer high quality education, but which are both highly sensitive in the current political discussion. These are: *i)* allowing universities to select students; and *ii)* giving them autonomy to set the level of student fees.

Box 2. Austria's university reform

Following the 2002 University Organisation and Studies Act (UG or University Act) and the European Bologna Process, Austrian public universities are in the middle of implementing wide-ranging reforms. The Bologna three-tier degree structure Bachelor–Master–PhD is in the process of being introduced: in the winter semester 2005 nearly 50% of the regular first-degree programmes provided by universities and universities of applied sciences (*Fachhochschule*) were offered as Bachelor/Master courses. This change is expected to significantly shorten study duration and also facilitate students' mobility in Europe.

With the University Act, Austria has moved away from a system where government tightly controlled input and output of universities to a more flexible system, where universities have more autonomy but at the same time are held more accountable for what they are doing. Universities became legal entities under public law, having full legal capacity which allowed a consolidation and registration of all resources and costs. Universities are autonomous in setting course content and in using the funds provided by the state. They are the employers of their personnel, and new staff is no longer hired as civil servants but on the basis of private contracts which are negotiated between the umbrella association of universities and the trade union.

The University Act also introduced a new system of funding that fully entered into force with the budget for the year 2007. Under the new system, universities get funds from three sources: *i)* from the federal government in the form of three-year global budgets; 80% of the total government funds are distributed according to three-year forward-looking performance agreements between the ministry and the individual university and 20% are distributed according to performance, as measured by a set of backward-looking indicators**;** *ii)* from student fees which are retained by the universities in which students enrol. These fees were introduced in 2001 but until 2004 their revenues accrued to the federal government budget. Student fees account for roughly 5% of total university funds and universities are autonomous in the use of these revenues. However, they cannot decide on the size of tuition fees as this is set uniformly by the Parliament; students have to currently pay €363 per semester; *iii)* The final source of funds for universities are receipts from commercial activities such as from property, investment of their assets and conducting research on a commission basis, national and international research funding.

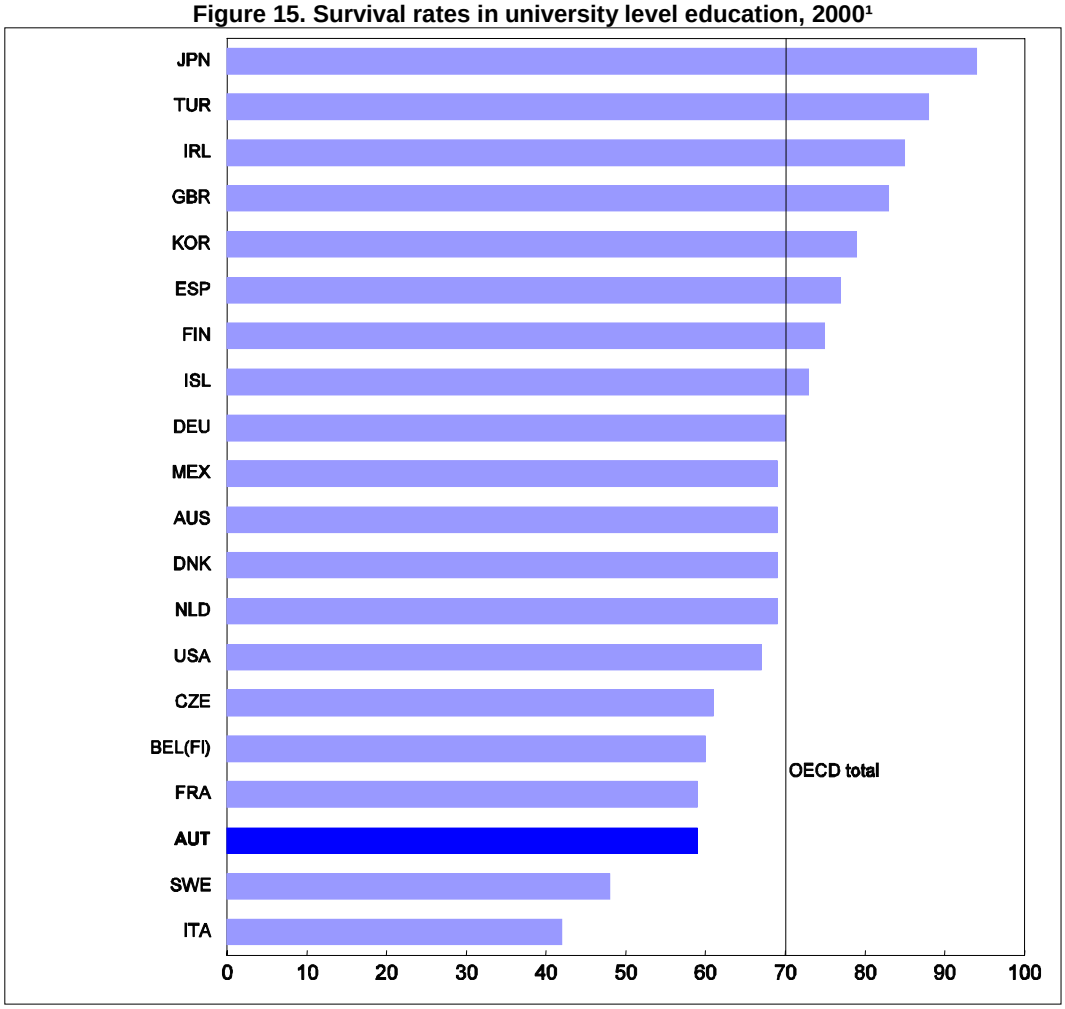
Universities' accountability has also improved. While the government continues supervising core educational services, universities have to establish quality management systems and all have now regular evaluations by students; some institutions also have evaluations by independent or government-funded agencies or outside observers. They must also deliver to the government the so-called intellectual capital report and a development plan, in which they define their particular strengths and competences and long-term resource requirements for building a specific profile.

