Determinants of Long-Term Growth in Austria – A Call for a National Growth Strategy

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This study, which offers a thorough analysis of growth in the past four decades, pinpoints total factor productivity (TFP) and human capital as the main engines of growth in Austria. In a further step it sheds light on the determining factors of TFP against the backdrop of a theoretical framework. The authors present evidence for the importance of innovative activity and human capital. They also examine the role of Austria's institutions involved in economic policy making as well as of economic rules and policies. Austria's dynamic external business is shown to foster productivity; EU enlargement could entail new agglomeration advantages. The study emphasizes the productivity-enhancing role of competition policy and market regulation. In their conclusions, the authors call for a long-term growth strategy for Austria and provide suggestions for such a strategy.

1 Introduction: Sustainable Growth – An Economic Policy Challenge

Delivering Lisbon – Implementation Stalls at the National Level

In hindsight, the post-war period of up to 1973 was a unique growth phase in Europe, underpinned by the speedy absorption of U.S. technology amid political and social stability (Crafts and Toniolo, 1995). In the 1980s and 1990s, growth slowed markedly in most European countries. Austria managed to delay the general slowdown in growth in the 1970s owing to its institutional framework and macroeconomic policy, but growth let up eventually. Even though it will be hardly possible in the future to attain growth rates similar to those prevailing in the 1950s and 1960s, some countries, e.g. Finland and Sweden, have succeeded in reversing the trend of declining rates.

The Lisbon European Council of March 2000 set the objective of transforming the European Union (EU) into the most competitive and dynamic knowledge-based economic area in the world by 2010. The underlying Lisbon strategy represents a comprehensive program of mostly structural policy measures that target a spectrum of issues.[1] To date, most euro area countries have made some progress in implementing this strategy; according to the European Commission (2004), it would, however, take a much faster pace of reform to meet the ambitious objectives set by the Lisbon Council.

In the face of slackening growth, a range of policy suggestions to stimulate growth were put forth also in Austria (see box Measures to Strengthen Long-Term Growth). Having defined growth as a key policy goal, the Austrian federal government has initiated a number of structural reforms. This study is meant to show that ultimately Austria, like the majority of euro area countries, needs a broadly based, long-term, *national* growth strategy.[2] Our starting point is that analyzing the determinants of growth in Austria by drawing on the more recent contributions in growth theory will help identify areas that require economic policy action.

[1] *Creation of an IT-based information society, establishment of a European Research and Innovation Area, stronger incentives for business creation, completion of the internal market, an efficient, fully integrated European financial market, sustainable budgets with growth-promoting revenue and expenditure structures, human capital formation, labor market reforms with a view to increasing labor supply and modernization of the welfare state.*

[2] *We thus basically agree with Pelkmans and Casey (2004), who, in evaluating the report by Sapir et al. (2003), had arrived at the conclusion that in Europe growth-enhancing structural policy measures have to be taken, above all, at the Member State level.*

Chapter 2 presents a growth accounting exercise with Austrian data, ascertaining total factor productivity (TFP) and human capital as the main engines of growth over the past four decades. In a further step, we analyze the factors influencing TFP against a theoretical framework in chapter 3. The role of innovative activity, which is frequently limited to the narrower concept of technological progress in the literature, is the focus of chapter 4. Chapter 5 highlights the importance of human capital for productivity advances. Chapter 6 investigates the influence of incentive schemes and of the infrastructure generated by economic rules and economic policies. Section 6.1 explores the role of Austria's institutions involved in economic policy making and outlines potential needs for adjustments amid an ever-changing international environment. Section 6.2 demonstrates that Austria's vigorous external economic activity has had a favorable impact on productivity and that EU enlargement, improving Austria's position in economic geographic terms, should result in agglomeration advantages. Section 6.3 is dedicated to the productivity-enhancing role of competition policy and market regulation. Chapter 7 concludes and comprises suggestions for a long-term growth strategy for Austria.

Measures to Strengthen Long-Term Growth –

Expert Recommendations and Measures by the Austrian Federal Government

Expert recommendations

Most of the proposals put forth by national and international organizations[3] call for improving human capital formation by reforming training and continuing education programs. Furthermore, almost all of the studies reviewed here propose an increase in the research and development (R&D) to GDP ratio. To attain an R&D/GDP ratio of 2.5% or 3%, public expenditures must increase and Austria must be promoted as a research location, according to the Austrian Institute of Economic Research (WIFO). The studies moreover call for a new growth paradigm to speed up structural change based on the three pillars of innovation, regulation and accumulation.

The International Monetary Fund (IMF), the Institute for Advanced Studies (IHS) and the Austrian Federal Economic Chamber (WKO) urge the government to take immediate action to reform the labor market. Here, it is above all necessary to increase labor force participation by recruiting and retaining older employees. According to the Organisation for Economic Co-operation and Development (OECD), public sector employment rules need to be made more flexible. Besides, the IMF advises the government to review the child-care benefit scheme and to provide more funds for child-care facilities.

Especially the EU, the OECD and the IHS stress the need for intensified competition in Austria. For instance, product market rules, shop opening hours and the regulations governing trades and professions should be liberalized further. The low productivity growth in the service sector might be traceable to the lack of competition.

According to the Austrian Institute for Industrial Research (2003), Austria should seize the opportunities presented by EU enlargement and harness the potential of networks and clusters more vigorously. In addition, the Austrian Federal Economic Chamber (2002) calls for improving the infrastructure connecting Austria with its neighboring countries to the east.

[3] *See IMF (2003), OECD (2003), European Commission (2004); for the Austrian Institute of Economic Research (WIFO) Aiginger and Kramer (2003), Aiginger et al. (2003) as well as Peneder et al. (2001); for the Institute for Advanced Studies (IHS) Felderer et al. (2002); Austrian Federal Economic Chamber (2002) and Austrian Institute for Industrial Research (2003).*

Measures by the Austrian federal government

The Austrian federal government has initiated a number of structural policy measures, which may be summarized as follows:[4]

(1) Boosting the employment ratio: By gradually increasing the legal retirement age, the government's pension reforms will lead to a lasting rise in older people's participation rate; in addition, an incentive scheme was put in place to encourage companies to employ older people. The introduction of the child-care benefit regime, however, seems to have dampened in particular women's participation rate.

(2) Fostering R&D and innovation: To anchor research promotion, the government established a National Foundation for Research, Technology and Development in 2003. It also raised both the research tax credit and the alternatively granted research subsidy.

(3) Promoting human capital formation: The government introduced a tax credit for continuing education with a view to offering companies an incentive to invest in staff training and development. The campaigns "unternehmen bildung" and "Bildungscluster" are aimed at intensifying cooperation between businesses and educational facilities.

(4) Intensifying competition: The liberalization of network industries has been largely concluded. The shop opening hours have been liberalized further. Setting up small businesses has become easier.

(5) Developing the infrastructure: Adjusting Austria's master transportation plan with a view to improving the infrastructure connecting Austria with the new EU Member States opens up a new agglomeration potential vis-à-vis Eastern Europe.

Other steps the federal government has taken include measures to increase external economic integration, ensure overall economic stability (especially fiscal consolidation) and boost the number of startup businesses.

2 Total Factor Productivity and Human Capital – The Main Engines of Growth in Austria: Results of a Growth Accounting Exercise

Austria's Relative Prosperity against the Euro Area Average Has Remained Unchanged since 1990

From 1960 to 2002, yearly growth of real per capita income averaged 2.75% in Austria. Narrowing the averaging period to the two most recent decades starting in the early 1980s produces a lower average growth rate of 1.95%, however. As a result of the relatively high growth rates of the 1960s and 1970s Austria's per capita income converged quickly toward that of the U.S.A. Compared with its U.S. counterpart, Austria's per capita income had increased from 60% in 1960 to around 80% at the beginning of the 1980s, at which it has since then stabilized.

A comparison with the euro area yields a similar picture. From 1960 to 2002, average per capita growth in the euro area trailed Austria's growth slightly at 2.5%. Put differently, Austria's per capita income mounted from some 110% of the euro area average in 1960 to about 120% in 1990, at which it has remained more or less unchanged.

