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STRUCTURAL CHANGE AND ECONOMIC GROWTH

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TABLE OF CONTENTS

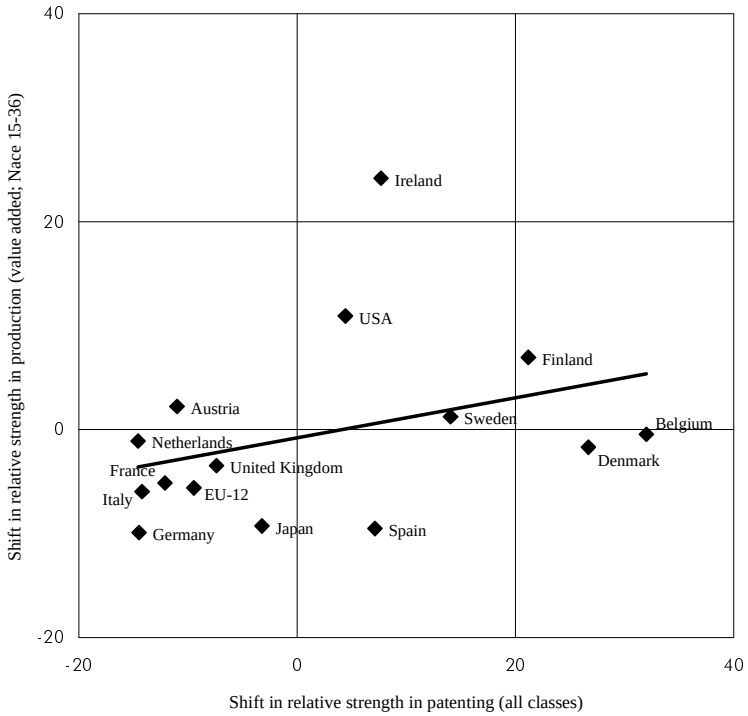
1. MOTIVATION AND OUTLINE

MICHAEL PENEDER

The objective of this study is to investigate the link between industrial structure and macroeconomic performance in terms of income levels and growth. It has been motivated by the repeated observation of pronounced deficits in the industrial structure of the Austrian economy – strikingly contrasted by the general perception of its good macroeconomic performance. If income per capita has remained among the highest in the world, it is logically consistent to question why we should concern ourselves with industrial structure and sectoral adjustments. Our specific purpose is therefore to clear the ground, and if possible, bridge the gap between these two divergent empirical findings, referred to as the Austrian paradox of old structures/high-performance (Peneder, 1999). The analysis will also pave the way for a fresh look at industrial policy and structural change.

Let us immediately start with a brief account of the data which cause the concern for an Austrian technology gap. The rather modest share of R&D expenditures in total GDP of 1.81 % in 1998 is probably the one indicator which attracts most public attention. Although it corresponds precisely to the same share of the European Union as a total, it is considerably below the levels of other high-income countries such as Sweden (3.70 %) or Finland (2.89 %) and even smaller than the aggregate value for the OECD (2.18 %). But shifting our attention from inputs to outputs of the innovation process, the discrepancy gap becomes even larger. Figure 1.1 illustrates the relationship between *technological* performance, measured by changes in the shares of registered patents in the USA, and *economic* performance, as measured by changes in relative shares of value added in the EU. The data refer exclusively to changes in the current position, irrespective of the initial levels of patenting and value added. Two features of the graph are important. First, we observe that knowledge production (even when measured by such a crude indicator as patenting) and economic performance are significantly correlated; secondly, we notice that according to these measures (and in striking contrast to the overall relationship) Austria performs badly in terms of its own production of technological knowledge, but nevertheless achieves a high level of economic performance in terms of manufacturing value added.

Figure 1.1 Change in international shares of patent activity and value added in %



Note: numbers refer to changes in the % of average shares between the two periods 1990 /1994 and 1995/1998.

Source: EUROSTAT, USPTO, calculations by Norbert Knoll.

Performance of the manufacturing sector is further disaggregated in Figures 1.2 and 1.3 according to the taxonomic groupings introduced in Table 1.1. The classifications are presented and explained more extensively in Peneder (2001). They explore the sources of competitive advantage from various perspectives, ranging from intangible investments in marketing and innovation to human resources and the externalisation of various services. An important methodological feature of the taxonomies is their consequent application of cluster analysis, which provides a powerful statistical technique specifically designed for classifying observations on behalf of their relative similarities with respect to a multidimensional array of variables. The classifications are based on data for the US (taxonomy I and III) as well as a sample of OECD countries (taxonomy II). This enabled the circumvention of major limitations in international comparisons, which otherwise result from a lack of comprehensive data on the variables that entered the clustering process.

