The Potential Growth Prospects of the Austrian Economy – Methods and Determinants

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In this paper we discuss issues related to the longer-run growth prospects of the Austrian economy. We briefly survey methods commonly applied to estimate the growth potential of an economy. According to currently available estimates, the growth rate of Austrian potential output is roughly 2%. We observe that potential growth has slowed down slightly over the past two decades. Turning to prospects for total factor productivity growth, there have been significant improvements over the last ten years with respect to R&D and trade openness. The impact of dynamic agglomeration gains also depends on the transport infrastructure. Product market competition and entry have markedly improved. Austria still has deficits in the areas of higher education and venture capital. By and large, most indicators – at least their growth rates – point towards good prospects for total factor productivity (TFP) growth. As regards labor supply, we show that demographic projections point to a slowdown in the growth of the working-age population, which in turn may lead to declining growth rates of actual and potential output. Such results are often achieved by using growth equations. This approach probably overestimates the negative effect on total GDP growth. The slowdown of labor supply growth can be mitigated by increasing participation rates. Austria has undertaken significant steps to increase the labor market participation of older workers by a series of pension reforms. After a decline in 2002 labor force growth has been rising steadily since 2003. Moreover, female labor supply has been increasing considerably more strongly than male labor supply.

JEL classification: E0, J0
Keywords: potential growth, TFP, labor market.

1 Introduction

Policymakers usually pay substantial attention to estimates of potential growth, that is the growth rate of potential output, when evaluating the overall cyclical position of an economy and also when assessing the macroeconomic performance. Comparably low GDP growth and high unemployment in many European countries have spurred an intensive discussion on economic policy reforms targeted primarily at utilizing the innovative potential of economies as well as to increasing the flexibility of labor markets, which are commonly regarded as too rigid. Moreover, many fear that future growth prospects may also be hampered by the slowdown of population growth and the expected decrease in the working-age population, which is associated with demographic transition.

For all these reasons, potential growth prospects rank high on the economic policy agenda. In this paper we consider a variety of related issues in the context of the Austrian economy. The purpose is to provide an introductory overview of some issues relating to the concept of potential growth. First, we give a definition of potential output and explain methods which are used by applied economists to estimate potential GDP. The next section is devoted to productivity growth, which is generally considered to be the main driver of economic growth. It gives an overview over recent developments in research and development, venture capital, education and other determinants of total factor productivity (TFP) growth. Next we discuss labor market aspects, focusing on the evolution of future labor inputs with a special emphasis on demographic aging and the related need for increasing the participation of older workers. The final section contains a short summary.

2 Estimating Potential Output

Although potential output can be defined in numerous ways, the most relevant definition used in the context of monetary policy is based on the idea that output above a certain level is likely to be associated with inflationary pressures. Put differently, potential

Refereed by
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output is defined as the maximum level of GDP that is consistent with a stable rate of inflation. The output gap, defined as the deviation of actual from potential output, provides an indicator of the balance between supply and demand influences and hence inflationary pressures.

An estimate of potential output allows us to distinguish between transitory influences and structural imbalances in the economy. This distinction appears to be particularly important for the analysis of fiscal policy and the assessment of fiscal balances. Over the medium and long run, potential output is a proxy for the aggregate supply capacity of the economy and helps assess the sustainability of output and employment growth paths.

However, potential output cannot be observed and therefore has to be estimated. Various estimation methods have been proposed. Most studies of potential output rely at least to some extent on the so-called "production function approach." The popularity of this approach stems at least partly from the fact that it allows to conduct growth accounting exercises, that is, it allows us to obtain estimates of how individual factors contribute to potential growth. Moreover, organizations and institutions such as the European Commission, the OECD and the IMF regularly apply the production function approach for policy evaluation.

Basically, this approach relies on the assumption that the supply side of the economy can be modeled as a neo-classical aggregate production function. Alternatively, regression and filtering methods have been applied to extract low-frequency movements in the data. These methods can be characterized as purely statistical and rely on a related but different definition of potential output. Here, it is assumed that potential output is identical to the trend or smooth component of actual output.

The production function approach can – in principle – also be used as a starting point for a growth accounting exercise that splits the observed growth rate into contributions from labor, capital and TFP. Moreover, if additional assumptions are made, growth contributions can also be linked to the "deeper" determinants of growth, as for instance Research and Development (R&D), human capital etc.

Based on such a growth accounting analysis, Gnan et al. (2004) conclude that Austria's per capita GDP growth was mostly driven by the growth of TFP. In particular, they report that the average growth rate of per capita GDP was 2.75% in the period from 1960 to 2002 and the contribution of TFP amounted to 2.37% on average. Thus, technological progress appears to be a major source of growth in Austria.

In principle, this kind of analysis also allows to consider the growth effects of various policy measures or changes in the economic environment. For instance, assuming that one is willing to make rather strong assumptions about the exact relationship between a policy measure under consideration and its impact on TFP, labor supply and capital stock, it would be possible to perform a kind of "scenario analysis."

As an example consider demographic changes and their impact on growth. Basically, it would be possible to obtain longer-term forecasts for the evolution of the working-age population, the participation rate and the unemployment rate, which could be taken as exogenous. Using these variables for the calculation of the potential labor input for the growth accounting exercise, it should be possible to calculate the growth effects of different demographic developments. (See the labor market section of this article for more details.)

However, this approach suffers from various shortcomings and inconsistencies. First, this approach is completely atheoretical; it imposes no cross restrictions on the inputs. Hence, assumptions have to be made on how labor supply developments affect the capital stock and TFP. One may start with the assumption that only the labor force changes, but capital and technology are not affected. This is highly implausible since a reduction in the labor force (and the associated increase in wages) is likely to lead firms to substitute capital for labor. In addition, suppose the world is correctly described by the Solow model, then the capital stock is an endogenous variable that will react to changes in labor in a way so that the capital labor ratio is constant in the long run. Put differently, assuming the inputs are independent of each other goes against even the simplest growth model. Moreover, (semi-) endogenous growth models[1] link demographic developments to TFP growth. Thus, the inconsistency becomes even more pronounced. A simple growth accounting exercise would miss this effect completely. Thus, it would be necessary to specify exactly how demographic changes affect all inputs of the production function in order to obtain a meaningful result. However, such exact specifications do not appear to be available, since modern growth models are too stylized and abstract for this purpose.

In short, using growth accounting exercises for simulation purposes provides a flexible framework that allows analyzing basically any question as long as rather heroic assumptions are made.

The Production Function Approach

With very few exceptions, a Cobb-Douglas production function exhibiting constant returns to scale is chosen mainly because it is easy to implement and analyze. It has to be noted, however, that several studies argue that a CES production function might be a better description of the data, since factor shares appear to vary over time.[2] In particular, growth accounting exercises are rather straightforward with a Cobb-Douglas function. In general, the production function maps the inputs labor (L), capital (K) and some measure of the overall state of technological progress into aggregate output (Y). Thus, aggregate output takes the form:

$$Y = F(E_L L, E_K K) = (E_L L)^a (E_K K)^{1-a},$$

where $\alpha \varepsilon (0,1)$ *and* E_L, E_K *denote the efficiency of labor and capital, respectively. This production function can be rewritten as*

$$F(TFP, L, K) = TFP(L)^a (K)^{1-a},$$

where $TFP = E_L^a E_K^{1-a}$ *is conventionally defined to be total factor productivity.*

Using this specification implies that the elasticity of substitution is assumed to be unity and output. Elasticities with respect to labor and capital are given by α *and* $1-\alpha$*, which can be estimated by the wage share under the assumption of constant returns to scale and perfect competition. The unitary elasticity of substitution also implies that factor shares remain constant over time.*

Potential output, Y^**, is defined as:*

$$Y^* = F(TFP^*, L^*, K^*) = TFP^*(L^*)^a (K^*)^{1-a},$$

[1] *See Jones (2004).*

[2] *See, among others, Willman (2002).*

where stars denote the "potential" levels of utilization of the respective input factor. After the specification of a production function, the next step is to obtain estimates of the potential levels of the inputs. As in the case of potential output itself, these potential input levels cannot be observed. Hence, additional assumptions are necessary to render this approach operational.

For the capital stock this problem is rather straightforward to solve since the potential contribution of the capital stock is given by the full utilization of the existing capital stock. This argument together with the fact that the actual capital stock series is rather smooth shows that there is no need to smooth the capital stock series. It has to be kept in mind, however, that the measurement of the capital stock entails rather severe data problems. Although data reliability is also problematic for other series used in the production function approach (e.g. hours worked), it appears to be particularly severe for the capital stock.

Finding potential labor supply is somewhat more involved since the "normal" degree of utilization of this factor is not as clearly defined as in the case of capital. The definition that is usually applied is based on the non-accelerating inflation rate of unemployment (NAIRU). However, since the NAIRU cannot be observed in the data, econometric methods have to be applied here. Commonly used methods include filtering techniques, structural labor market models (e.g. based on wage bargaining) and unobserved component models.