What are the main factors that have driven growth in Austria in the past and have these determinants changed over time? To explore these questions, we apply a simplified version of the growth accounting method proposed by Jones (2002). In this analysis, we break down real per capita income growth into the con-

[4] *See Federal Government of Austria (2003), Federal Ministry for Economic Affairs and Labor (2001 to 2003).*

tributions to growth made by the individual factors of production.[5]

Physical Capital's Direct Contribution to Growth Is Relatively Small

Chart 1 summarizes the results of the growth accounting exercise. The rise in the capital-output ratio merely contributed some 0.11 percentage point to the growth of the Austrian per capita income from 1960 to 2002. Moreover, this positive contribution to growth stems from the years after 1981 since the contribution to growth of the capital-output ratio was –0.33 percentage point during the first half of the observation period. This puts physical capital among the lesser drivers of real income growth per capita in Austria, in particular from 1960 to 1981.

Growth Accounting

Growth accounting builds on the following macroeconomic production function:

$$Y_t = K_t^{\alpha}(A_t H_t L_{Yt})^{1-\alpha}.$$

In this function, the overall output of period t (Y_t) is generated by the factors capital (K_t), human capital (H_t) and labor (L_{Yt}), measured in hours worked. A_t is the total factor productivity (TFP), which may be interpreted as a measure of the human capital stock as well as of structural and institutional aspects which do not directly impact the use of the factors of production, but influence the overall output only indirectly, i.e. via the efficiency with which the factors can be utilized.[6] Parameter α equals the share of capital income in aggregate income.

The assumption is that the overall labor supply (L_t) may be used either in the output-producing sector or in the research sector. We therefore get $L_{Yt} = l_t L_t$, with L_t referring to labor supply measured in hours worked and l_t corresponding to the share in the labor supply that directly generates output. The remaining labor supply, i.e. $(1 - l_t)L_t$, is employed in the R&D sector, which raises TFP in the medium to long run. We do not, however, model the exact relationship between $(1 - l_t)L_t$, and A_t; moreover, A_t is calculated as a residual. After some rearrangement, we can decompose the growth rate of per capita income, g_y, as follows:

$$g_y = \frac{\alpha}{1-\alpha} g_{K/Y} + g_l + g_H + g_A + g_{L/N},$$

where N_t denotes the population and L_t/N_t represents the average hours worked per person. The per capita income growth rate thus equals the sum of the contributions to growth made by the capital-output ratio, the share of the labor supply employed in the output-producing sector and the human capital as well as TFP and the hours worked per person.

We use the following data sources in our growth accounting exercise: The data on real GDP, population, employment and average hours worked stem from the University of Groningen Total Economy Database and the annual macro-economic (AMECO) database of the European Commission. The capital coefficient is derived from the AMECO database. The stock of human capital is approximated based on the adult population's average years of schooling and is taken from de la Fuente and Doménech (2002). As this data set ends in 1990, the average growth rate of the average years of schooling from 1980 to 1990 is extrapolated for the period from 1990 to 2002.[7] The number of R&D employees was

5 *More recently, growth accounting analyses were applied, among others, by Prescott (2002), Jones (2002), Easterly and Levine (2001) as well as Hall and Jones (1999). Koman and Marin (1997) conducted a growth accounting exercise with Austrian data.*

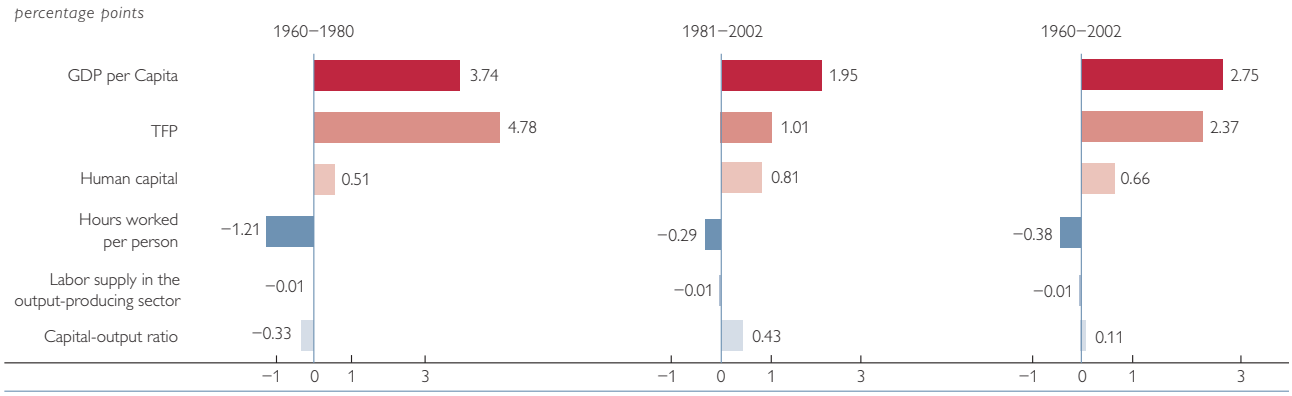
6 *The concept of technical progress (Hicks, 1932), which is frequently used in the growth literature, is closely linked to TFP (Solow, 1957). Technical progress denotes much more than just purely technical innovations, such as computers; it also refers to organizational change.*

7 *To verify the robustness of the results, we repeated the calculation with human capital data from Barro and Lee (2001), as this data series is available until the year 2000. Since this calculation did not yield different qualitative results, we opted for extrapolating the data series compiled by de la Fuente and Doménech (2002), which had been processed more thoroughly.*

drawn from the OECD Research & Development (R&D) Database. Furthermore, we had to assume a value for parameter α, the share of capital income in aggregate income; according to Gollin (2002), we chose 0.3.

Chart 1

Contributions to Per Capita GDP Growth



Source: OeNB.

Decline in Hours Worked Dampens Per Capita Income

With the labor supply shifting from the output-producing to the R&D sector, the per capita income growth rate edged down by 0.01 percentage point in the three observation periods, i.e. the two subperiods and the entire period. However, the direct negative effect on overall economic output appears to have been more than compensated for indirectly as the increased utilization of labor and human capital in the R&D sector caused TFP to rise.

The decrease in the average hours worked per person led to a reduction in the per capita income growth rate by 0.38 percentage point from 1960 to 2002. From 1960 to 1980, this dampening effect was even more pronounced at –1.21 percentage points, contracting to –0.29 percentage point as from 1981.

Total Factor Productivity as Main Driver of Growth, Human Capital Gaining in Significance

As is evident from chart 1, per capita growth was basically driven by human capital and TFP and in the entire observation period, TFP accounted for 2.37 percentage points (86% of the per capita growth rate) . The contribution to per capita growth stemming from the rise in the human capital stock equaled 0.66 percentage point (24% of the per capita growth rate).

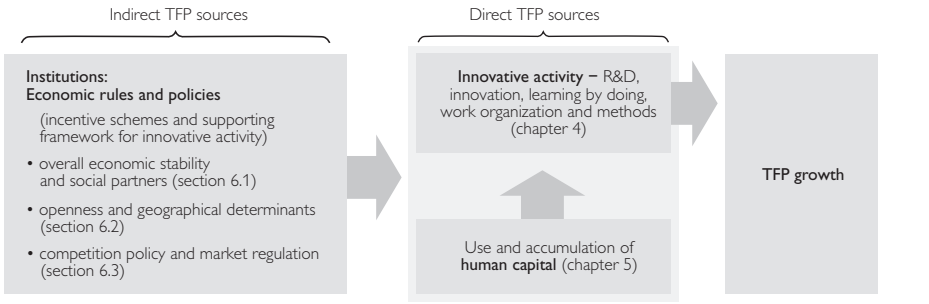
The relative contributions to growth of these two variables shifted markedly over time. From 1960 to 1980, TFP growth accounted for the single biggest contribution at 4.78 percentage points, followed by a wide margin by the increased human capital stock, whose share was, however, still remarkable at 0.51 percentage point. Things changed somewhat after 1981. Although TFP continued to account for the largest contribution to growth at 1.01 percentage points, its relative share contracted to just over 50%. At the same time, human capital gained in significance, with its contribution mounting to 0.81 percentage point (41% of per capita growth).