Table 1.1: Three taxonomies of manufacturing industry

Taxonomie I (Factor inputs)				
Mainstream manufacturing (MM)	Labour intensive industries (LI)	Capital intensive industries (CI)	Marketing driven industries (MDI)	Technology driven industries (TDI)
Taxonomie II (Human resources)				
Industries with particularly high shares of ...	Low skilled labour (LS)	Medium skilled, `blue-collar´ labour (MBC)	Medium skilled, `white-collar´ labour (MWC)	High skilled labour (HS)
Taxonomie III (External service inputs)				
Industries with high inputs from ...	Knowledge based services (IKBS)	Retail & marketing services (IR&M)	Transport services (ITR)	Other

Source: Peneder (2001)

Like any broad classification, the new taxonomies must be interpreted with care, since they necessarily rely on reduction and condensation of relevant information. In many respects industries within the categories are still very heterogeneous. We also cannot assume entire consistency between different economic areas regarding the typical combinations of factor inputs, skill requirements, or external service inputs. However, it must be emphasised that it is precisely one of the advantages of the taxonomic approach that the latter is not a necessary assumption for international comparisons. It only requires consistency as far as membership within the broad boundaries of the final classification is concerned. Obviously this is a much weaker assumption than required for direct comparisons based on the continuous variables from which the taxonomies had been generated.

A first test for the economic relevance of the taxonomic groups is to check, whether they discriminate well with respect to some of the most widely used indicators in comparative studies on industrial development. Table 1.2 summarises the results for three crucial aspects. First, the differences between industries related to average growth of apparent consumption, value added and employment; secondly the growth and levels of labour productivity; and finally the degree to which the supply of goods can be qualitatively differentiated.

To begin with growth performance, the three taxonomies generally turn out to discriminate very well, especially with regard to apparent consumption (comprising industrial production + imports – exports) and value added. If the European Union, Japan and the USA are taken together, between 1990 and 1998 annual growth in demand was highest and above 3.0 % in technology driven industries and mainstream manufacturing, high-skill industries, as well as those branches of manufacturing where external inputs from retail and advertising or from knowledge-based services were exceptionally high. A similar pattern emerges if we take a look at value added growth between 1985 and 1998, except for the case of marketing driven industries which outperform mainstream manufacturing and the generally higher growth rates for medium skilled industries. One may therefore conclude, that industries with an a priori characterisation of being more progressive in the sense of investing in a larger range of competitive assets (such as innovation, marketing, or labour skills) also tend to grow faster than e.g. purely labour and capital intensive as well as low-skill industries.

With regard to employment, the general dynamics depend on the simultaneous interplay of growth in both value added and labour productivity. While it is a quite general observation that manufacturing industries are not able to maintain employment levels, the numbers in Table 1.2 make apparent the different sources of decreases in the number of jobs. Some branches such as low-skill and labour intensive industries are primarily hit by the lack of dynamics from the demand side. Others loose employment primarily due to their extraordinary good performance in terms of labour productivity. Technology driven industries are the best example. But when low dynamics of demand and high growth of labour productivity occur together, the combined effect on employment is most detrimental. This corresponds to the actual situation of capital intensive industries.

Unit values in foreign trade are often used in comparative analysis of industrial performance to characterise the degree of quality differentiation of various product groups. Because of the lack of reliable information on Japanese and US unit values, the data in Table 1.2 refer only to the European Union. In short, almost all the variation in unit values can be accrued to the separate groups of technology driven and high-skill industries. This surprisingly marked differentiation is consistent with results reported in Peneder (2001) and is still valid after elimination of outliers.