Total factor productivity is usually calculated as the so-called Solow Residual, and the potential TFP contribution is proxied by the smooth component of the Solow Residual.

The purely statistical approach to the estimation of potential output consists of the extraction of the low-frequency component of GDP. An important advantage of these methods is that filtering techniques are simple to implement and usually not restricted by limited data availability.

The simplest approach in this category is based on the assumption that the trend component of GDP is a linear function of time. This trend can be extracted via a simple regression, and an estimate of the output gap can be obtained as the difference between actual and trend GDP.

A widely used method is the Hodrick-Prescott filter. This method is slightly more involved since it requires a parameter that summarizes the trade-off between the fit and the smoothness of the trend component. Note that for the extreme case where all the weight is put on smoothness, the Hodrick-Prescott filter converges to a linear trend. Thus, the choice of the "smoothing parameter" is rather crucial, albeit arbitrary. However, the most important drawback of the Hodrick Prescott filter appears to be its rather poor performance at the end of the sample. Since policymakers are usually concerned with current developments, this drawback appears to be particularly relevant. This has been proposed to eliminate the so-called end-of-sample bias by applying the Hodrick-Prescott filter to a GDP series with incorporated forecasts. Although this remedies the end-of-sample bias, the estimate of the trend component becomes rather sensitive to the forecast.

To sum up, it appears that the various methods frequently used for the estimation and calculation of potential output do not differ greatly.

The various methods to estimate potential output have in common that they are designed to obtain real-time estimates. Put differently, they should provide an answer to the question how much of the latest movement in GDP is due to the underlying trend as opposed to cyclical factors. However, it appears that the available methods to estimate potential output are not able to completely eliminate the cyclical component. To some extent, this observation can be explained by the end-of-sample bias of the Hodrick-Prescott filter. Even the production function approach relies to some extent on filtered series as inputs; hence, results turn out to be similar to those obtained by the purely statistical approach. To conclude, it appears that despite rather frequent debates in policy circles on the relative advantages of the production function approach compared with the purely statistical approach, both methods are likely to yield rather similar results. Moreover, discussions focus exclusively on the point estimates for the potential growth rate without taking into account that estimates are probably subject to a non-negligible amount of uncertainty.

2.1 Overview of Recent Estimates for Austria

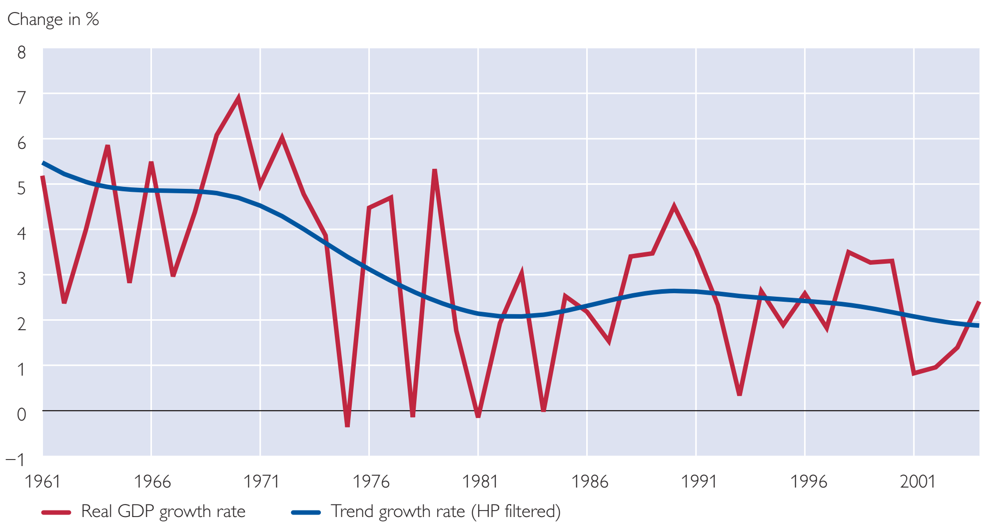
Chart 1 shows growth rates on real GDP and trend GDP from 1960 to 2004. The Hodrick-Prescott filter is used to extract the trend component. Overall, the figure shows that potential growth rates declined from 1960 to 1980. Moreover, potential growth has remained rather stable at slightly above 2% afterwards. For the period 1980 to 2004 the average growth rate of trend GDP has been 2.3%.

Estimates of growth and potential growth are provided by the IMF, the OECD, the European Commission and the OeNB on a regular basis. Table 1 displays recent estimates obtained from these organizations.

Available estimates for 2006 indicate that the growth rate of Austria's potential output should currently lie in the range between 1.8% and 2.2%. The OECD is slightly more optimistic than the other institutions and estimates potential growth to be 2.2%. Currently, only the European Commission and the OeNB provide forecasts for 2007: the OeNB expects a potential growth rate of 2.0%, whereas the European Commission forecasts 1.8%.

Chart 1

Real GDP Growth and Trend Growth



Source: OeNB.

For slightly longer time periods, the table shows that potential growth rates are likely to have been declining over the last years. For the year 2000 all available estimates lie above 2.2%, whereas for 2006 most estimates lie slightly below 2.0%. Thus, potential growth appears to have slowed down in Austria.

Table 1

Estimates of Potential Growth for Austria

	2000	2001	2002	2003	2004	2005	2006	2007
European Commission	2.2	2.1	2.0	1.9	1.9	1.9	1.8	1.8
OECD	2.5	2.3	2.6	2.5	2.4	2.3	2.2	×
IMF	2.3	2.3	1.8	2.4	1.8	1.7	1.8	×
OeNB	2.5	2.3	2.2	1.6	2.0	2.0	1.9	2.0

Source: OECD Economic Outlook 2005, Ameco database, World Economic Outlook September 2005, OeNB fall 2005 outlook and own calculations.

In short, currently available estimates point towards potential growth rates of around 2% in the near future.

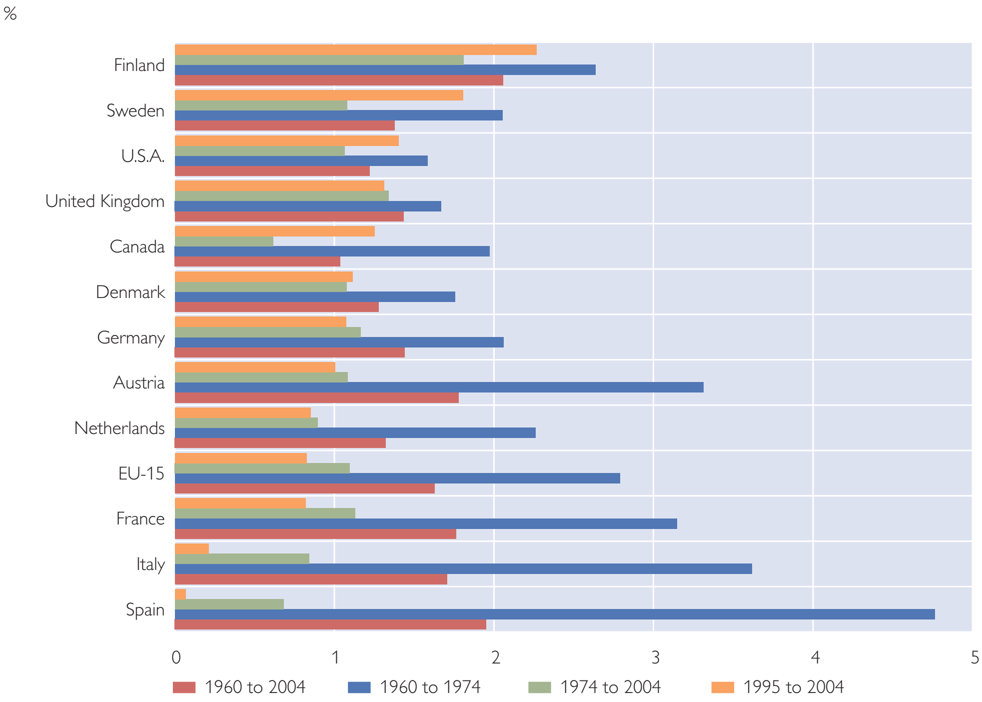
3 Prospects for Total Factor Productivity Growth

Total factor productivity is now seen as the main reason behind international income differences (Easterly and Levine, 2001). From 1960 to 2004, TFP grew faster in the EU-15 than in the U.S.A. This masks the divergence between very fast TFP growth from 1960 to 1974 and much slower TFP growth from 1974 to 2004. As regards the average TFP growth rate for the period 1995 to 2004, a differentiation should be made between two groups of countries. The first group experienced constant or falling TFP growth (e.g. UK, Denmark, Germany, Austria, the Netherlands, France, Italy and Spain as well as the EU-15 average), whereas the second group saw a pickup in TFP growth (e.g. Finland, Sweden, the U.S.A. and Canada). These diverging productivity growth patterns were part of the inspiration behind the Lisbon Agenda (the growth strategy of the EU) and also behind the term "New Economy."