3 Sources of Productivity Gains in Austria – A Conceptual Framework

The growth accounting exercise in chapter 2 shows that growth in Austria over the past 40 years is predominantly attributable to the rise in TFP. In other words, the factors of production labor and capital are utilized much more efficiently today than in 1960. What factors fueled and tempered TFP growth? In chapters 4 to 6, we compare the relevant empirical findings of the more recent literature on growth with Austrian evidence to identify past and future determinants of TFP growth in Austria. We thus use the methodology proposed by Crafts (1996), who – given the lack of comprehensive internationally comparable TFP data for an empirical analysis of underlying growth factors – contrasted the new growth theory with economic history. This type of analysis promises particularly important insights for policymakers because Austria's TFP growth contracted further in recent years, i.e. from 1996 to 2000 (Nicoletti and Scarpetta, 2003), while a number of OECD countries have succeeded in reversing the TFP growth trend.[8]

Chart 2

Determining Factors of TFP Growth in Austria



Source: OeNB.

Chart 2 illustrates the interplay of the factors influencing TFP. Innovative activity[9] is a direct source of TFP. It increases output by redeploying input factors (business and production process innovation) and spawns higher-quality, entirely new and more diverse products. Innovative activity depends on the availability of adequate human capital, though. National institutions and the economic rules and policies of a country impact on innovative activity via incentive schemes, the provision of the necessary infrastructure and framework conditions; they are therefore indirect determinants of TFP growth. Such indirect factors are (a) an economy's openness, including its geographical position and significance as a business location as well as the level of agglomeration, (b) institutions involved in economic policy making and (c) competition policy and market regulation.

The country-specific component is more pronounced in driving TFP

[8] *Cases in point are Finland and Canada, but also the U.S.A., which accounts for the highest TFP level. The figures should be taken with a grain of salt, however, since, apart from computational difficulties, sustainable changes in trends may be determined only over a long period of time.*

[9] *We define innovative activity as the causes of technological progress and, by extension, of total factor productivity and as ways leading to such progress.*

growth than industry-specific productivity gains across national borders (Costello, 1993).[10] Thus, the country-specific interplay of factors determining TFP appears to be the reason why TFP growth differs from country to country.[11] Successful innovative activity in new industries may well rest on changed requirements for the available human capital and on new incentive schemes.

4 Innovative Activity Fuels Productivity Growth

Among innovative activities, the growth literature has singled out R&D efforts as well as the diffusion and efficient application of R&D results as particularly important contributors to growth. Apart from that, TFP growth is fueled by a variety of other activities, including innovations that reflect for instance the implications of learning by doing for the production process (Arrow, 1962) or incremental improvements made in response to customer feedback. Reorganizing production and work methods, as demonstrated by Adam Smith's pin-making example,[12] may likewise yield efficiency gains. To economize on space and given the high positive externalities of research and development, we will concentrate on R&D, the diffusion of R&D results and innovation especially in the manufacturing industry.

R&D Creates High Social Returns

While there is a wealth of microeconomic evidence showing that R&D has high private returns, the social return of R&D is much harder to pin down empirically, as R&D spillovers are difficult to measure. With the social returns of R&D characterized by nonrival consumption, they are, however, assumed to be higher than the benefits for individuals (Temple, 1999). Against this background, the private sector tends to invest less in R&D than is optimal for society as a whole. Ideally, industrial countries would spend more than four times as much on R&D as they currently do (see for instance estimates by Jones and Williams, 1998). Meister and Verspagen (2004) simulate the impact that raising European R&D expenditure to 3% of European GDP – i.e. reaching the target set by the Barcelona European Council – may have on the European productivity gap relative to the U.S.A. They show that achieving the Barcelona target alone will not suffice to close the gap between the EU and the U.S.A., to which the EU is committed under its Lisbon strategy. Despite the high significance of R&D for TFP growth, the measures inspired by the Lisbon strategy should therefore not only aim at raising R&D expenditures, but also at different growth drivers.

[10] *The extensive work by Porter (1990) and Lundvall (1992) corroborates the calculations with regard to the relevance of the national environment and the national innovation system for determining differences in overall economic output.*

[11] *Levine and Renelt (1992) propose to regard and analyze national (economic) policy as a complex set of measures.*

[12] *More recent examples include Fordism as well as the reorganization of production and the innovation of business processes through information and communications technologies.*

Domestic R&D Raises the Capacity to Absorb Foreign Research Findings

Countries that are not productivity leaders may benefit more from adopting technologies developed abroad than from investing in R&D themselves. Temple's (1999) reading of the literature is that growth differentials are partly explained by the transfer of technologies. The estimates of Coe and Helpman (1995) indicate that foreign R&D is a powerful driver of domestic TFP growth. Eaton and Kortum (1996) find that even the U.S.A., the global leader in technology, derives half of its TFP growth from absorbing foreign research results.

Numerous growth models basically treat technology as a public good that is freely accessible throughout the world. Even if this were to be the case, a country's absorption capacity would still play a decisive role. Griffith et al. (2004) and Scharler et al. (2004) concur in finding that local R&D and local human resources are the key determinants of a country's absorptive capacity. The fact that local research acts as a catalyst for technology transfer implies that the economic effects of R&D for productivity growth have been underestimated in the existing literature. Human skills interact with R&D in the determination of a country's absorption capacity: Acemoglu and Zilibotti (2001) find a mismatch between the demands of foreign technology and the skills of the domestic workforce to account for national differences in TFP. Furthermore, the capacity of national innovation systems to spread knowledge (Lundvall, 1992), as reflected by the degree of interaction between producers and users of knowledge, influences the emergence and transfer of innovations. Finally, Scharler et al. (2004) find fairly unregulated labor and product markets to boost the capacity to absorb and implement foreign technologies.[13]

Austria's Mediocre R&D Ratio Reflects the Structure of Its Economy

The assessment of Austrian R&D and technology transfer activities is mixed. While the gap between Austria's R&D share of GDP (2003: 2.19%) and the OECD average almost closed in recent years, this ratio continues to appear too low for securing future productivity growth when compared with Austria's high GDP per capita. What is a cause for concern in this respect is that corporate expenditure with a direct bearing on innovation accounts for just a relatively small portion of total R&D spending (Hutschenreiter et al., 2003). This assessment is, however, put in perspective somewhat by the fact that Austrian companies score better when the broader concept of innovation is applied (Statistics Austria, 2003) and that the Austrian R&D deficiencies largely reflect the domestic industrial structure.

Different economic sectors have different research intensities depending on the nature of the underlying technologies (Breschi et al., 2000). In an international comparison, Austria has a high share of medium-technology industries. At the same time, the productivity performance of the Austrian industry is very good, a relationship that has been dubbed a "structure-performance paradox" (Peneder,

[13] *The findings of Keller (2002) moreover indicate that distance affects absorption capacity even in the age of globalization: While technological knowledge has become considerably more global over time, the benefits from technological spillovers continue to decline with distance.*

2001). These findings are not new – WIFO reports identified structural deficiencies already in 1947/48 (Steger, 1985). Seidel (1985a and b) points out the discrepancy between robust macroeconomic performance and structural weaknesses of the Austrian economy. This discrepancy may, to some extent, reflect the heavy subsidization of basic industries in the post-war period. Austria's broad-based investment promotion policies, a key pillar of the Austrian economic policy framework, used to support above all capital-intensive industries.

High Productivity despite Low R&D Spending due to Incremental Innovation?

Moreover, empirical evidence on the Austrian production and innovation framework shows that manufacturing companies in particular are good at incremental innovation in market niches (see for instance Leitner, 2003, who describes the 50 most striking innovations made in Austria). This type of production has also become known as diversified quality production (DQP) (Streeck, 1991). In this case, innovation happens gradually in the production process through the input of highly qualified skilled workers, often in response to customer feedback. This contrasts with radical innovations often designed by highly funded in-house R&D facilities for the final consumer market, which are typical of U.S. companies. While the efforts going into incremental innovation do not necessarily show up as R&D expenditure, their impact will be reflected in innovation surveys (Statistics Austria, 2003).

The papers compiled by Pichler (2003) underline the persistency of this pattern in Austria's industrial history and confirm the influence of path dependence and lock-in effects in the evolution of innovations – in Austria, knowledge has typically been accumulated in existing industries, whereas in general the emergence of radical innovations and of new industries is a comparatively seldom thing (Lundvall, 1992).