Table 1.2: Industrial specialisation and economic performance: EU, Japan, and USA

	Consumption (1990/1998)	Value Added	Employment	Labour productivity	Export unit values	Import unit values
	EU+Japan+USA				EU	
	Average annual change 1985/1998 in %			1998 1.000 Euro	1999 Euro /kg	
Mainstream manufacturing (MM)	+ 3,22	+ 3,71	– 0,17	+ 3,89	62,1	3,87	3,36
Labour intensive industries (LI)	+ 2,50	+ 3,28	– 0,85	+ 4,17	46,5	2,65	2,41
Capital intensive industries (CI)	+ 1,48	+ 3,54	– 1,49	+ 5,11	102,0	0,56	0,55
Marketing driven industries (MDI)	+ 2,47	+ 4,22	+ 0,08	+ 4,14	72,0	1,52	1,33
Technology driven industries (TDI)	+ 3,75	+ 4,74	– 0,95	+ 5,74	104,6	16,26	15,78
Industries with high shares of . . .							
Low skilled labour (LS)	+ 2,16	+ 3,32	– 1,01	+ 4,38	61,4	1,13	1,10
Medium skilled, 'blue collar' (MBC)	+ 2,92	+ 4,38	+ 0,01	+ 4,37	60,4	4,10	3,41
Medium skilled, 'white collar' (MWC)	+ 2,83	+ 4,37	– 0,48	+ 4,88	89,9	1,24	1,11
High skilled labour, (HS)	+ 3,22	+ 3,93	– 0,58	+ 4,54	85,5	19,43	17,19
Industries with large inputs from . . .							
Knowledge-based services (IKBS)	+ 3,07	+ 4,55	– 0,53	+ 5,11	91,5	2,63	2,05
Retail & advertising (IR&A)	+ 3,24	+ 4,53	– 0,16	+ 4,70	79,1	4,62	4,49
Transport services (ITR)	+ 2,37	+ 3,71	– 0,31	+ 4,03	67,2	0,86	0,80
Other Industries	+ 2,24	+ 3,22	– 1,08	+ 4,35	60,5	1,90	1,73

Source: EUROSTAT, WIFO calculations

Recapitulating, we have seen that the three taxonomies discriminate well with respect to a number of indicators, which are generally applied in comparative studies on industrial development. Their general credibility should hence be sufficiently established to be applied for the international comparison of industrial structures in the following section of this introductory chapter as well as the econometric analysis in Chapter 5.

Figure 1.2 presents three static snapshots of relative shares in the total value added of Austrian manufacturing and that of the European Union for the year 1998. It is immediately striking that within each classification, the taxonomic group which would generally be considered the most progressive, always exhibits for Austria the lowest number of value added shares relative to the European Union. This observation is most pronounced with respect to the technology-driven industries. Here we see that the shares in value added of total manufacturing are only 14.16 % in Austria, as opposed to 22.92 % in the EU. The second largest structural deficit appears in industries with exceptionally high external inputs from knowledge-based services (12.40 % in Austria in contrast to 19.23 %

in the EU). Distinguishing between industries with respect to the human resources dimension reveals the least differences relative to EU. But again, we see that for the most sophisticated group of high-skill industries, value added shares are lower in Austria (13.11 % versus 16.67 %). Conversely, pronouncedly higher value added shares for Austria can be found for the labour intensive branches of manufacturing (20.13 % vs. 15.55 %) and industries with high external inputs from transport services (32.39 % vs. 23.57 %).

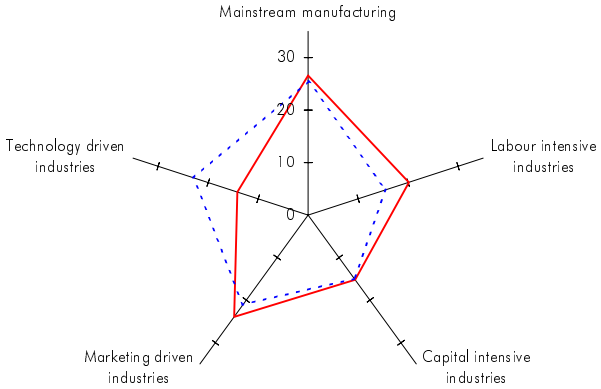
Recent qualitative evidence from a Delphi report on Austrian technology reveals that these structural characteristics of the manufacturing sector are consistent with a similar bias in the general resources of Austrian expert knowledge:

> The hypotheses regarding research-intensive industries necessarily received the highest marks for innovativeness. However, respondents consider themselves best informed about mainstream industries, least about research-intensive industries. Evidently, even experts are not as familiar with research-intensive industries as with more traditional ones. They consider the few hypotheses about innovations in mainstream sectors most important and desirable, they expect the best chances of realisation in labour-intensive and the worst in research- as well as in advertising-intensive sectors. Potential leadership in R&D and in economic exploitation is seen both in capital intensive and labour intensive sectors (Tichy, 2000B, p. 8).