Allowing universities to select students

Austria has universal free access to public universities for all students who finish upper secondary school with a diploma (the "*Matura*"); the exceptions are medicine, where there are entry tests and quotas for holders of secondary school leaving certificates which have been issued in Austria or in the EU, and the University of Applied Sciences; both have the right to select students for the limited amount of places they offer in their courses. The generally free access contributes to overcrowded courses in some fields of study and high dropout rates of about 40%, among the highest in the OECD (Figure 15). Many students leave the chosen course voluntarily after being frustrated by overcrowded courses, having found out that they prefer jobs which don't require a university degree or take up another course. Many others are, however, also forced to leave after one year as they don't pass the exams which appear to be particularly difficult as these are also used by universities to reduce student numbers to more manageable levels. This causes high opportunity costs for individuals and the society in terms of foregone earnings, frustrations and wasteful spending. It would therefore be better to allow universities to select students at entry, as is the case in many OECD countries. This would require finding an efficient and fair selection mechanism; experiences in

other countries may be helpful in this respect.[22] However, raising completion rates will not be achieved by selection alone, but will also have to be accompanied by improvement of governance and quality of teaching and learning.

Figure 15. Survival rates in university level education, 2000[1]



1. Percentage of graduates in relation to the number of new entrants in the typical year of entrance to the specified programme.

Source: OECD (2005), *Education at a Glance*.

Allowing universities to set the level of tuition fees

As mentioned above, Austria has introduced tuition fees which are set by the federal government at a uniform rate per semester for all universities (currently €363 per semester). Some OECD countries which have introduced tuition fees for public universities give them autonomy to setting the levels, sometimes up to government-defined ceilings. This has the advantage of further developing competition, improving efficiency and making the system more responsive to student preferences: a likely outcome is increased diversity and differentiation of the system, as universities have more direct control over funds and can

22. The Universities of Applied Sciences can already select their students. Furthermore, the University of Linz runs a formal information programme on its courses for prospective students. These "information tests" have succeeded in lowering the drop-out ratio by a third.

design their courses more closely in accordance with students and labour market needs. An important condition for this to work is transparency and accountability of universities.

In Austria (as in some other OECD countries) there are different views about the pros and cons of having tuition fees at all or allowing universities to fix them, which would, in the case of Austria, probably imply an increase in fees. Opponents of having tuition fees (or of increasing fees) argue that it reduces tertiary education in general which runs counter to the objective of improving the skill level of the workforce. It also raises concerns as poorer students are most affected and may be *de facto* excluded from university education. Both arguments are valid if tuition fees are not accompanied by properly designed policies. Indeed, by increasing costs of studying, tuition fees tend to reduce the rate of return of tertiary education and incentives to study. Furthermore, the share of students from families with lower incomes and lower educational background is already rather low in Austria, posing the risk of perpetuating the educational divide across generations. On the other hand, a strong argument in favour of tuition fees is that private returns of tertiary education are higher than social returns as tertiary graduates benefit from higher salaries while the costs of universities are borne by society and thus to a large degree by workers with lower education and incomes. Furthermore, for a number of reasons free or low fee systems have generally not been able to significantly raise the share of students from poorer families and also ended up with equity problems. In Austria, the early streaming of students according to the various types of schools may also contribute to such problems.[23] Considering the various arguments, some countries where tuition fees exist (and at much higher levels than in Austria) have introduced student loan schemes, which enable all students, independent of their economic background, to go to universities if they wish.