Judging from productivity growth rates in the manufacturing industry, we conclude that Austria's performance with regard to innovative activity has actually been better than the R&D ratio would suggest. Naturally, the question arises as to whether Austria's economic structure constitutes a risk factor for future productivity growth. Peneder et al. (2001) show that unless the pace of structural change accelerates, Austria may face growth setbacks in the long term.[14] With the catching-up process completed, the potential for rapidly adopting foreign technologies will be limited; as a result, growth will increasingly depend on outright innovation. Yet the innovation schemes described above imply that technology- and research-intensive industries are unlikely to mushroom; a gradual process of change is far more likely unless a sudden sales crisis emerges that would entail a massive shift in the sectoral structure. Future research into Austria's slowing

[14] *One reason why both technology-oriented and traditional industries have been performing well in terms of productivity is that the former have benefited from high demand as a result of product innovation while the latter have been good at developing innovative business processes (Akella et al., 2003). In the longer term, business process innovation may dry up as a source of productivity even for the traditional industries. Marin (1995) sees one explanation for the Austrian growth puzzle in the accumulation of experience – i.e. in the benefit of learning – in existing industries, while agents opening up new industries may initially incur productivity losses as they are just starting out on the learning curve.*

growth momentum should focus more strongly on innovative activity in the service sector (Dachs and Leo, 1999) with a view to gaining more insights into the underlying causes of TFP growth.[15]

5 Human Capital as a Growth Factor

Human Capital Boosts Productivity

Human capital is the stock of knowledge and skill embodied in economically active individuals, which may be proxied statistically by the average years of schooling. As in the case of R&D, a wealth of microeconomic evidence attests that it pays to invest in education. De la Fuente and Doménech (2002) find evidence of a strong positive correlation between human capital and productivity also 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.

Yet human capital accumulation by itself is not a sufficient condition for growth; what is also important is that the skills of individuals match the structure of the economy. For instance, in developing countries, highly educated people have often found employment only in the public sector (Temple, 1999). Krueger and Kumar (2003a and b) identify the skill-specific orientation of the continental European schooling system as one possible reason for the divergent productivity growth paths of Europe and the U.S.A. European education policies favoring specialized vocational education might have worked well in the 1960s and 1970s. In the subsequent information age marked by rapid technological change, however, flexibility and adjustment have become a lot more important. Against this background, the U.S. focus on tertiary education and skills transferable between firms prove to be more advantageous. Blanchard (2004) argues as well that European universities have a (crucial) need for reform.

Aging Labor Force May Dampen Productivity Growth

The aging of the population is also likely to have an impact on productivity growth. Prskawetz and Fent (2004) show in a number of scenarios that productivity projections are significantly influenced by underlying assumptions on the degree of possible substitution between employees of different ages. Lindh (2004) points out that higher investment in human capital but also a longer and more intensive utilization of the stock of human capital may help alleviate the growth problem triggered by population aging. In Austria, utilizing the human capital stock more intensively and efficiently meets with obstacles, though. One way to improve the compatibility of work and family commitments would be to provide sufficient child-care facilities. By contrast, the current child-care benefit regime creates disincentives for women to rejoin the labor force rapidly (OECD, 2003).

Austrian Education System in Need of Reform

According to the PISA survey (OECD, 2001), Austrian student performance in reading, mathematics and science at the secondary level of education is significantly above the OECD average. However, the good score comes at a relatively high financial cost (Mangold and Hennessy, 2003). At the tertiary level of education, the

[15] *Productivity gains are low in the tourist industry, which is comparatively large in Austria (Smeral, 2003).*

low if increasing share of university graduates in general and the low share of science and technology graduates[16] in particular may be an obstacle to TFP growth. This may restrict the scope for structural change and innovative activity in existing companies, an effect that is further exacerbated by a brain drain. Austria's vocational concept of education used to be a recipe for success in the production type described above. However, a number of factors, including the acceleration of technological change and the rapid tertiarization of the economy call for a review of the education system to enable it to build capacity for innovative activity.

6 How Do Austrian Institutions Influence Productivity Growth?

Institutions Facilitate or Obstruct Innovative Activity

Hall and Jones (1999) find the productivity level of a country to be largely determined by its institutional setup and its economic policies. The economic institutions[17] of a country define the rules for economic action and provide incentives or disincentives for innovative activity. Together with the economic policy framework, they create basic incentives for using existing or developing new ideas and knowledge and for accumulating and efficiently applying human capital. Institutions are part of the social capital or the social capability to trigger growth processes (Johnson and Temple, 1998).

The institutional concept of the theory of national innovation systems (Lundvall, 1992) is a broad framework that determines human interaction, which is necessary for innovative activity. The significance the institutional setup of a country has for innovative activity results from the fundamental uncertainty that accompanies the process of change as well as from the complex communication between the agents of change. Institutions may promote or hinder innovative activity. On the one hand, they facilitate change by creating reliable framework conditions for innovative processes. Especially if the knowledge involved is only informal or exists only implicitly in the minds of the process agents, something new will be developed more easily when agents share the same language and the same social and cultural norms. On the other hand, institutions may lag behind technological progress because of their relative stability and inertia. This may cause the productive potential of a new technology to remain unexploited. Institutions may also prevent agents from "creatively forgetting" knowledge that has become obsolete, and they may be responsible for technological lock-in effects.

6.1 How Do Economic Stability and the Social Partners Influence Productivity Growth?

Economic Stability Boosts Growth; Investment Is a TFP Channel

The Austrian growth performance is widely believed to be basically the result of the high investment ratio, which had in turn been shored up by the stable political and economic framework and the hard currency policy (Zagler, 2000). The growth

[16] *When technical high school graduates are included, Austria is above the EU average, but still trails Finland and Sweden by a wide margin.*

[17] *According to North (1991, p. 97) institutions are the rules of the game of a society or the humanly devised constraints that structure political, economic and human interaction. They are composed of informal constraints (taboos, conventions, norms of behavior and rules of conduct) and formal rules (laws and regulations).*

accounting exercise in chapter 2, by contrast, identifies TFP growth and human capital as the key determinants. While the accumulation of physical capital is a channel for TFP growth (Wolff, 1991),[18] TFP growth is also affected by a host of other factors.

The adequacy of the Austrian investment promotion regime may be called into question as, unlike labor productivity, capital productivity was low by international standards (Guger, 1998). Furthermore, the broad-based investment promotion measures used to favor capital-intensive industries, thus obstructing structural change. The recently expanded research tax credit regime and the newly introduced research subsidy scheme are likely to be more relevant for TFP than the (temporarily extended) investment allowance.

Macroeconomic stability in general is seen as a key driver of cross-country growth differentials (Temple, 1999). Ramey and Ramey (1995) show output volatility to have a negative effect on long-term growth. However, except for the mechanism described above (stability encourages investment, which may in turn promote TFP growth) no conclusive evidence has been established yet about the relationship that exists between macroeconomic stability and TFP growth, and about the role price stability plays in the process of TFP growth (Temple, 2000).

Positive and Negative Effects of the Social Partnership Regime on TFP Growth Are Increasingly Superseded by International Influences and Regulation

The social partnership system is likely to have affected TFP growth both positively (via three channels) and negatively (via one channel). First, the income policy pursued was conducive to Austria's hard currency policy, which pushed the open sector of the Austrian economy toward ever-higher productivity rates ("productivity whip"). This effect was relevant from the end of the 1970s until the introduction of the euro; yet even since 1995, when Austria joined the EU, it may have been superseded by the effects of stiffer competition, which stand to intensify even further in the future. Second, the social partnership process used to shore up political and social stability, including the stabilization of expectations,[19] through various channels (including income policy and the social partners' comprehensive integration[20] into economic and social policymaking), and thus contributed to reducing uncertainty and transaction costs (Butschek, 1995). In combination with the investment-friendly and growth-oriented policies of the Austrian trade unions,[21] this contributed to a high investment ratio. This effect weakened as the openness of the Austrian economy increased, as competences were trans-

[18] *Austria's high investment ratios largely reflect strong construction investment (Peneder et al., 2001), which tends to contribute little to TFP growth.*

[19] *Abramovitz (1981) believes that the scope for conflicts inherent in the growth process, because it undermines established vested interests, calls for a conflict-solving mechanism. He sees a certain rationale for social protection measures facilitating the social adaptation process that drives growth and technological progress, and thus ultimately TFP growth.*

[20] *Since the two major political parties agreed in principle on the economic framework of the mixed economy, businesses operated in a climate of stability in which they could make reliable planning decisions.*

[21] *See Olson (1971) for an explanation why comprehensive associations are able to internalize negative externalities of their activities. Dowrick and Spencer (1994) describe the theoretical mechanism that coordinated trade unions – as exist in Austria – are more innovation-friendly than uncoordinated trade unions – as exist in the United Kingdom.*

ferred to the EU and as international political instabilities rose. Wage policy will nonetheless continue to be an important stability factor in the euro area. Third, the social partners are a key pillar of the apprenticeship system – which may be seen as a public good – and thus contribute fundamentally to human capital formation; after all it takes broad-based associations to organize an apprenticeship system and to prevent free-rider problems that would thwart the system.