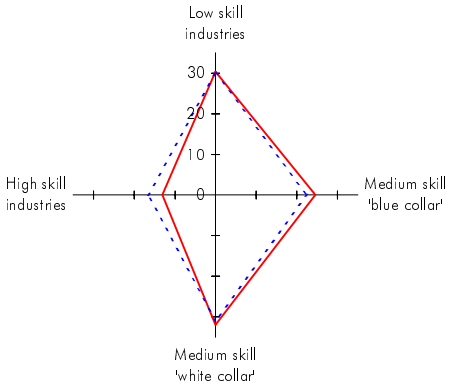
In short, the Austrian patterns of specialisation are deeply rooted in the corresponding pattern of industrial knowledge. This also explains why the overall picture does not improve, if we shift our attention to the dynamic patterns presented in Figure 1.3. The graphs depict for each type of industry the development of Austria´s relative shares in EU value added and exports. Consistent with the previous results, the most sophisticated industries appear in the bottom lines, indicating that these hold the lowest shares in EU value added and exports for each of the taxonomies. Compared to 2.75 % of value added (1998) and 3.01 % of exports (1999) for total manufacturing, the respective shares are much lower for technology-driven (1.70 % and 2.14 %), and high-skill industries (2.16 % and 2.60 %), as well as for industries with high shares of knowledge-based services (1.77 % and 1.79 %). There is no evidence of catching up in terms of industrial structure. Although it is true that manufacturing has increased its shares of nominal value added in the European Union between 1988 and 1998 by more than one third, the relative gaps between the various types of industries have not changed in favour of the above categories.

Figure 1.2: Austria's technology gap: relative shares in total value added, 1998 in %