As a result, the acceleration of productivity growth has become a major economic policy goal for the countries which have not succeeded in (partly) reversing the productivity slowdown. Judging from the last 30 years, trend TFP growth in Austria oscillates around 1%. This compares favorably with the EU-15 average of 0.8%, which is kept low by Italy and Spain. Up to now, however, Austria has not seen an acceleration in its trend TFP growth.

Chart 2

Average TFP Growth Rates of Selected Countries between 1960 and 2004



Source: European Commission.

3.1 Drivers of TFP Growth

There is no full consensus on what drives TFP growth rates, many studies thus simply extrapolate current trend TFP growth.[3] We make reference to the existing vast literature on possible determinants of TFP growth to give a tentative picture of the prospects for TFP growth in Austria. As a guiding framework, we use the one developed in Gnan et al. (2004) on the basis of the empirical literature while taking account of recent advances (chart 3). In this framework, direct sources of TFP growth (different kinds of innovative activity which depend on the available human capital) are supported or shaped by indirect sources (rules and policies, such as product market regulation). The main determinants are shared with other exercises of this type (see also Gelauff et al., 2004). It is not clear how the labor market affects TFP growth. The relationship between labor market regulation and innovation seems to differ sector-wise, with considerable uncertainty as to the overall effect (see also Bassanini and Ernst, 2002).

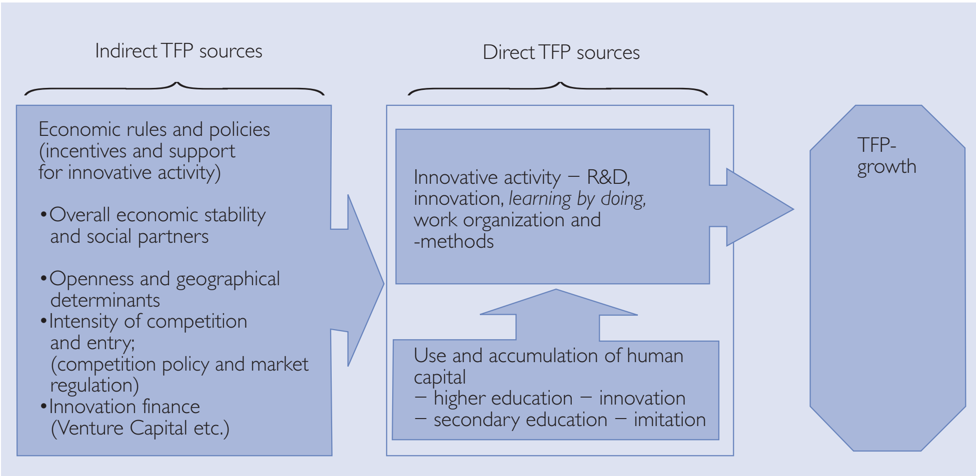
The sections 3.2 and 3.3 will follow the structure of chart 3, first turning to the direct drivers of TFP growth and then addressing the indirect drivers. Policymakers need to remember that

[3] *This is partly due to the fact that TFP is an unobservable "statistical residual," depending on the specified production function. In particular, TFP growth captures the part of real GDP growth unexplained by labor and capital inputs. For instance, if the measurement of labor input relies on persons employed rather than hours worked, TFP growth will include changes in average hours worked. Measuring the growth of capital input using the available capital stock will lead to TFP growth tracing the changes in capital utilization, a highly cyclical variable. TFP growth rates should thus be averaged over several years.*

any improvement in one or several TFP drivers will not automatically lead to higher TFP growth, as they are the result of empirical cross-country regressions, which may not necessarily materialize in every country at every time. Moreover, there is often a black box between the change in input (e.g. R&D) and output (aggregate measured TFP growth). Because of the role of TFP growth in explaining international income differences and because of the lack of consensus on drivers of TFP growth, we will subsequently often draw comparisons between Austrian figures and international figures.

Chart 3

Drivers of TFP Growth



Source: OeNB.

3.2 Direct Sources of TFP Growth

3.2.1 R&D, Innovation

The positive impact of the innovation input indicator R&D expenditure on productivity growth is among the most safely established results of the empirical literature (e.g. Griliches, 1995). The R&D intensity of the Austrian economy has been rising steadily since the 1980s, from 1.13% in 1981 to 2.35% in 2004. On average, it increased by 0.05 percentage point per year over the period 1981 to 2004. The average annual rise in the R&D ratio picked up speed from 1994 on, amounting to 0.08 percentage point in the period from 1994 to 2004 and to 0.09 percentage point in the last five years of this period.[4] As a small open economy, Austria is particularly sensitive to R&D spillovers from Germany (Coe and Helpman, 1995). Germany's R&D ratio increased at a much lower rate, from 2.31% to 2.51% between 1993 and 2003, and remained stable over the last five years. The Italian R&D ratio has remained unchanged over the last ten years at around 1.1%. However, for a country trailing the worldwide technology frontier, the more domestic research and development activities there are, the higher should be the absorption of foreign knowledge (Griffith et al., 2004). Even if the foreign creation of knowledge remains constant, the rise

[4] *There remains some doubt on the statistical validity of the sharp rise in the Austrian R&D ratio.*

in the Austrian R&D ratio should foster the absorption of international knowledge and create an additional impact on productivity, as long as Austria's TFP level remains behind the world frontier.

Before R&D impacts on productivity, it should show up in *patents and innovation measures*. Turning first to patents, Bloom and Van Reenen (2000) find that a doubling of the citation-weighted patent stock increases total factor productivity by 3%. However, it takes time until a patent translates into productivity because the new products and processes have to be embedded into new capital equipment and training. In Austria, between 1991 and 2001, the number of patents per million population registered at the European Patent Office (EPO) rose at a compound growth rate of 6.1% from 91 to 175, whereas the respective number of patents registered at the US Patent and Trademark Office (USPTO) increased more slowly, by 3.2% from 46 to 65. This rise has to be seen against the background of a general surge in patenting in the industrialized countries. It contrasts somewhat with the observation of stagnating R&D ratios in many OECD countries. The *level* of patents per million population in Austria at the USPTO is the same as the level of the EU-15 and slightly above the EU-15 at the EPO.

Based on the findings of the Community Innovation Survey (CIS II and III), the innovation performance in relation to R&D funding of Austrian companies can be analyzed and compared across EU countries (Falk and Leo, 2004). According to the CIS, Austria's innovation ratio ranks fifth in the EU: 43% of the Austrian companies included in the survey stated that they had launched innovations in the past three years. At 54%, Germany takes the lead, followed by Belgium, Luxembourg and Portugal. In terms of innovation output, i.e. the proportion of innovations relative to total sales, Austria came in third at 21%, behind Germany (37%) and Finland (27%). The share of new-to-market products in Austrian firms' sales remained constant at 7.6% from 2000 to 2002 (CIS II and III); positive signs are the increased percentage of Small and Medium-Sized Enterprises (SMEs) innovating in-house (from 35% to 44%) and that more innovative SMEs are now cooperating with other firms (from 8% to 13%).

While patent and innovation performances have been less impressive than the growth of R&D expenditure, the overall productivity of Austria's research system should be at least average (Janger, 2005; similar EU Innovation Scoreboard, 2005).[5] Thus, additional R&D expenditure should indeed lead to higher productivity growth. Not only the *efficiency and the effectiveness* of the research and innovation system should be considered when reflecting on prospects for TFP growth, but also the *time lag* necessary to transform research and innovative activities into real output. In a survey among American firms, Mansfield (1991) puts the mean time lag between R&D and innovation at seven years. In a survey of evaluations of research promotion funds, Burger and Felderer (2005) reach the conclusion that commercial applications resulting from research efforts usually take four to eight years to reach the market. The lag structure

[5] *This is a field of ongoing research, with more sophisticated tools hopefully soon available, see e.g. Mairesse and Mohnen (2002).*

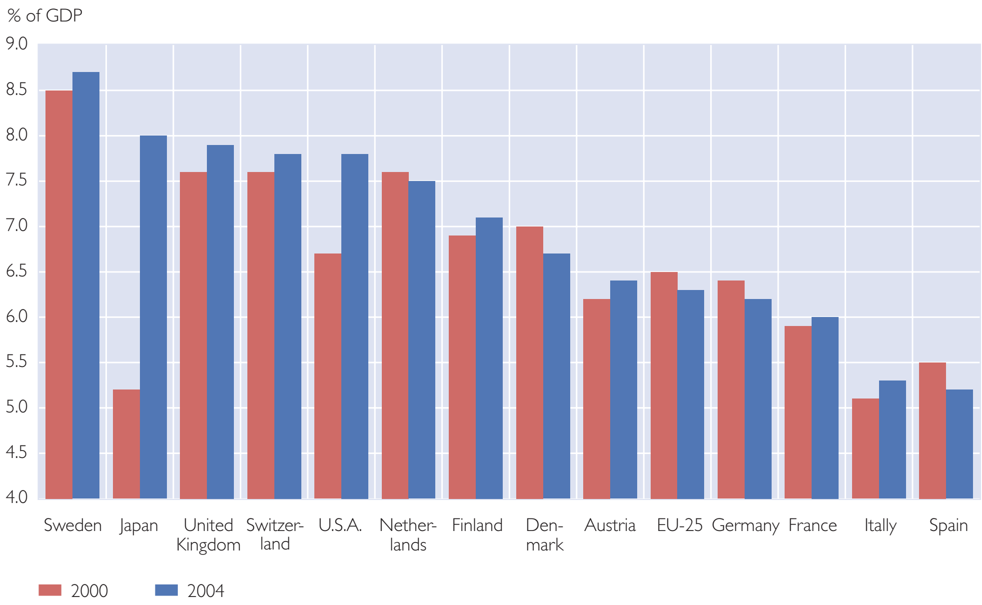
from science to markets differs from sector to sector. On average, it seems to take more than four years before R&D results in innovation, and before innovations show up in measured aggregate TFP growth, it may take some more years.