At the same time, a certain resistance toward innovative activity may have been a drag on TFP growth. Landesmann (1992) finds that the social partners rarely advocated forward-looking economic policy and TFP-relevant measures, such as subsidizing R&D, reforming training and continuing education and generally promoting structural change. By contrast, they often sought to protect vested interests by forming coalitions with employers. By reinforcing a wide wage dispersion across industries, income policies have tended to obstruct structural change (Guger, 1998). Butschek (1985) identified the conservation of structures as the underlying weakness of the Austrian system, a criticism that he has since qualified in a more recent paper (1995).

Overall, the impact of the social partnership framework on TFP is likely to be increasingly superseded by international influences and regulation (the internal market of the EU, WTO-led deregulation, EU enlargement), while its conflict-solving potential and thus stabilizing role are here to stay.

6.2 Openness and EU Enlargement Favor Productivity Growth in Austria

Austria's Openness Facilitates Competition and Technology Transfer

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.[22] Utilizing possibilities for specialization and realizing economies of scale are other channels through which TFP growth may be fueled. Alcalá and Ciccone (2004) provide empirical evidence for a positive influence of real openness (imports and exports at market prices as a share of GDP at purchasing power parities) on TFP growth, and for a positive correlation between population growth and productivity. Frankel and Romer (1999) likewise show international trade to affect growth through the TFP channel. Coe and Helpman (1995) find the positive effects of foreign R&D on domestic TFP to be the higher the more open the domestic economy (in terms of trade flows) is. In addition, they show that in Austria TFP growth responds particularly positively to German R&D.

In the post-war period, Austria's ties with the Western hemisphere and accession to EFTA produced significant productivity impulses. At the same time, growth was adversely affected by Austria's not joining the EU right away in the 1960s (Fischer, 1985). Accession to the EU in 1995

[22] *For an empirical confirmation in the form of a sectoral study, see Galdón-Sánchez and Schmitz (2002) as well as Nicoletti and Scarpetta (2003).*

constituted an important regime change; the productivity gains recorded for the manufacturing industry since 1995 have been above average. EU enlargement and the ongoing liberalization of world trade should boost TFP growth further. Since the small size of the Austrian market and of its population work to its disadvantage, the openness of the economy will continue to be an important factor also in the future, even though national borders constitute a major obstacle for economic exchange despite the prevailing free-trade regime (Helliwell, 1998). While Austria is a comparatively open economy even now, there is room for further opening-up – currently Austria ranks 7th among the top 20 in the broad globalization index (A. T. Kearney and Foreign Policy, 2004) but is outperformed by other small European economies when it comes to export and import ratios.

EU Enlargement Enhances Austria's Geographical Conditions for Productivity Growth

EU enlargement does not contribute to TFP through competition and technology spillovers alone; it may also contribute by changing the geographical determinants of productivity such as location and the degree of agglomeration. 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," or 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.

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.[23] This presupposes adequate transport and communications infrastructures, which also contribute to productivity growth (the exact impact of this effect is, however, controversial; see Gramlich, 1994). Agglomeration advantages may thus be realized as trade costs go down. In other words, Austrian TFP growth would benefit from infrastructure development.

6.3 Competition and Intelligent Regulation Foster Productivity Growth

Product Market Deregulation May Fuel TFP Growth

Several studies provide strong evidence that product market regulation correlates with productivity growth in a number of ways. By simulating the effects of cutting the euro area's product market regulation[24] to the

[23] *Peneder et al. (2001, p. 145) hence argue that it would be a pity if the chance of EU enlargement were passed up amid unfounded fears that vicinity may constitute a threat rather than a chance.*

[24] *In the three areas of privatization, market entry barriers and industry-specific regulation.*

level of the three euro area countries with the lowest degree of regulation, Nicoletti and Scarpetta (2003) deduce a significant potential for TFP growth. Alesina et al. (2003) find market entry barriers in particular to adversely affect investment activity. Van Ark et al. (2003) show that the bulk of the EU's productivity gap vis-à-vis the U.S.A. reflects productivity differences in retail and wholesale trade as well as in the financial services industry. Foster et al. (2002) empirically trace virtually all of the U.S. retail sector's productivity gains to new, productive companies entering and existing companies leaving the market. McGuckin and Van Ark (2001) consider certain product and labor market rules to prevent European companies from fully exploiting the advantages of new information and communications technologies.[25] Detailed empirical studies at the industry level appear to confirm these effects (McKinsey Global Institute, 2002 and 2003). Often, these effects will not be limited to pure deregulation measures, but perhaps even more so depend on an intelligent (re)regulation of markets – as a case in point, the European mobile phone market has benefited from the introduction of the GSM standard.

In Austria, competition in product markets used to be limited on account of numerous regulatory schemes – partly initiated by the social partners – under which especially new competitors found it hard to enter the market and declining industries benefited from an excess of protection (Guger, 1998). Following EU accession, numerous industries have been opened up, and many companies have been privatized in this process. A development that stands out in this respect was the liberalization of the network industries, which has been largely completed. For these sectors, dedicated regulatory authorities (e.g. Telekom Control) have been put in place, and entry barriers have been generally lowered by the fact that it has been made easier to establish a company and that the regulations governing trades and professions have been liberalized. However, the intensity of competition has been criticized as inadequate, above all with regard to the service sector (OECD, 2003). Entry barriers and industry-specific regulations, e.g. for professions, continue to exist. An area that benefits from particularly high, EU-wide protection is agriculture. While the Austrian competition policy was recently subjected to a sweeping reform, there have been calls for increasing the capacity of the newly established competition authority (OECD, 2003) and for simplifying the competition framework and for remedying its shortcomings (Böheim, 2003).

The Austrian Labor Market is Fairly Flexible

No conclusive evidence has so far been produced on the productivity effects of labor market regulation; at an aggregate level, relationships may be masked by industry-specific success factors,[26] for instance when labor market regulation is shown to foster

[25] *See findings presented in Scharler et al. (2004).*

[26] *Some industries rely on both firm-specific and industry-specific skills that employees will be able to acquire thanks to adequate support by labor market regulation. Other industries, by contrast, rely on external labor markets on which they may quickly recruit skilled labor (see Hall and Soskice, 2001, for a description of this mechanism).*

human capital formation in some industries. Scharler et al. (2004) show that labor market and product market regulation adversely affect the capacity to absorb new technologies, but distinguishing the individual effects is difficult. Compared with Germany (even after the implementation of the Hartz reforms), Austrian labor regulations are fairly flexible. In Austria, the type and degree of product market regulation may thus in fact be a bigger issue for future growth than labor market regulation.

Impact of the Financial Regime on TFP is as yet Unclear

Financial systems facilitate innovation through a number of mechanisms (King and Levine, 1993). Whether a market-based regime or a bank-based regime is better at facilitating innovation, is as yet unclear even though the market-based system has been conjectured to have advantages in times of rapid technological change (Ahn and Hemmings, 2000). The availability of venture capital financing for technology-oriented business upstarts also appears to constitute a TFP channel (Gompers and Lerner, 2001). The Austrian bank-based regime is well developed, and corporate bond markets have been benefiting from the greater liquidity of the euro markets. Yet as a ratio of domestic GDP, venture capital funding remains small by international standards. This is attributable to a weak capital market (i.e. low stock market liquidity) and to the structure of the Austrian economy (Peneder and Wieser, 2002).