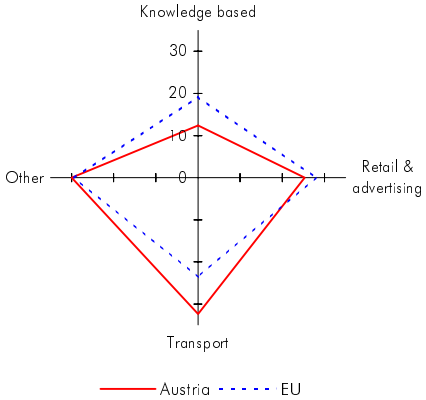
Factor input combinations



Human resources



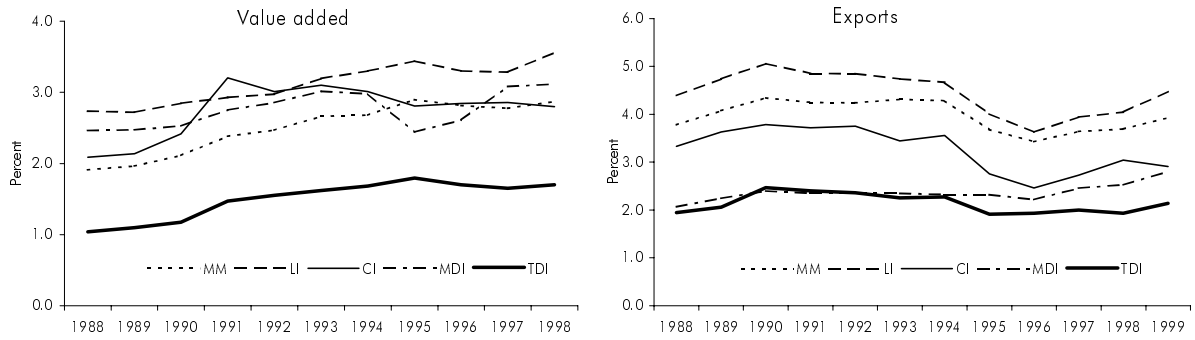
High inputs from external services



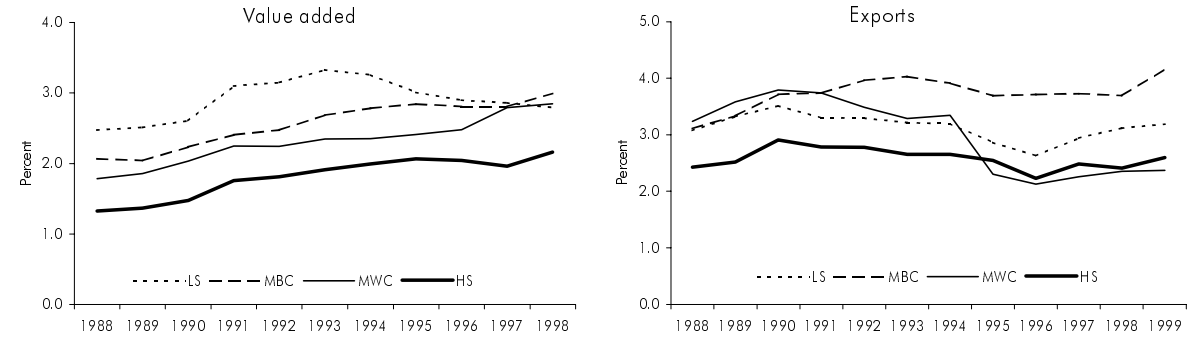
Source: EUROSTAT New Cronos, own calculations.

Figure 1.3: Austrian shares of value added and exports in the EU, 1988 to 1998

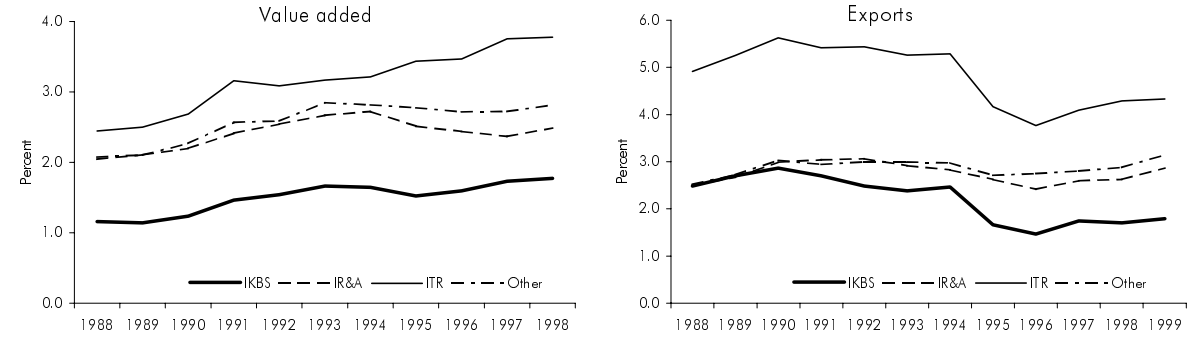
Factor Inputs



Human Resources



External Service Inputs



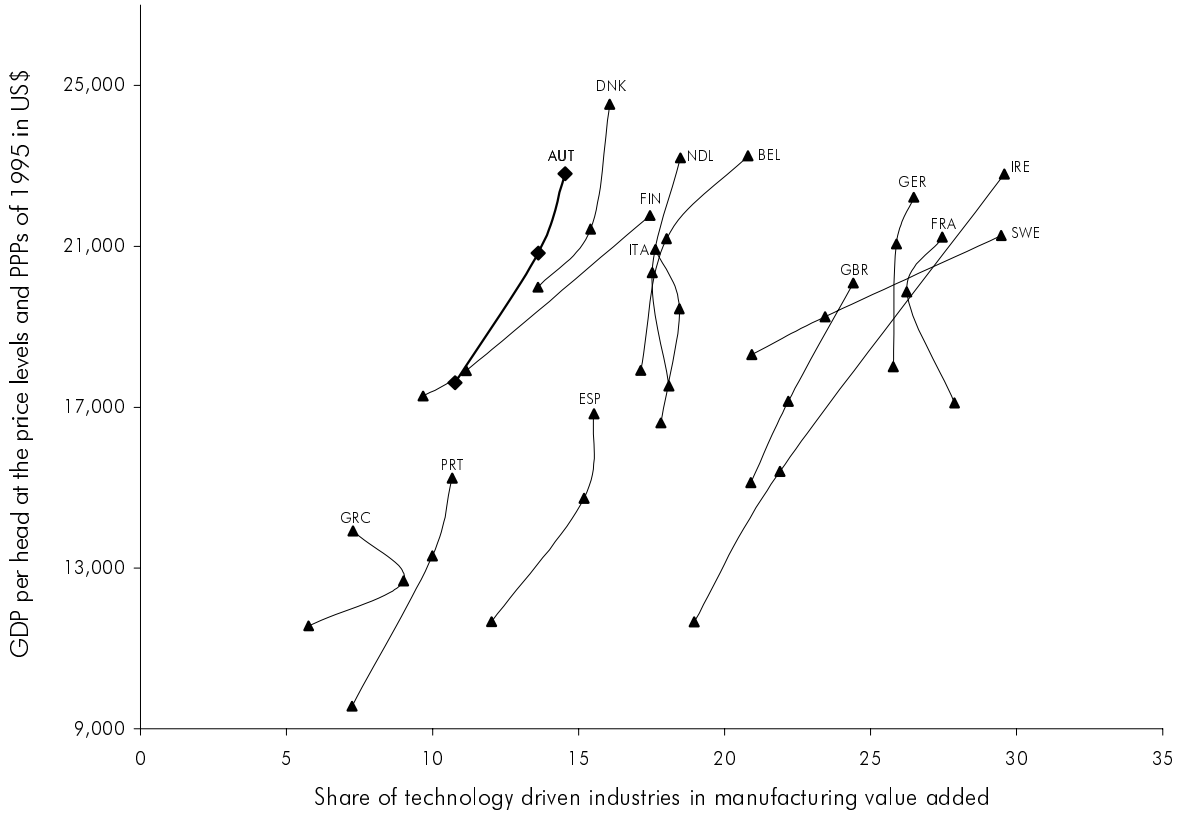
Source: EUROSTAT New Cronos, own calculations.