3.2.2 Expenditure on Information and Communication Technologies (ICT)

The general purpose technology character of ICT led to many studies investigating the productivity effects of ICT on the *total* economy. The outcome of these studies is inconclusive. While there are certainly productivity-enhancing effects at the micro- and meso-level, such as in ICT-producing and -using industries (see Bartel et al., 2005, and European Commission, 2004b), there remains doubt as to what extent ICT has spurred TFP growth in the *overall* economy (Vijselaar and Albers, 2002). In Austria, ICT expenditure as a percentage of GDP remained broadly stable at 6.2% to 6.4% of GDP from 2000 to 2004. This corresponds to the EU average. In general, ICT expenditure peaked in 2002 and has come down since then. Only the U.S.A. and Japan have experienced sizeable increases.

Chart 4

ICT Expenditure in 2000 and 2004



Source: European Innovation Scoreboard 2005.

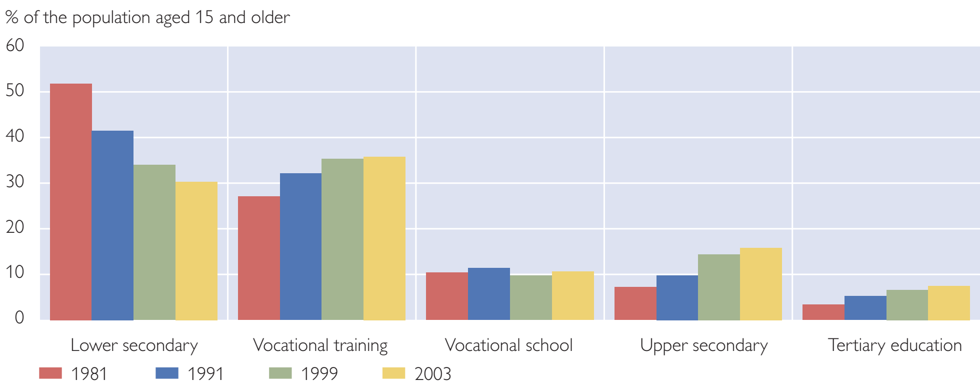
3.2.3 Human Capital

De la Fuente and Domenech (2002) find evidence of a strong positive correlation between human capital and productivity at the macroeconomic level. According to their estimates, raising the average period of schooling by one year will increase productivity by around 6% in the EU-15. Looking at the average level of educational attainment may not be enough to judge the prospects for TFP growth in Austria. More recent research focuses on productivity growth effects of higher education in countries close to the technological frontier. The European growth report by Sapir et al. (2004) argues that the relative importance of innovation as opposed to imitation increases as a country moves closer to the technological frontier. Vandenbussche et al. (2004) show that human capital does not affect innovation and imitation uniformly – primary and secondary education tend to produce imitators, while tertiary education tends to produce innovators. Aghion et al. (2005a) estimate that 1,000 USD per person in additional spending on research-type education raises an at-the-frontier state's annual per employee growth rate by 0.269 percentage point but raises a far-from-the-frontier state's per employee growth rate by only 0.093 percentage point. Thus, as a country moves closer to the worldwide efficiency frontier, higher education should become increasingly important for productivity growth.

Average years of schooling in Austria have been stable at 11.3 years, slightly below the OECD average of 11.8 (2002) over the past decade. There was a pronounced shift toward higher-level education types from 1981 to 2003.

Chart 5

Educational Attainment in Austria



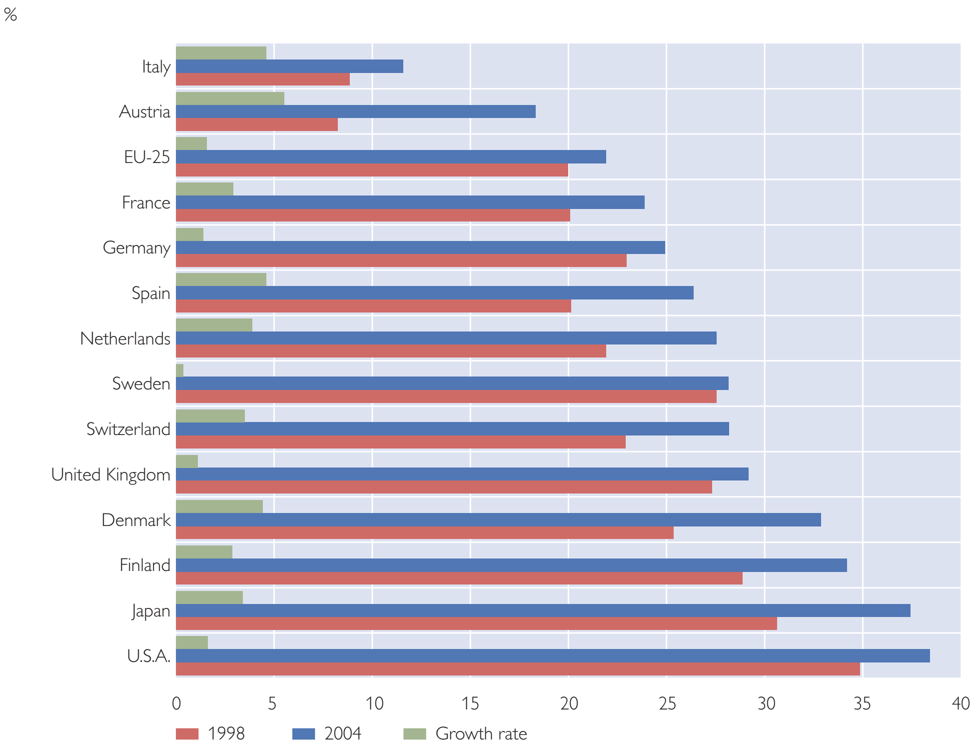
Source: Statistics Austria.

The share of the population with tertiary education has been rising but remains well below the level of the EU-25 and below the level of countries with similar R&D ratios. The growth rate is high by international comparison (between 1998 and 1999, there was a break in the data, the growth rate is calculated for the period 1999 to 2004). It is doubtful that this rate of growth can be sustained over the medium term, as the entry rates into tertiary education in Austria are at the lower end of the OECD spectrum at around 30% (e.g. Finland and Sweden attain entry rates above 70%). The low share of tertiary graduates is partly due to the education system, which leads to professional qualifications at the secondary level whereas in other countries tertiary-type education programs are more widespread. Whether secondary and tertiary-type programs can be functional equivalents remains to be seen, i.e. whether the Austrian system can be as productivity enhancing as systems more focused on higher education, regardless of what the available cross-country empirical literature indicates.

According to Aghion et al. (2005a), one should also look at spending per student. Austria is well above the OECD total as regards spending per student in primary and secondary education, but below the OECD total as regards tertiary-type spending. However, the OECD total is rather high due to the contribution from the U.S.A. For efficiency considerations of the Austrian university research system, see Janger (2005). In terms of the frequency of citation of a country's literature, Austria ranks eighth among the EU-15, behind Germany. Switzerland has by far the highest relative citation index value for science and engineering articles, followed by the U.S.A. and the Netherlands (OECD, 2005).