Austrian Regulatory Framework Provides Incentives for Industries with Incremental Innovation

Soskice (1999) and Hall and Soskice (2001) present an overarching theory explaining the interaction between the TFP-relevant areas of market regulation and innovative activity. They claim that coordinated market economies, i.e. economic systems that are controlled – beyond market forces and government regulations – by business and labor associations; and liberal market economies, i.e. economic systems controlled by the market and the state alone, have developed coherent regulations that favor different industries. The regulatory framework of liberal market economies is supportive of radical innovation, while that of coordinated market economies encourages incremental innovation. By this definition, the Austrian economy provides incentives for industries with incremental innovation. Yet there is no empirical evidence of the influence on TFP growth in the aggregate economy.[27] Kitschelt (1991) puts forth the theory that certain technological cycles require certain institutions and that, as a result, different countries will be successful at different times.

7 Conclusions – A Call for a National Growth Strategy

The Austrian Incentive and Support Framework for Innovative Economic Activity Must Be Adapted to the New Conditions

Amid EU accession, the changeover to the euro, EU enlargement, globalization, population aging and with the evolution of the information age, the

[27] *Evidently, such forces would work only if industries with incremental innovation included first and foremost medium-technology segments. Such evidence has not been produced to date.*

political, economic and technological framework conditions for Austria have changed tremendously in recent decades. Against this background, the question arises as to whether the existing domestic economic institutions still offer adequate incentives and adequate support for innovative activity. In other words, is the Austrian growth mix, i.e. the interaction of TFP factors, still adequate? The domestic slowdown in TFP growth, which has been rebounding in various other countries, is a cause for concern, even more so as, despite all globalization effects, TFP growth continues to be largely determined by the national productivity regime. While smaller countries may have an initial disadvantage when it comes to TFP growth,[28] they also have a decisive advantage: As their preferences are more homogeneous, they find it easier to formulate and implement productivity-enhancing policy measures (Alesina, 2003). Nonetheless they need to work out a coherent strategy, given that the interrelation of the aspects involved is rather complex.[29]

Advantages of a Coordinated Medium-Term Growth Strategy

An Austrian growth strategy would have to reflect the outcome of an academic and political process in which all relevant organizations should be involved. The overall strategy should integrate reform proposals made for the various areas into a coherent package that takes adequate account of the interrelationship between the various elements. From an organizational point of view, it may be advisable to install a single "growth coordinator" (or "Lisbon coordinator"), who would be responsible for coordinating the design and implementation processes of all suggested growth policy measures. The growth strategy could define the common ground on which a new fundamental consensus can be forged across parties and social partners on measures to promote growth. Such a broad-based and detailed multiyear strategy would have a number of advantages:

– Decoupled from the political election cycle, reforms should thus be implemented more speedily. Regular progress evaluations might prevent reform deadlocks.
– Reforms are not seen as clientelism but as strategies to enhance common welfare. (This implies probably changes for everyone.)
– By giving the general public and companies a chance to prepare for change well in advance, the growth strategy contributes to stabilizing expectations and to maintaining social peace.
– Individual parties directly affected by the forthcoming changes as well as the national and international expert audiences have sufficient time to discuss optimal solutions.

Thus, the growth strategy would create possibilities for optimally supporting innovative activity that is necessary for long-term growth. This strategy could draw on the positive experiences gained with the Austrian hard currency policy and social partnership regime and provide for a growth mix adjusted to the new framework conditions. The chance for formulating such a strategy is there –

[28] *See Alcalá and Ciccone (2004), who find a positive correlation between productivity and population size.*
[29] *Peneder et al. (2001) call for a new growth paradigm – a coherent mix of measures – to accelerate structural change.*

not only because Austria is a small, manageable country, but also because the social regulatory mechanisms that help balance interests are still in place.

Some Specific Suggestions

Below selected areas are pointed out in which a review of existing structures appears worthwhile. These measures support proposals raised earlier and presuppose a consistent focus of budget spending on TFP determinants, such as investment in human capital, R&D and infrastructure. They consist of direct (innovative activity and human capital) and indirect (agglomeration and competition) measures to boost TFP growth.

(1) *Create an R&D pull strategy and rely on first-rate universities to create momentum for local innovation*
Technology policymakers have already come up with numerous programs, studies and recommendations for action. In the future, it may be opportune to cease pursuing a push strategy and instead apply a strong pull strategy integrating all measures which aim at structural change with a view to boosting Austrian R&D activities.[30] In other words, established companies and industries should no longer be pushed to spend more on R&D activities; the focus should rather be on more research-intensive industries that will "automatically" pull up the R&D share. One of the pillars of this strategy would be first-rate universities, a natural breeding ground for local innovation and structural change. Naturally, for universities to play such a role, it takes incentives and structures that will offer students (of science and technology) superior training, facilitate the transfer of academic knowledge to productive application in the economy, and encourage the mobility of researchers between universities and industry as well as the establishment of spin-offs.

(2) *Adapt the human capital strategy to the requirements of the information age and an aging population*
There are signs that the current focus of the education system is misaligned with the economic structure or the requirements for innovative activity. The nature of innovative activities in the service sector and the faster pace of technological change (in the manufacturing industry) call for training the ability to respond flexibly to change and the capacity to rapidly acquire new skills. Unless countermeasures are taken, the scarcity of students and researchers in science and technology disciplines will considerably impede the innovative efforts of businesses. Furthermore, the brain drain of Austrian researchers, particularly to the U.S.A., is linked with the way universities are organized.[31] Population aging requires well-designed systems of lifelong learning that facilitate necessary career changes at an advanced age, for instance on account of physical disabilities. It takes a more efficient and a more intensive utilization of human capital to cope with a

[30] *See Peneder et al. (2001) for a detailed discussion of structural change and related measures.*

[31] *The University Organization Act of 2002 failed to exploit the advantages of the U.S. tenure track system; see Scheibelhofer (2003) and Pechar (2004). For more suggestions (especially with regard to education and professional development), see Aiginger et al. (2003).*

shrinking and aging labor force and ensuing productivity effects – one way may be to offer more child-care facilities to help employees to better balance work and family commitments.

(3) *Improve infrastructures to exploit agglomeration advantages created by EU enlargement*
An improved transport infrastructure would allow for a more effective exploitation of agglomeration advantages that EU enlargement may create. According to the current master transportation plan (Federal Ministry of Transport, Innovation and Technology, 2002) infrastructure expansions are to be oriented on the expected demand for transportation. Given the economic geography mechanisms described above, infrastructure expansions should also reflect the anticipated impact of transportation supply on demand – not because they would raise transportation flows but because they would promote endogenous growth in agglomerations by reducing transaction and innovation costs. Policymakers should consider implementing the master transportation plan more speedily and in a forward-looking manner by putting the priority on improving the links to Austria's eastern neighbors.

(4) *Speed up the deregulation of product markets and services*
Given the low intensity of competition in the service sector, there is scope for increasing incentives to adopt new technologies (OECD, 2003). Competition-enhancing measures that Austria may take include speeding up the process of adopting the EU directive on services in the internal market and EU trade liberalization measures at the EU level, as well as removing market entry barriers and industry-specific regulatory policies at the national level.

(5) *The complex interaction of individual areas requires an integrated perspective and evidence-based policies*
Potential interdependencies between individual areas (such as financial, product and labor markets; see Hall and Soskice, 2001) call for caution about unanticipated consequences. With Austrian regulation giving industries with incremental innovation an edge in international competition, a fundamental policy change may put existing industries at a disadvantage before industries benefiting from the new approach may evolve. In establishing a growth strategy, it would therefore be imperative to first analyze its repercussions in detail (scenarios and simulations in order to set up policies based on evidence).

References

Abramovitz, M. 1981. Welfare Quandaries and Productivity Concerns. In: The American Economic Review 71(1). March. 1–17.

Acemoglu, D. and F. Zilibotti. 2001. Productivity Differences. In: The Quarterly Journal of Economics 116(2). 563–606.

Ahn, S. and P. Hemmings. 2000. Policy influences on Economic Growth in OECD Countries: An Evaluation of the Evidence. OECD Working Paper 246.

Aiginger, K. and H. Kramer (project managers). 2003. Wirtschaftspolitik zur Steigerung des Wirtschaftswachstums (final version). Vienna: WIFO.