Finally, the lines in Figure 1.4 visualise the combination of developments in real GDP per capita on the vertical axis and systematic shifts in the sectoral composition of production on the horizontal axis. The three marks on each line refer to the years 1985, 1992 and 1998. It becomes immediately clear that the development of aggregate levels of income and structural change cannot be considered as independent processes. We rather observe a co-movement over time, whereby GDP per capita and the share of technology-driven industries both tend to increase. Consistent with our concern for the old-structure/high-performance paradox, the Austrian economy appears on the upper left side of the graph, signalling high levels of income combined with a lower share of production in the technologically most sophisticated industries. The discomforting fact about this picture, however, is its very peculiar path of development, largely disentangled from the majority of other European economies. While the speed of structural change generally seems to have increased during the second period (since 1992) for countries such as Finland, Sweden, Ireland, Belgium or the United Kingdom, it appears to have slowed down further in the case of Austria –although it must be stressed that Austria has nevertheless maintained a high level of per capita income.

This short introductory excursion confirms the persistence of pronounced structural deficits found in so many studies of Austrian economic performance. But industrial structure does not constitute a normative goal in itself. It must be derived from the general purpose to raise and maintain a society´s desired standard of living. In other words, these empirical findings are only relevant to economic policy, if industrial structure relates to an economy´s level of income and potential for growth. To know whether or not such a relationship exists, is therefore an imminent task for any long-term orientation of industrial policy.

The evidence presented in Table 1.2 is important but not yet sufficient to take such a relationship for granted. The reason is that it only relates measures of meso-performance to meso-characteristics. For example, it might still be the case that higher growth in some types of industry simply diverts ressources away from other industries, leaving the overall level of economic activity unaffected. What we therefore require is additional evidence on the relationship between meso-characteristics (as, for example, provided by the taxonomies) and macroeconomic performance.

Figure 1.4: GDP and the value added share of technology-driven industries: 1985/92/98



Source: OECD, EUROSTAT, own calculations.

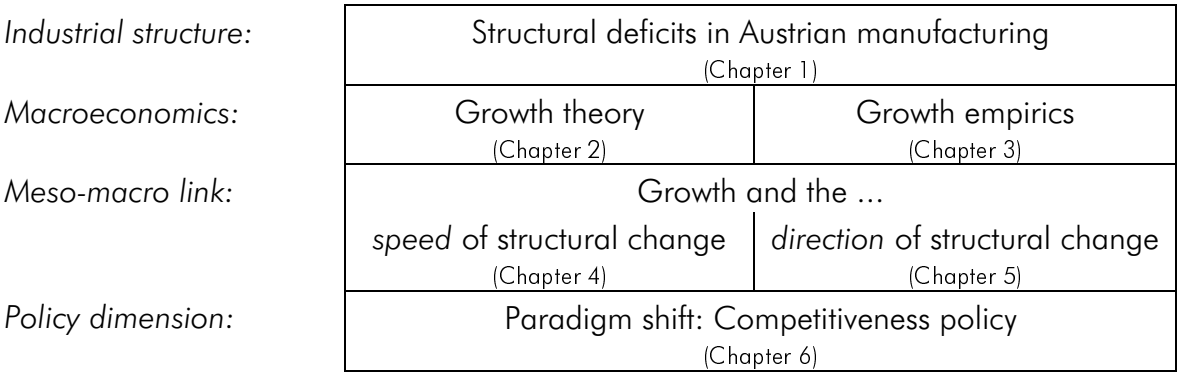
Unfortunately, established economic theory is not very informative in that regard. Structural change introduces a high degree of complexity, which appears too difficult to deal with appropriately in the rigorous formal models of general equilibrium theory. Conversely, more appreciative theories are capable of dealing explicitly with industrial dynamics and structural change but miss to integrate the effects of general equilibrium mechanisms on aggregate growth. As a consequence, the meso- and macro-levels of economic activity are regularly treated as seperable fields of analysis and systematic empirical research of the links between the two levels is a rare occurrence. In order to gain a better understanding of the Austrian old-structures/high-performance paradox, this is nevertheless what we must attempt for. Pursuing that goal from various angles of analysis, our report is structured as follows (Figure 1.5):