Chart 6

Share of Tertiary Graduates in the Total Population Aged 15 to 64, Compound Growth Rates from 1998 to 2004[1]



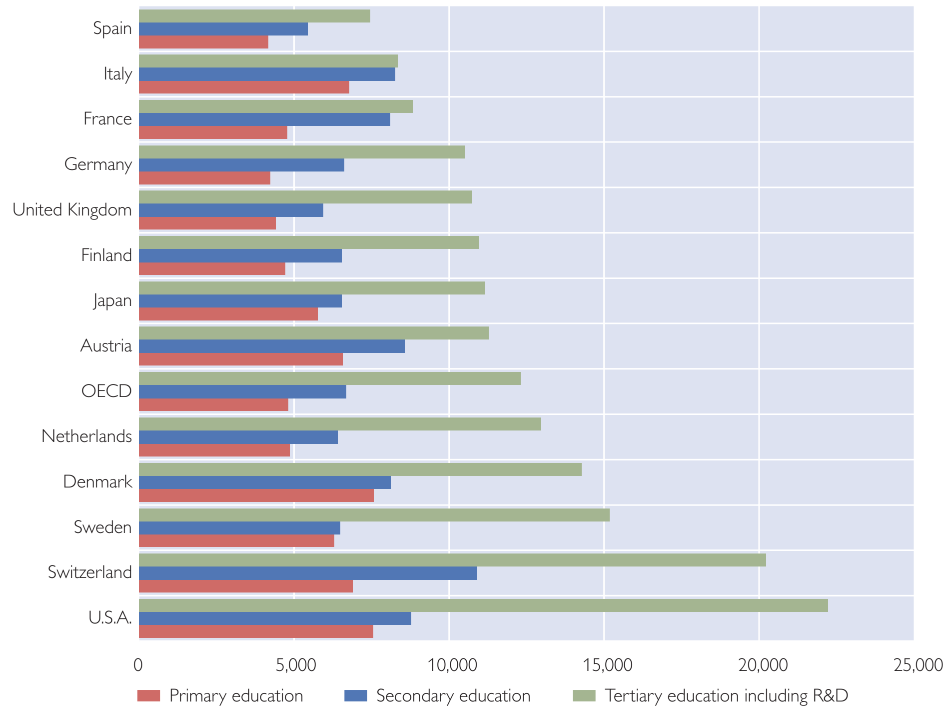
Source: European Innovation Scoreboard 2005.

[1] *Austrian growth rate from 1999 to 2004, EU-25 average growth rate from 2000 to 2004.*

Chart 7

Spending per Student and Level of Education

in constant USD and in purchasing-power parity



Source: OECD Education at a Glance (2004).

Chart 8

Number of Researchers per 1,000 Employees in 2003 and Growth from 1995 to 2003

Source: OECD.

In terms of GDP, Austrian spending on tertiary education decreased slightly from 1.2% of GDP in 1995 to 1.1% of GDP in 2002. Spending has also fallen in the U.S.A. and Finland, while Sweden, Denmark and Canada have experienced a rise.

The number of researchers per 1,000 employees is below the EU-15 and OECD average, but their average annual growth rate is well above the EU-15 and the OECD average.

3.3 Indirect Sources of TFP Growth

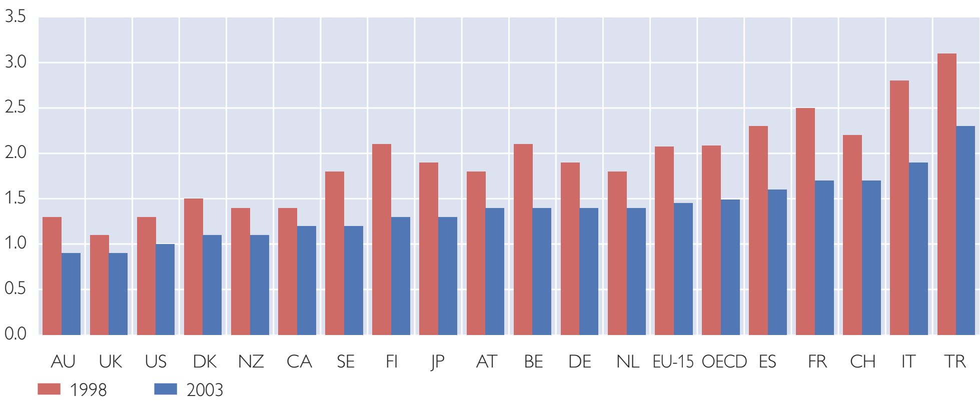
3.3.1 Domestic Competition

Much of the empirical OECD work (e.g. Nicoletti and Scarpetta, 2003) finds a uniform positive impact of increased competition on total factor productivity growth. The OECD uses indicators of product market regulation as proxies for actual competition intensity. Other work provides a more complex picture of the relationship between competition and productivity (Aghion and Griffith, 2005). The effects of competition on productivity seem to vary with the distance to the worldwide frontier of efficiency (the highest level of TFP) and sectoral characteristics. However, for an advanced country like Austria, the overall effects of increased competition on productivity should be positive.

Regulation of product markets in Austria is within the OECD average and has decreased like in the other EU countries. Market concentration is above the OECD average, which is typical of a small open economy. Above-average mark-ups can be found especially in the service sector (hotels and restaurants, retail); in manufacturing (e.g. steel) they reflect a quality advantage. Mark-ups in gas and electricity as well as in telecommunications are below the OECD average (Aiginger et al., 2004). Due to EU directives, ongoing network industry liberalization (railways, certain postal services) can be expected. In subsectors of the service sector, such as the liberal professions, an above-average degree of regulation persists in Austria (European Commission, 2004a).

Chart 9

Product Market Regulation, OECD Composite Indicator



Source: OECD.

A special case of product market regulation is public ownership. The OECD estimates the positive effects of privatization on productivity (Nicoletti and Scarpetta, 2003). Their privatization measure takes the 1975 value of the privatization index of the Fraser Institute and updates this value with privatization receipts from the OECD privatization database and others. The most recent value dates back to 1998 and shows a rather high value for Austria. Since then, further privatization has been undertaken. It is likely that already in 1998 their indicator showed too high a value, because the receipts from privatization from 1990 to 2000 amounted to 3.9% of GDP, only slightly below the EU average of 4.2%. State-owned or partly state-owned firms in industry and infrastructure today account for roughly 5% of GDP (not including the government sector) (Aiginger, 2003). Many of these firms already face competition, so that the effects of state-ownership on productivity can be expected to be limited.

3.3.2 Foreign Competition and Embodied Knowledge Flows

The openness of an economy (measured basically by trade and FDI flows) affects TFP growth above all through two channels: An open economy may absorb foreign technologies (with imported goods often driving international spillovers) and ideas. Moreover, openness adds to the intensity of domestic competition, which, in turn, creates incentives for change and fuels productivity growth. Austria's trade openness measured as the average of exports and imports increased significantly by a full 12 percentage points from 30% in 1995 to 42% in 2004. In the period from 1980 to 1995, it remained roughly stable at 30%. This compares with similar values for Finland, Sweden and Denmark and higher values only for the Netherlands and Belgium.

FDI flows have also been growing considerably, with inflows and outflows now almost balanced. The average inflows and outflows from 2000 to 2003 were 2.5% and 2.6% of GDP, respectively. There is still room for further FDI growth, considering that Finland, Denmark and Sweden record FDI flows of 6% to 8% of GDP. One of the reasons for this might be the rather heavy restrictions on FDI inflows as measured by the OECD (Golub, 2003), placing Austria above the OECD average in terms of barriers to FDI inflows. This finding needs further research, though.

3.3.3 Entry and Business Start-Ups

Technology-oriented start-ups may also be regarded as a form of innovation and could thus be included in the direct factors determining TFP growth. We focus on all entries. Aghion et al. (2005b) provide evidence that the entry rate has a positive effect on total factor productivity growth for industries which are close to the technological frontier. However, productivity growth is not stimulated by the new entrants, whose productivity is known to be low at the beginning; rather, enhanced productivity growth is the result of an escape competition effect, whereby incumbent firms raise their productivity due to the threat of entry. High levels of entrepreneurship are also a condition for the rising R&D stock to translate into higher venture capital intensity (Romain and Van Pottelsberghe, 2004b).

Data on entry and start-ups are scarce and international comparison is often very difficult. The OECD is working on harmonized statistical methods to enable better comparison. However, entry and exit rates are fairly similar across industrial countries and show no particular volatility, while post-entry performance differs markedly between Europe and the U.S.A. (Bartelsman et al., 2004). The numbers of Austrian start-ups are based on data from the Austrian Federal Economic Chamber and are insufficient to perform an analysis on the lines of Aghion et al. (2005b). The number of Austrian start-ups has risen considerably, from an average below 10,000 in the mid-1990s to above 20,000 in the most recent years. This is mainly due to an increase in the number of self-employed, while the numbers of limited liability and of public limited companies have even come down slightly. The impact of the rise of the entry rate from 5.8% in 1993 to 8.9% in 2002 on productivity must thus be questioned. Austria's entry rate compares with, e.g., 12% in the UK or 7% in Finland and in Italy. The Austrian Institute for SME Research is doing a research project at the moment to analyze what really lies behind the numbers. An empirical study on Portuguese firms shows, for instance, that positive indirect supply-side effects from higher levels of new business formation take about eight years to materialize (Baptista et al., 2005). This is in line with the results on R&D and innovation obtained by Mansfield (1991).