Aiginger, K., M. Böheim, M. Falk, P. Huber, G. Hutschenreiter, N. Knoll, A. Köppl, H. Leo, M. Peneder and M. Schratzenstaller. 2003. Pressegespräch. Defizite in Standort- und Wachstumspolitik in Österreich. Vienna: WIFO.

Akella, J., J. M. Manyika and R. P. Roberts. 2003. What High-Tech Can Learn from Slow-Growth Industries. In: The McKinsey Quarterly 4.

Alcalá, F. and A. Ciccone. 2004. Trade and Productivity. In: The Quarterly Journal of Economics 119(2). May.

Alesina, A. 2003. The Size of Countries: Does it Matter? In: Journal of the European Economic Association 1(2–3). April–May. 301–316.

Alesina, A., A. Silvia, G. Nicoletti and F. Schiantarelli. 2003. Regulation and Investment. NBER Working Paper 9560.

Arrow, K. 1962. The Economic Implications of Learning by Doing. In: Review of Economic Studies 29. June. 155–73.

A. T. Kearney and Foreign Policy. 2004. Globalization Index. In: Foreign Policy, 3–4/2004.

Barro, R. and J. W. Lee. 2001. International Data on Educational Attainment: Updates and Implications. In: Oxford Economic Papers 53(3). 541–563.

Blanchard, O. 2004. The Economic Future of Europe. NBER Working Paper 10310.

Böheim, M. 2003. Wettbewerbspolitik in Österreich unter neuen Rahmenbedingungen. Zwischenbilanz und Ausblick. In: WIFO Monatsberichte 7/2003. 515–528.

Breschi, S., F. Malerba and L. Orsenigo. 2000. Technological Regimes and Schumpeterian Patterns of Innovation. In: The Economic Journal 110(463). April. 388–410.

Butschek, F. 1985. Die österreichische Wirtschaft im 20. Jahrhundert. Stuttgart: Gustav Fischer Verlag.

Butschek, F. 1995. Sozialpartnerschaft aus Sicht der Neuen Institutionenökonomie. In: WIFO Monatsberichte 10/1995. 644–654.

Ciccone, A. and R. Hall. 1996. Productivity and the Density of Economic Activity. In: The American Economic Review 86(1). 54–70.

Coe, D. T. and E. Helpman. 1995. International R&D Spillovers. In: European Economic Review 39(5). May. 859–87.

Costello, D. M. 1993. A Cross-Country, Cross-Industry Comparison of Productivity Growth. In: The Journal of Political Economy 101(2). April. 207–22.

Crafts, N. F. R. 1996. Endogenous Growth: Lessons for and from Economic History. CEPR Discussion Paper 1333.

Crafts, N. F. R. and G. Toniolo. 1995. Post-war Growth: An Overview. CEPR Discussion Paper 1095.

Dachs, B. and H. Leo. 1999. Die Innovationsaktivitäten der österreichischen Wirtschaft. Band 2: Dienstleistungssektor. Vienna: WIFO.

De la Fuente, A. and R. Doménech. 2002. Human Capital in Growth Regressions: How Much Difference Does Data Quality Make? An Update and Further Results. CEPR Discussion Paper 3587.

Dowrick, S. and B. J. Spencer. 1994. Union Attitudes to Labor-saving Innovation: When Are Unions Luddites. In: Journal of Labor Economics 12(2). April. 316–344.

Easterly, W. and R. Levine. 2001. What have we learned from a decade of empirical research on growth? It's Not Factor Accumulation: Stylized Facts and Growth Models. In: World Bank Economic Review 15(2). 177–219.

Eaton, J. and S. Kortum. 1996. Trade in Ideas: Patenting and Productivity in the OECD. In: Journal of International Economics 40(3–4). May. 251–78.

European Commission. 2004. Delivering Lisbon. Reforms for the Enlarged Union. Report from the Commission to the Spring European Council. Brussels: Office for Official Publications of the European Communities.

Federal Government of Austria. 2003. Regierungsprogramm der Österreichischen Bundesregierung für die XXII. Gesetzgebungsperiode. Vienna.

Federal Ministry for Economic Affairs and Labor. 2001 bis 2003. Wirtschaftsbericht Österreich. Vienna.

Federal Ministry of Transport, Innovation and Technology. 2002. Generalverkehrsplan Österreich. Vienna.

Felderer, B., R. Koman and U. Schuh. 2002. Vorschläge zu Wachstumspolitik und Budgetkonsolidierung in Österreich. Vienna: IHS.

Fischer, W. 1985. Vom internationalen Trend mitgerissen? – Der weltwirtschaftliche Hintergrund. In: Kramer, H. (ed.). Vom Nachzügler zum Vorbild? Österreichische Wirtschaft 1945 bis 1985. Vienna: Federal Ministry of Science and Research. 13–24.

Foster, L., J. Haltiwanger and C. J. Krizan. 2002. The Link between Aggregate and Micro Productivity Growth: Evidence from Retail Trade. NBER Working Paper 9120.

Frankel, J. and D. Romer. 1999. Does Trade Cause Growth? In: The American Economic Review 89(3). June. 379–399.

Galdón-Sánchez, J. E. and J. A. Schmitz Jr. 2002. Competitive Pressure and Labor Productivity: World Iron-Ore Markets in the 1980's. In: The American Economic Review 92(4). 1222–1235.

Geppert, K., M. Gornig and A. Stephan. 2003. Productivity Differences in the European Union. National, regional and spatial effects. DIW Discussion Papers 383.

Glaeser, E. L., H. D. Kallal, J. A. Scheinkman and A. Shleifer. 1992. Growth in Cities. In: The Journal of Political Economy 100(6). December. 1126–1152.

Gollin, D. 2002. Getting Income Shares Right. In: The Journal of Political Economy 110(2). 458–474.

Gompers, P. A. and J. Lerner. 2001. The Money of Invention: How Venture Capital Creates New Wealth. Boston: Harvard Business School Press.

Gramlich, E. M. 1994. Infrastructure Investment: A Review Essay. In: Journal of Economic Literature 32(3). 1176–1196.

Griffith, R., S. Redding and J. Van Reenen. 2004. Mapping the Two Faces of R&D: Productivity Growth in a Panel of OECD Industries. In: Review of Economics and Statistics (forthcoming).

Guger, A. 1998. Economic Policy and Social Democracy. The Austrian Experience. In: Oxford Review of Economic Policy 14(1). 40–58.

Hall, P. and D. Soskice. 2001. An Introduction to Varieties of Capitalism. In: Hall, P. and D. Soskice (eds.). Varieties of Capitalism. Oxford: Oxford University Press.

Hall, R. and C. Jones. 1999. Why do Some Countries Produce so Much More Output than Others? In: The Quarterly Journal of Economics 114(1). February. 83–116.

Helliwell, J. 1998. How much do National Borders matter? Washington D.C.: Brookings Institution.

Hicks, J. R. 1932. The theory of wages. London: Macmillan.

Hutschenreiter, G., N. Knoll, H. Leo, M. Peneder, G. Booth, H. Gassler, N. Gretzmacher, W. Polt, A. Schibany, H. Schiffbänker, G. Streicher, B. Dachs, K. Whitelegg and J. Mahlich. 2003. Österreichischer Forschungs- und Technologiebericht. Vienna: Federal Ministry for Science, Education and Culture.

IMF. 2003. Austria - Article IV Consultation. Staff Report. Washington D.C.

IWI (Austrian Institute for Industrial Research). 2003. Press information: 49 Thesen zur Industriepolitik Österreichs. Vienna.

Johnson, P. A. and J. Temple. 1998. Social Capability and Economic Growth. In: The Quarterly Journal of Economics 113(3). August. 965–990.

Jones, C. I. 2002. Sources of U.S. Economic Growth in a World of Ideas. In: The American Economic Review 92(1). March. 220–239.

Jones, C. I. and J. C. Williams. 1998. Measuring the social return to R&D. In: The Quarterly Journal of Economics 113(4). 1119–1135.

Keller, W. 2002. Geographic Localization of International Technology Diffusion. In: The American Economic Review 92(1). 120–142.

King, R. G. and R. Levine. 1993. Finance and Growth: Schumpeter Might Be Right. In: The Quarterly Journal of Economics 108(3). August. 717–737.