Chapter 2 starts with a brief recapitulation of the main theoretical findings in the literature on economic growth, ranging from the now classic treatments of Solow and Swan up to modern growth models with endogenous innovation and technological change. Consistent with our concern for the Austrian paradox, Gernot Hutschenreiter puts especial emphasis on a particular mechanism of economic growth through technological catching-up in small open economies and the social capabilities required for its realisation. In the comparative analysis of Austria´s macroeconomic performance in Chapter 3, Markus Marterbauer demonstrates that despite above average long-term growth performance, Austria´s positive growth margin relative to the European Union continuously decreased during the past three decades and finally disappeared during the second half of the 1990s. Three potential explanations must be considered: One obvious reason is the successfully completed process of catching-up to Germany´s high level of income, eliminating the effects of common convergence mechanisms. Additionally, the author points towards a certain degeneration in the once coherent concept of demand oriented macroeconomic policies. A third possible explanation is, of course, the lack of sectoral adjustment and reallocation of productive resources.

An exploration of this last point is the task of the two subsequent chapters, which attempt to empirically validate the presumed links between industrial structure and macroeconomic performance. In Chapter 4, Karl Aiginger investigates whether growth of the manufacturing sector is related to the absolute scope of readjustments between industries, labelled the "speed of change". His results confirm a significant positive relationship and additionally lead him to emphasise that not only the speed but also the direction of change matters. This last aspect is then explored more extensively in Chapter 5, where Peneder pursues three common approaches, ranging from Harberger´s graphical visualisations of the growth process to decomposition analysis and dynamic panel econometrics, investigating the empirical validity of various hypotheses about the scope and direction of structural change and macroeconomic performance.

Chapter 6 provides a short summary and experiments with some tentative explanations for the Austrian growth puzzle. Its general implications for industrial policy point towards the need for a paradigmatic shift. The notion of "competitiveness policy" is applied for a brief illustration of what might develop into a dynamic concept of supply side reforms, enabling structural change and increasing the long-term prospects for growth and development.

Figure 1.5: Plan of the Study



Making use of a wide range of available experience, the study not just delivers a unique combination of macroeconomic and structural analysis. It also covers considerable new grounds in terms of methodology, ranging from the application of new taxonomies to dynamic panel econometric estimations of the much under-researched link between meso-structure and macro-performance. It provides evidence in favour of a Schumpeterian view of economic development, characterised by the simultaneous interplay of growth and structural change and thus proves the relevance of the Austrian paradox. The most essential message therefore is that the deficits in industrial structure have to be taken seriously by Austrian economic policy. Whereas some fundamental sources of the historic growth performance (e.g. the potential for catching-up; promotion of demand aggregates through national macroeconomic policy) have vanished, industrial policy should seize the initiative and offer new stimulus to long term growth via structural reforms. The final policy chapter offers a new perspective on how such a strategy could be derived.

Although the views expressed remain the sole responsibility of the authors, we must emphasise that this report is the outcome of a large co-operative effort. It was commissioned by the Austrian Federal Ministry of Economic Affairs and Labour under the responsibility of DG DDr. Gottfried Zwerenz and Mag. Eva Hribernig. Again, I was helped immeasurably by the scientific advise of Michael Pfaffermayr. The authors are furthermore indebted to all the participants of two workshops at WIFO. Special thanks go to Gunter Tichy, Ewald Walterskirchen and our international advisor Paul Geroski. All the authors are grateful to Dagmar Guttmann, Margot Ludwar, Traude Novak, Eva Sokoll, Martha Steiner, and Tatjana Weber for their reliable assistence.