Concerning the regulation of entry, there have been changes, e.g. the regulations on small business and trade have been somewhat liberalized and a one-stop shop for business creation has been introduced. The Doing Business (IFC, 2005) study on business start-up regulation places Austria well above the OECD average in terms of number of procedures, duration and minimum capital required to set up a company with limited liability. However, the study focuses on a very standardized example firm (a limited liability company) to enable cross-country comparison, without mentioning the fact that limited liability companies only represent a small share of business start-ups in Austria (roughly 10%); it should be checked whether the result of this study is representative for limited liability companies in Austria.

3.3.4 Venture Capital

Venture capital may be considered not only a means to finance new businesses, but also a proxy for the amount of new, risky and possibly technology-oriented ventures, i.e. innovative activities. In a working paper – with results to be interpreted with caution – Romain and Van Pottelsberghe (2004a) find that a 1% increase of the venture capital stock leads to an increase of TFP by 0.009%; they find a social rate of return to venture capital of 3.33 (i.e. an additional EUR 1 of venture capital stock leads to EUR 3.33 of output growth, which is higher than the social rate of return to public R&D (2.69) and business R&D (1.99) as estimated by the same authors. Kortum and Lerner (2000) obtain a more robust result with regard to patenting. Higher venture capital activity in an industry is associated with a significant rise in patenting rates.

The Austrian venture capital stock rose by 50%[6] from 2000 to 2003, albeit from low levels in 1998 (i.e. VC intensity is low in Austria); yearly venture capital investments have been falling since 2002. In absolute terms, the stock of venture capital is still very low, far below EU levels (which, in turn, are low compared with U.S. levels). The average amount of venture capital invested per year between 2000 and 2003 was only 0.057% of GDP in Austria, compared with

[6] *Computed by the method suggested by Romain and Van Pottelsberghe (2004a), i. e. perpetual inventory method with a rate of depreciation of 30%.*

0.13% in the EU and 0.375% in the U.S.A. The current growth rates do not look promising either. There is some discussion on whether it is the lack of interesting ventures to finance or the framework conditions which hamper venture capital intensity.[7] Overall, the rising liquidity of the Austrian exit markets (e.g. the Austrian stock exchange) should provide more exit options for venture capital, thus increasing venture capital intensity. The rising R&D stock and technological opportunities proxied by the number of patents should make venture capital investments rise as well (Romain and Van Pottelsberghe, 2004b). Thus, assuming that Austria does not fundamentally differ from other European countries in its ability to reap business opportunities – and innovation and patent data indicate no such anomaly –, there should be a positive outlook for venture capital intensity converging to the European average, provided that the framework conditions are right.

3.3.5 Economic Geography

Geographical determinants of productivity such as location and the degree of agglomeration could play a particular role for Austria. In conurbations, corporate productivity is boosted above all by local technological spillovers (Glaeser et al., 1992). Yet even without such spillovers, market mechanisms in small and large agglomerations (e.g. the "blue banana," the central axis of the EU, which stretches from London to Milan) may create a dynamic virtuous circle between agglomeration and endogenous growth (Martin and Ottaviano, 2001). Higher productivity levels have been confirmed empirically for cities and larger agglomerations (for the U.S.A., see Ciccone and Hall, 1996). In Europe, the influence of the national productivity regimes naturally prevails, but Geppert et al. (2003) find production levels to be significantly higher around larger agglomerations in Europe as well. It is not clear whether rates of growth of TFP would be affected permanently or whether there are level effects on labor productivity only. However, Acs and Varga (2005) find that after controlling for the stock of knowledge and research and development expenditures, both entrepreneurial activity and agglomeration have a positive and statistically significant effect on technological change in the European Union.

The opening up of Eastern Europe has propelled Austria from the rim to the center of the European economy. Given the dynamics of the axis Prague-Vienna-Bratislava-Budapest, the blue banana may henceforth stretch further east. With the increasing catching-up and opening-up of Southeastern Europe, yet another economic area will gain momentum and thus create a positive climate for productivity growth in Austria. This presupposes adequate transport and communications infrastructures, which are only partly in place.

4 Labor Market Aspects of Potential Growth

4.1 Labor Market Reform as a Priority of Economic Policy

The labor market is often seen as key to future growth prospects. In the discussion about economic policy reform there are two areas in which labor market aspects are prominent: First, there is the goal of increasing labor force par-

[7] *For an overview of different venture capital intensities explaining innovation differences between the U.S.A. and Europe, see Dosi et al. (2005).*

ticipation, most prominently featuring in the EU's Lisbon strategy, which envisages quantitative employment targets the EU aims to reach by 2010: An overall employment rate of 70% (70 out of 100 in the working-age population, i.e. the population aged 15 to 64 years, should be employed), a female employment rate of 60% and an older workers' (aged 55 to 64 years) employment rate of 50%.[8]

What justification may be given for increasing employment rates? Economies with high GDP growth rates (such as the United States and some – especially northern – European countries) tend to have more people in employment. On the other hand, low employment rates in other countries do not reflect voluntary decisions to abstain from participating in the labor market: Many continental – in particular southern – European countries face high unemployment rates. Additionally, although the participation rates of men and women are converging, the lower female labor supply observed in most countries is another "untapped" labor force potential. For example, mothers of young children very often drop out of the labor force after unsuccessfully trying to re-enter the labor market. Austria already exceeds the quantitative goal of 60% but female employment is stagnating at this level and there are a number of examples of female employment rates of close to 70% or more (Denmark, Finland, Sweden and the United Kingdom).

Raising employment rates is also seen as necessary in the face of aging societies characterized by a declining labor force and an increasing average age of those working, which puts pressure on social security systems. In Austria, the primary concern is to keep older workers longer in employment, because Austria has an extremely low older worker's labor force participation rate of less than 29% (contrary to its overall employment rate, which is clearly above the EU average and at almost 68% already close to the overall employment target of 70%). Like in other European countries, the low labor force participation of older workers is the result of policies aimed at fostering early retirement by creating opportunities and incentives for workers to leave the labor force before reaching the statutory retirement age. Many consider the employment prospects of women and older workers as the primary area of economic policy: For example, in a recent report by the OECD (2005a) it is recommended that Austria make further efforts in reforming its pension system as well as reducing inactivity traps for women with children.

There is a second reason why labor markets are considered important for restoring higher economic growth in Europe. High and persistent unemployment led many academics and policy institutions like the OECD to argue that far-reaching reforms of labor market institutions (e. g. reforms of tax and benefit systems, employment protection and wage setting procedures) are important elements in the solution of the unemployment problem. But while there is general agreement on this issue, the details – i.e. which labor market institutions are harmful and what actions should be taken – are subject to an intensive debate.

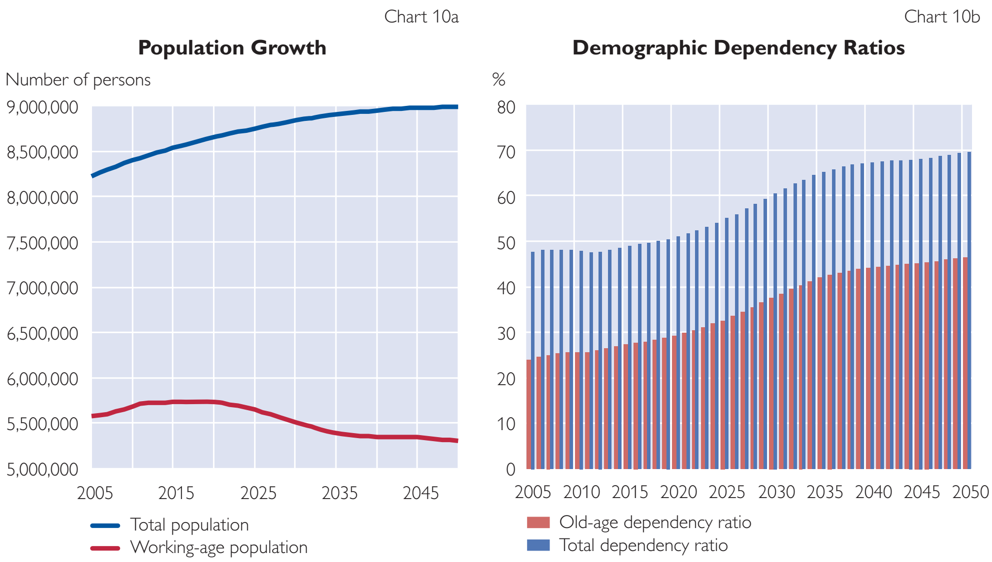
[8] *For information on the current state of these indicators, their evolution over time and the cross-country variation, see the "Employment in Europe" report of the European Commission (2005b).*

4.2 Increasing Labor Inputs and the Retirement Age

4.2.1 Demographic Transition

Due to increased life expectancies and the decrease of fertility rates after the baby boom of the 1950s and 1960s, the OECD countries will see a substantial ageing of their populations over the coming decades. This process will evolve slowly in the short to medium run but will accelerate in the 2020s, when the first baby-boom cohorts will retire. Whereas the number of the working-age population is going to increase for approximately another ten years, it will start to decrease slightly afterwards and decline even more strongly in the 2020s (see panel (a) in chart 10).[9] Because the total population continues to rise, demographic support ratios are going to increase (panel (b)). For example, the old-age dependency ratio (i.e. the ratio of the population aged 65 years or older to the working-age population) is expected to go up from 26% at present to 46% in 2050.