Kitschelt, H. 1991. Industrial Governance Structure, Innovation Strategies, and the Case of Japan: Sectoral or Cross-National Comparative Analysis? In: International Organization 45(4). 453–93.

Koman, R. and D. Marin. 1997. Human Capital and Macroeconomic Growth: Austria and Germany 1960–1992. CEPR Discussion Paper 1551.

Krueger, D. and K. B. Kumar. 2003a. Skill-specific rather than General Education: A Reason for US-Europe Growth Differences? NBER Working Paper 9408.

Krueger, D. and K. B. Kumar. 2003b. US-Europe Differences in Technology-Driven Growth: Quantifying the Role of Education. NBER Working Paper 10001.

Landesmann, M. 1992. Industrial Policies and Social Corporatism. In: Pekkarinen, J., M. Pohjola and R. Rowthorn (eds.). Social Corporatism – A Superior Economic System? Oxford: Clarendon Press.

Leitner, K. H. 2003. Von der Idee zum Markt: 50 der besten Innovationen Österreichs zwischen 1975 und 1999. In: Pichler, R. (ed.). 2003. Innovationsmuster in der österreichischen Wirtschaftsgeschichte. Vienna: Studienverlag.

Levine, R. and D. Renelt. 1992. A Sensitivity Analysis of Cross-Country Growth Regressions. In: The American Economic Review 82(4). September. 942–63.

Lindh, T. 2004. Is Human Capital the Solution to the Aging and Growth Dilemma? OeNB Workshop: Current Issues in Economic Growth. March.

Lundvall, B. Å. (ed.). 1992. National Innovation Systems: Towards a Theory of Innovation and Interactive Learning. London: Pinter Publishers.

Mangold, R. and R. Hennessy. 2003. PISA-Ergebnisse, Effizienz und Produktivität des Bildungssystems. In: Wirtschaftspolitische Blätter 3. 437–446.

Marin, D. 1995. Learning and Dynamic Comparative Advantage: Lessons from Austria's Post-War Pattern of Growth for Eastern Europe. CEPR Discussion Paper 1116.

Martin, P. and G. Ottaviano. 2001. Growth and Agglomeration. In: International Economic Review 42(4). November. 947–968.

McGuckin, R. H. and B. van Ark. 2001. Making the Most of the Information Age: Productivity and Structural Reform in the New Economy. Perspectives on a Global Economy. In: The Conference Board. Research Report 1301-01-RR. October.

McKinsey Global Institute. 2002. Reaching Higher Productivity Growth in France and Germany.

McKinsey Global Institute. 2003. Improving European Competitiveness.

Meister, C. and B. Verspagen. 2004. European Productivity Gaps: Is R&D the solution? OeNB Workshop: Current Issues in Economic Growth. March.

Nicoletti, G. and S. Scarpetta. 2003. Regulation, Productivity and Growth: OECD evidence. World Bank. Policy Research Working Paper 2944.

North, D. C. 1991. Institutions, Institutional Change and Economic Performance. Cambridge: Cambridge University Press.

OECD. 2001. Knowledge and Skills for Life – First results from PISA 2000. Paris.

OECD. 2003. OECD Economic Surveys: Austria 2003. Paris.

Olson, M. 1971. The Logic of Collective Action. Public Goods and the Theory of Groups. Cambridge: Harvard University Press.

Pechar, H. 2004. Österreichs Universitäten brauchen einen tenure track. Contribution to Hochschulpolitisches Forum of March 25, 2004.

Pelkmans, J. and J.-P. Casey. 2004. Can Europe Deliver Growth? The Sapir Report and Beyond. BEEP briefing no. 6. Bruges: College of Europe.

Peneder, M. 2001. Eine Neubetrachtung des „Österreich-Paradoxon". In: WIFO Monatsberichte 12/2001. 737–748.

Peneder, M., K. Aiginger, G. Hutschenreiter and M. Marterbauer. 2001. Structural Change and Economic Growth. Vienna: WIFO.

Peneder, M. and R. Wieser. 2002. Der österreichische Markt für Private Equity und Venture Capital 2001. Ergebnisse einer Unternehmensbefragung. In: WIFO Monatsberichte 10/2002. 661–667.

Pichler, R. (ed.). 2003. Innovationsmuster in der österreichischen Wirtschaftsgeschichte. Vienna: Studienverlag.

Porter, M. 1990. The Competitive Advantage of Nations. London: Macmillan.

Prescott, E. 2002. Prosperity and Depression. In: The American Economic Review 92(2). May. 1–15.

Prskawetz, A. and T. Fent. 2004. Workforce Ageing and Economic Productivity: the Role of Supply and Demand of Labour. An Application to Austria. OeNB Workshop: Current Issues in Economic Growth. March.

Ramey, G. and V. A. Ramey. 1995. Cross-Country Evidence on the Link Between Volatility and Growth. In: The American Economic Review 85(5). December. 1138–1151.

Sapir, A., P. Aghion, G. Bertola, M. Hellwig, J. Pisani-Ferry, D. Rosati, J. Viñals and H. Wallace. 2003. An Agenda for a Growing Europe: Making the EU System Deliver. Brussels.

Scharler, J., J. Crespo-Cuaresma and N. Foster. 2004. On the Determinants of Absorptive Capacity: Evidence from OECD Countries. OeNB Workshop: Current Issues in Economic Growth. March.

Scheibelhofer, E. 2003. Brain Gain, Brain Drain oder Brain Waste? Zum Problem der Abwanderung österreichischer WissenschafterInnen. In: Wirtschaftspolitische Blätter 3. 409–419.

Seidel, H. 1985a. Das Ergebnis eigener Leistung? Die Charakteristika der österreichischen Wirtschaftsentwicklung. In: Kramer, H. (ed.). Vom Nachzügler zum Vorbild? Österreichische Wirtschaft 1945 bis 1985. Vienna: Federal Ministry of Science and Research. 25–38.

Seidel, H. 1985b. Die Entfaltung der Produktionskräfte der österreichischen Wirtschaft. In: Bodzenta, E., H. Seidel and K. Stiglbauer. 1985. Österreich im Wandel. Gesellschaft, Wirtschaft, Raum. Vienna, New York: Springer Verlag. 77–124.

Smeral, E. 2003. A Structural View of Tourism Growth. In: Tourism Economics 9(1). 77–93.

Solow, R. 1957. Technical Change and the Aggregate Production Function. In: Review of Economics and Statistics 39(3). August. 312–320.

Soskice, D. 1999. Divergent Production Regimes. Coordinated and Uncoordinated Market Economies in the 1980s and 1990s. In: Kitschelt, H., P. Lange, G. Marks and J. D. Stephens (eds.). Continuity and Change in Contemporary Capitalism. Cambridge: Cambridge University Press. 101–134.

Statistics Austria 2003. Innovation in österreichischen Unternehmen 1998–2000. Vienna.

Steger, N. 1985. Österreichs Wirtschaft in der Welt von heute und morgen. In: Kramer, H. (ed.). Vom Nachzügler zum Vorbild? Österreichische Wirtschaft 1945 bis 1985. Vienna: Federal Ministry of Science and Research. 177–183.

Streeck, W. 1991. On the Institutional Preconditions of Diversified Quality Production. In: Matzner, E. and W. Streeck (eds.). Beyond Keynesianism. The Socio-Economics of Full Employment. Aldershot: Elgar. 21–61.

Temple, J. 1999. The New Growth Evidence. In: Journal of Economic Literature 37(1). March. 112–56.

Temple, J. 2000. Inflation and Growth: Stories Short and Tall. In: Journal of Economic Surveys 14(4). September. 395–426.

Van Ark, B., R. Inklaar and R. H. McGuckin. 2003. ICT and productivity in Europe and the United States. Where do the differences come from? CESifo Economic Studies 49(3). 295–318.

WKO (Austrian Federal Economic Chamber). 2002. 12-Punkte-Programm zur Zukunftssicherung Österreichs. Vienna.

Wolff, E. N. 1991. Capital Formation and Productivity Convergence over the Long Term. In: The American Economic Review 81(3). June. 565–579.

Zagler, M. 2000. The Austrian Miracle – Revisited: testing eight explanations for high Growth and Maybe a Ninth. Vienna University of Economics and Businesses Administration. Working Paper 11. April.