There are concerns that student loans may lead to excessive debt, leading to high default rates and fiscal costs or – the other extreme – that this measure is inefficient in increasing access to university as students are risk-averse. However, in countries with loan programmes, default rates have been very low and countries with student fees and large loan programmes tend to have relatively high enrolment rates (Figure 16). While the causation of this relationship can run in both directions, it is consistent with the view that student loans facilitate access to university and that concern about equity problems caused by student fees are not founded. Nonetheless, the overall efficiency of student loan programmes also depends on their design. A number of countries have introduced loans with loan repayments varying with income (see Box 3). With such income-contingent loans, students who don't succeed in getting a well paid job will not be stuck with high debt servicing costs and do not have to repay the full loan. Such schemes should also facilitate university access for students who are particularly risk-averse, including those from poorer backgrounds and appears to be more efficient than providing subsidies to poorer students (for a further discussion see Chapter 6 of *OECD Economic Surveys: United States*, 2007).

23. In principle, the financing of higher education costs including tuition fees should be possible also for poorer students simply by using bank loans. However, there are various factors (such as asymmetric information about students' abilities and uncertainty about future income) which contribute to financial market imperfections so that using this source of finance to a larger degree is only possible with adequate government intervention.

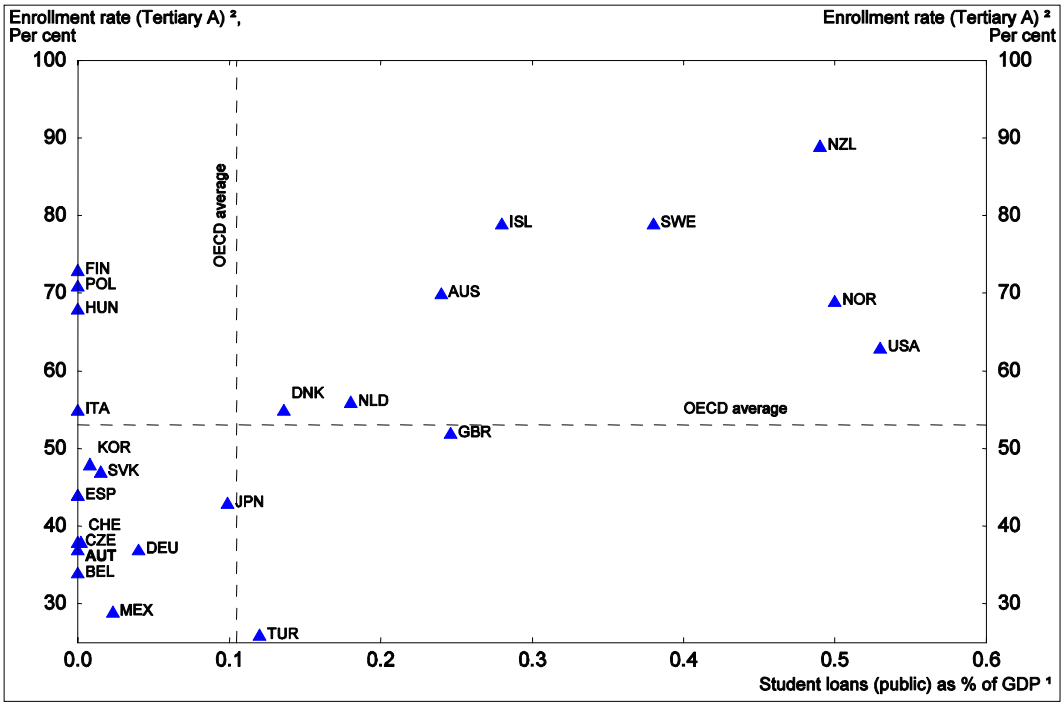
Box 3. Income contingent loans

Income contingent loans (ICLs) help students to finance higher education including tuition fees and at the same time protect them against excessive risks as there is built-in insurance against inability to repay (Barr, 2004). ICLs are a relatively new instrument and only a few OECD countries have implemented them, such as Australia, New Zealand and the United Kingdom (only recently). In the first two countries, entry into universities has increased after its introduction.