Population Projection for Austria (Autumn 2005)



Source: Statistics Austria.

The demographic developments affect future potential labor inputs. A shrinking population may lead to a decline of a country's total GDP.[10] Perhaps the most important concern is the sustainability of pension systems, most notably pay-as-you-go systems, in which pension income is directly financed by the social security contributions paid by those in employment. Thus, policies that boost labor-force participation attract considerable interest. Increasing labor force participation may offset demographic developments for a considerable time.

9 *All statements on the expected population developments in Austria are based on the autumn 2005 population projection by Statistics Austria (Hanika, 2005).*

10 *However, a shrinking population does not necessarily lead to decreasing incomes per capita, which is the relevant measure for economic welfare. See also The Economist, January 7, 2006.*

4.2.2 Growth Accounting Exercises and Their Limitations

Projection exercises of the magnitude of future labor forces in OECD countries are based on given population projections and typically consist of both the extrapolation of past trends of participation patterns (in particular the higher participation probabilities of younger female cohorts) and an attempt to quantify the future impact of policy measures on participation (most notably pension reforms, which were undertaken in virtually all OECD countries). Two recent working papers of the OECD (Burniaux et al., 2004) and the European Commission (Carone, 2005) are typical examples of studies using a rather high degree of disaggregation of the labor force components and country-by-country evaluations of pension reforms. They combine trends and assumptions of future participation rates, which include cohort effects and estimated effects of past pension reforms.

Aging undoubtedly constitutes a problem for social security systems and public budgets. Trends and scenarios of the evolution of the working-age population help to anticipate times of tighter labor markets and financial pressure on pension systems. Some obvious remedies for these problems are reversing the trend towards early retirement and creating demographic stabilizers in pension systems. In Austria, significant steps have been taken in these directions.

However, some of the purported consequences of aging are untenable or exaggerated. There are a number of macroeconomic projections according to which aging leads to slower GDP growth. However, growth equations in which the growth of labor input is decreased and all the other determinants (capital, efficiency of input use) are held constant necessarily lead to this result. A typical example is a projection exercise by Musso and Westermann (2005), who – in different scenarios of slower working-age population and labor force participation growth – calculate decreasing GDP growth rates in the euro area.

The budgetary projections compiled by the Economic Policy Committee for the European Commission (Economic Policy Committee and European Commission, 2006) build upon similar growth accounting exercises (Carone, 2005). Table 2 lists some of the input variables for the growth equations, such as male and female labor force participation rates and employment growth for the Austrian economy. Although participation increases, employment growth eventually becomes negative (due to the projected shrinkage of the working-age population).[11] This leads to an expected real GDP growth rate of merely 1.1% in the mid-2020s.

Table 2

EPC Projections of Economic Growth: Results for Austria

	2005	2010	2015	2020	2025
Male participation rate (15 to 64 years, %)	80.4	82.2	82.9	83.3	82.6
Female participation rate (15 to 64 years, %)	66.2	70.1	71.9	72.9	72.8
Total participation (15 to 64 years, %)	73.3	76.1	77.4	78.1	77.7
Labor force (1,000s)	4,049	4,233	4,331	4,349	4,234
Employment growth (%)	1.1	0.9	0.2	–0.1	–0.7
Real GDP growth (%)	1.9	2.6	2.0	1.7	1.1

Source: Economic Policy Committee and European Commission (2006).

Such methods may be useful to isolate partial effects and draw attention to their potential magnitudes but ignore basic economic principles. Very likely, shortages of production factors will trigger substitution effects. If labor becomes scarce wages tend to rise, which will cause substitution towards less labor-intensive forms of production. Higher wages may also induce demand for less (or shorter) education and lead to longer working hours or longer working lives.

To get more realistic impressions of the economic impact of aging societies, models which allow for substitution and feedback effects are preferable. For example, in Börsch-Supan (2001) labor force growth scenarios are only a starting point. He then uses a calibrated overlapping-generations model of the German economy to study the effects of aging and the gradual introduction of a multi-pillar pension system to quantify increases in capital/labor ratios, wages and labor productivity. Hofer and Url (2005) use a similar model for the Austrian economy to study potential effects resulting from aging within the working-age population. They find that even under strong assumptions (i.e. drastically declining individual age-productivity profiles of workers) the adverse macroeconomic impact is very small. Although these models allow for a range of feedback and substitution effects, they are not without limitations. For example, in both papers labor supply is given exogenously.

4.3 Labor Market Policies, Structural Labor Market Reforms and Growth

Demographic transitions and policies increasing employment rates are frequently investigated within growth accounting frameworks, mostly by adjusting the quantity of the labor input in the production function. By contrast, many labor market policies are, however, analyzed with completely different models and methods. Most approaches to study the effects of labor market policies and changes in labor market institutions focus on effects on the unemployment rate.

Nickell and Layard (1999) do not give a precise definition of what they mean by "labor market institutions:" Inter alia, they consider labor taxes, employment protection, trade unions and wage bargaining systems including minimum wage legislation, unemployment benefit systems and barriers to regional mobility. A widespread classification distinguishes between active and passive measures. Active measures are related to the functions of public employment services, for example assistance in job search and various training measures, but also employment subsidies. Passive measures are primarily unemployment benefit systems. Although this distinction is widespread, it is clear that the effects cannot always be neatly separated. For example, the effect of unemployment benefits on unemployment duration crucially depends on job search assistance and sanctions in case of non-compliance (see, for example, OECD 2005b).

In 1994, the OECD launched a comprehensive reform initiative, the "jobs strategy."[12] Taken as a whole, this paper indicates that there is a positive association between the overall "reform intensity" and the changes in natural unemployment rates. (The OECD plans to publish an evaluation report of the jobs strategy in 2006.) The OECD recommendations recently have evoked a number of critical publi-

[12] *See the OECD working paper by Brandt et al. (2005) for a summary of labor market reforms since then.*

cations. The literature on the economic effects of labor market institutions is also inconclusive, and empirical results are often fragile (Cahuc and Zylberberg, 2004; OECD, 2004; Freeman, 2005). In a recent survey of the European unemployment problem, Blanchard (2005) holds the view that labor market institutions are only part of the story of low growth in Europe.

Statements on GDP growth effects of labor market institutions and their changes are rare. For example, Nickell and Layard (1999) discuss possible effects of labor market institutions on unemployment within an equilibrium unemployment model, but decide to discuss long-run growth effects separately (and informally). Even more common in labor economics are micro studies in which, for example, the effects of policy measures on employment probabilities, individual job careers or unemployment durations are investigated empirically (see Burgess and Garrett, 2005, for a recent survey). In this literature, there is no link to macroeconomic effects at all.

For these reasons, we do not discuss the growth effects of a number of policy measures and reforms related to the labor market. These include the reduction of the income tax in 2005 (which, however, was partly offset by higher social security contributions), the tightening of suitability criteria for unemployed workers receiving unemployment benefits in 2004 and the reform of the severance pay scheme in 2002. Finally, a range of active labor market policy measures has been introduced (especially in 2005) to tackle the increase of unemployment since 2001.

4.4 Recent Reforms Relevant for Labor Supply

In the recent years, the Austrian government has undertaken several policy reforms related to the labor market, most importantly a series of pension reforms.

4.4.1 Reforms of the Public Pension System

The Austrian government launched a series of legislative initiatives to implement far-reaching reforms of the public pension system in 2001, 2003 and 2004. From the viewpoint of labor market participation, the following aspects are probably the most relevant: (1) the gradual increase of the eligibility age for early retirement due to long insurance record; (2) the complete abolition of two other early retirement schemes (early retirement due to reduced work capacity and early retirement due to long-term unemployment); (3) a decrease in replacement rates by basing pensions on the total earnings history (and not only on those 15 years with the highest earnings); (4) the introduction of the freedom to choose the retirement age (between 62 and 68 years), with corresponding benefit deductions or delayed retirement credit.[13]

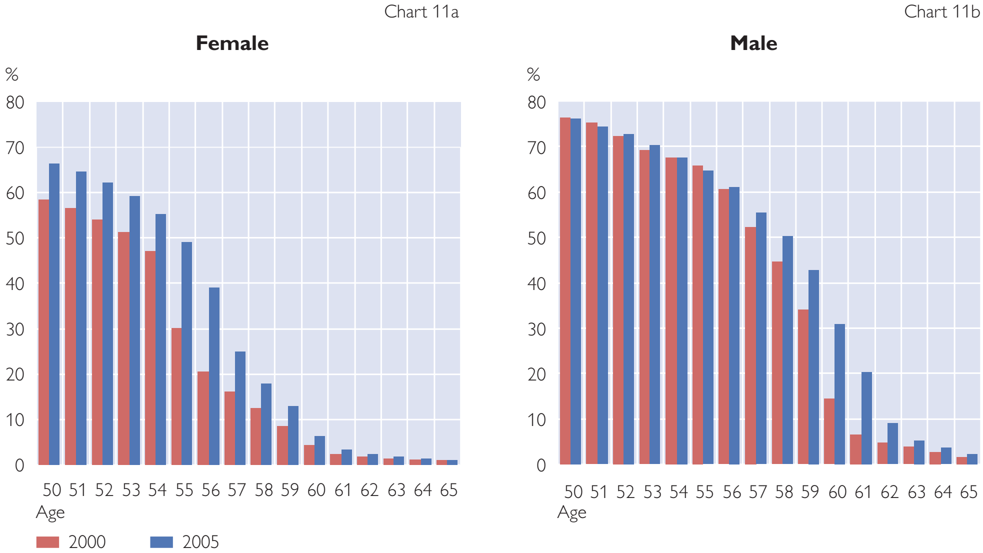
The reforms thus will clearly improve the fiscal sustainability of the pension system and result in higher labor supply. In the short to medium run, the effects on labor force participation and employment rates are less clear. Most importantly, most of the reforms are introduced gradually. For example, those born before 1955 will be exempt from most of the changes in the system. Moreover, although some early retirement routes were

[13] *Currently, women's statutory retirement age (60 years) is lower than men's (65 years). Between 2024 and 2033 it will gradually be increased towards 65 years.*

closed, there appears to be a high degree of substitutability of these routes. For example, the number of disability pension beneficiaries has increased, and participation in quasi-early retirement schemes (such as the phased retirement scheme; see OECD, 2005c) is widespread.

Therefore, the full labor market and growth potential effects of the pension reforms will unfold only slowly. But as chart 11 – which compares male and female participation rates (from administrative data) in 2000 und 2005 – indicates, participation rates have already gone up, most likely due to increases in the early retirement age. (The general increase of female labor force participation, which is clearly visible in the left panel of the chart, is a cohort effect.)

Labor Force Participation Rates in 2000 and 2005



Source: Federal Ministry of Economics and Labour.

4.4.2 Reform of the Child Benefit System

The recent years saw the launch of a number of other labor market reforms (or reforms relevant from a labor market perspective). In 2002, a new child benefit system was introduced. Most importantly, the duration of entitlement was increased, and eligibility to the benefits was extended to all parents of young children.[14] Based on family policy considerations, this reform probably has negative consequences for female labor supply[15] although there is also a countervailing effect because the amount of earnings allowed without loss of benefits has been liberalized (OECD, 2005c).

[14] *In the old system, only employees were entitled to child care benefits. Most recipients in the scheme are women.*

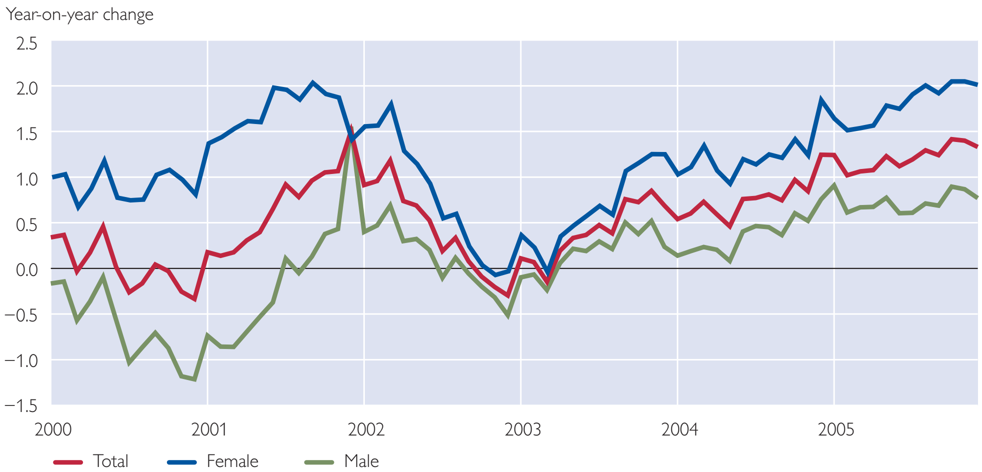
[15] *See Lalive and Zweimüller (2005) for a careful empirical study on the fertility and labor supply effects of two changes in the duration of parental leave that happened in Austria in the 1990s.*

4.5 Recent Labor Force Developments

How did the Austrian labor force develop in recent years? According to the harmonized employment and participation rates published by the European Commission (2005b), employment and labor force participation as a fraction of the total working-age population was stagnant between 1999 and 2004. Older workers' participation rates even decreased marginally, which contradicts the administrative data shown in chart 11. However, one has to take into account that in the underlying labor force surveys yielding these data, a new methodology was applied, which resulted in a time series break in these data in 2004. This implies that survey data are not a good source for an analysis of recent trends in labor market participation.

Chart 12

Labor Force Growth



Source: Social security registers ("active employment"), registered unemployment.

Alternatively, chart 12 plots relative year-on-year changes of total labor force participation as well as labor force growth by gender according to administrative data (social security data on registered "active" employed and registered unemployed). The chart shows that total participation increased in 2001, declined in 2002 and has been steadily rising since then. By the end of 2005, annual labor force growth stood at approximately 1.4%. Interestingly, the labor participation rates of men and women evolved differently: Women's labor supply growth rates were on average higher due to the cohort effect mentioned above, with younger women showing a higher propensity of participation than older ones. Especially in 2000, male participation was on the decline, probably because of the extensive use of early retirement options before they were tightened or closed. In the period between 2003 and 2005 both male and female labor supply were increasing, with female labor force growth being considerably stronger.[16]

[16] *These figures refer only to dependent employment and standard employment contracts. Total labor force growth has been probably even stronger because of the rising number of self-employed, but also due to the increase of non-standard employment contracts, such as marginal employment.*

5 Summary

The literature offers a variety of methods for estimating potential growth. However, it seems that the different methods do not yield results that vary greatly. Moreover, it has to be kept in mind that real time estimates of potential growth are likely to be subject to substantial uncertainty, which warrants caution in their interpretation. According to currently available estimates, the growth rate of Austrian potential output is roughly 2%. We observe that potential growth has slowed down slightly over the past two decades.

Turning to the prospects for total factor productivity growth, there have been significant improvements in areas where there is broad consensus on their positive association with TFP growth (and a lot of empirical research has been done on this positive relationship), such as *R&D* and *trade openness*, over the last 10 years. High growth rates in these areas have now also led to levels above the EU average. Another very positive development for Austria has been the opening up of Eastern Europe and EU enlargement, even though there is less consensus on these developments' precise impact on TFP growth. The impact of *dynamic agglomeration gains* also depends on the transport infrastructure. In product markets, there have been improvements as regards *competition and entry*, but the exact impact is often difficult to judge because of imperfect data. Overall, product market regulation in Austria does not differ substantially from the EU average because of the Single Market regime. Differences in sub-sectors, such as the liberal professions, remain, however.

Two areas on which there is less empirical evidence but which are rather widely held to be important for TFP growth – *higher education and venture capital* – show levels below the EU average. In both cases, stocks or levels rather than growth rates might be particularly important as to their ultimate impact on TFP growth. The two areas differ in their growth rates, rather surprisingly. Higher education as well as the number of researchers have experienced high growth rates, although the systemic conditions would actually discourage such a trend: in Austria, the entry rates into tertiary education are low. As regards venture capital, by contrast, many factors would suggest a pick-up, but up to now no significant improvement or catch-up to the European average has been observed.

By and large, most indicators – at least their growth rates – point towards good prospects for TFP growth. The efficiency and effectiveness of R&D, innovation and human capital systems show room for improvement, but nothing points towards an entirely wasteful or ineffective use of resources. The question remains as to when improvements in the underlying variables will show in TFP growth? Empirical firm level surveys indicate that it takes between four and eight years from R&D to innovation. More time will pass until innovation shows in measured aggregate TFP.

Demographic projections point to a decrease in working-age population growth, which may lead to declining growth rates of actual and potential output. This is often the outcome of growth equations in which labor force projections are used as inputs in a production function. We are skeptical about such approaches because they probably overestimate the negative effect on total GDP growth. The slowdown of labor force growth can be mitigated by increasing labor force participation, especially of women and older workers. Austria has undertaken significant steps to increase older workers' labor market participation by a series of pension reforms. These effects will unfold only slowly. However, small positive effects on older worker's participation are already visible in administrative data. After a decline in 2002 labor force growth has been rising steadily since 2003. Moreover, female labor supply has been increasing considerably stronger than male labor supply.

It is needless to say that this paper has left out many potentially interesting aspects of growth. A further discussion of issues related to economic growth will follow in a subsequent paper.

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