ICLs work as following: The repayment of the loan only starts once the person enters employment and only above a certain income level. Debt service costs are calculated as a percent of monthly income so that a larger loan or higher interest rate do not increase monthly repayments but only lengthen the duration of the repayment. People with low lifetime earnings may therefore not fully repay their debt. ICL are a consumption smoothing tool: just as pension contributions are paid now to finance pension later, income-contingent graduate contributions are paid later to finance education now (Barr, 2004). The system is progressive: individuals who derive greater private benefits from a tertiary degree see the level of their public subsidy reduced. Ceilings on annual and overall borrowing can protect against improvidence (Barr, 2004). Stipulations can be made in the loan to ensure repayment if the graduate has gone abroad.

Experience from the countries which introduced such loan systems show that thorough public information is vital to explain the system and to avoid people being worried about large nominal debt. Repayments can be collected together with personal income tax (OECD, 2007, forthcoming).

Figure 16. Student loans and enrolment rates, 2003



1. Loans are valued at principal.
2. US enrolment is for both tertiary type A and type B institutions.

Source: OECD (2006), *Education at a Glance*.

Given these considerations the government should consider giving the universities autonomy to set tuition fees and at the same time introduce universal and income-contingent student loan schemes along the lines existing in some other countries (OECD, 2007, forthcoming). The same regime should be applied to the Universities of Applied Sciences. This could help making tertiary education more efficient and more attractive to students and also shorten the duration of studying. Reducing the progressivity of the income tax system would also increase the return on higher education but could only be dealt with in the context of a future tax reform which would also have to consider other aspects.

Box 4. Policy recommendations for making innovation policies more effective

Simplify the institutional framework for innovation policy

- Merge the Science Council and the Council for Research and Technology (CRT) or enhance cooperation between them, to achieve more coherent policy advice, and strengthen its influence on policies in order to increase spending efficiency. .
- The policy advising bodies and the ministries involved in innovation policies should broaden their perspective by also considering the impact of general framework conditions on innovation, such as the availability of human capital, financial constraints and product market competition.
- The responsibility for specific innovation policies should lie with a single Ministry. Task sharing between agencies and ministries should terminate, with the operational running of innovation support programmes confined to agencies.
- Pooling of programmes of the various agencies (such as AWS, FFG and CDG) should be considered.

Ensure efficiency of innovation subsidies

- Ensure efficiency of R&D subsidies including tax incentives by regular independent evaluations.
- Further strengthen links between public research centres and the business sector to ensure diffusion of innovation generated in public research.
- Enable competition between universities to prevent lack of critical mass in fostering excellence of research.
- Enhance generic technology development programmes and university-industry cooperation at the expense of direct bottom-up firm support while avoiding giving undue emphasis to specific areas or sectors.

Improve product market competition

- Proceed with reforms to simplify the system of competition policy, in particular merging the Federal Cartel Attorney with the Federal Competition Authority and to strengthen enforcement.
- Further foster competition in particular in professional services and distribution. Also implement EU directives relating to postal services, banking and services in general.
- Reduce FDI regulations regarding foreign ownership in the liberal professions and other areas.

Improve conditions for start-ups

- Simplify and reduce the cost of firm creation, including minimum capital requirements.
- Strengthen legal protection of minority equity holders and creditors. Further develop the stock market and the venture capital market.
- Create new structures for venture capital funds which conform to international best practice, including even treatment and full openness to international venture capital investors.
- Monitor regularly policies which distribute seed capital to young firms and prevent crowding out of private capital.

Ease immigration of skilled workers and researchers

- Simplify and reduce administrative procedures for immigration of highly skilled workers and researchers, the barriers to their occupational and institutional mobility and the barriers to work for their spouses of researchers, including the quotas for so-called key workers.

Improve human capital development

- Allow universities to select students by appropriate selection mechanisms.
- Allow universities to decide on the level of tuition fees but at the same time introduce a universal and income-contingent student loan system and other policies which offset the potential negative effect of tuition fees on incentives to invest in tertiary education.

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