2. GROWTH THEORY

A BRIEF OUTLINE WITH SPECIAL REFERENCE TO THE AUSTRIAN GROWTH PUZZLE

GERNOT HUTSCHENREITER

2.1 Introduction

Macroeconomic growth models are, in principle, not about structural phenomena. Nevertheless they are useful in setting the stage for a more detailed discussion of the process of economic growth. They lead to broad policy conclusions and provide a framework for the evaluation of policies. The purpose of this chapter within the overall study is to survey the broader lessons which we can learn from studying growth theory combined with specific references to the Austrian development. Emphasis will thus be laid upon the role of technological catching-up in small open economies as well as the importance of a broad range of social capabilities reflected in the institutional environment of an economy.

The large gains in productivity and per-capita income realised in recent history would be inconceivable without technological progress. For this reason, most economists agree that innovation drives long-run growth of productivity and income per-capita. The role of technological change in economic development is reflected in macroeconomic models of economic growth. This is true for both neoclassical and endogenous growth models, although in very different ways. Neoclassical models (Section 2.2) seem to emphasise the accumulation of physical and human capital which are subject to diminishing returns. In the long run, growth is entirely driven by technical progress which remains unexplained by the model. In contrast, the characteristic feature of endogenous growth models (Section 2.3) are non-decreasing returns. Some of these (the so-called "R&D-based" or "idea") models attempt to explain technological change within the model. "R&D-based" endogenous growth models also provide a framework to analyse international knowledge flows and their impact on economic performance (Section 2.4).

The evolutionary approach, on the other hand, provides more detailed insights into the processes of innovation and economic growth. The analysis of structural change is also a core concern in the agenda of evolutionary economics. However, this literature deliberately lacks the general equilibrium features of neoclassical and endogenous growth models since evolutionary economists view technological change as a disequilibrium process beset by ex-ante uncertainty, path dependency and protracted adjustment processes (*Nelson,* 1998). As a consequence, growth theory has to take due account of the institutional framework which presumably contributes strongly to cross-country differences in economic growth. Since the evolutionary agenda is in many respects not sufficiently developed to offer a coherent set of consistent and well established theoretical models, we do not attempt to survey them here. Rather, to address the role of institutions and policy in the growth process, we complement our outline of growth theories with some related considerations for Austria (Section 2.5). Section 2.6 draws some policy conclusions.

2.2 Neoclassical growth models

Neoclassical growth models emphasise the accumulation of capital. In more recent models a broad concept of capital includes not only physical but also human capital and sometimes other intangible assets. Whatever the number of inputs taken into account, it is characteristic to the neoclassical world that capital accumulation is assumed to drive productivity growth in the short run. Eventually, however, capital runs into diminishing returns. Long-term (steady-state) growth is therefore exclusively due to exogenous technical change. Without that "manna from heaven", growth grinds to a halt. Thus, neoclassical growth models emphasise the role of technology in a rather peculiar way. Despite its vital importance to the growth process, technological progress just as the differences in technology across countries is left unexplained. For a justification of that approach see *Solow* (2000).

The Solow – Swan model

The standard model of neoclassical growth theory is the Solow – Swan model developed by *Solow* (1956) and *Swan* (1956) (for an exposition see, e.g., *Barro – Sala-i-Martin,* 1995, *Valdes,* 1999). In this model, inputs (capital services K and labour L subject to

"labour-augmenting" technical progress captured by the index of technology T) are linked to output Y by the aggregate production function

$$Y_t = f(K_t, T_t * L_t) \quad .$$

The model dynamics is driven by a capital accumulation equation which specifies the relationship between investment in tangible assets and the capital stock. In the simplest case, investment is a fixed proportion of output.

Technical progress is completely exogenous to the Solow – Swan model. This does not mean that the technology plays no role in that framework. Rather the opposite holds true: In its steady state, output per capita and (since labour is fully utilised) labour productivity grows at the exogenously given rate of technical progress and this is the only reason why there is growth. This fact is a major weakness of the Solow – Swan model because it "means that the rate of growth is determined outside the model and is independent of the preferences, most aspects of the production function, and policy behaviour" (*McCallum,* 1996, p. 50). For example, it is well-known that if the savings/investment rate increases, the long-run *level* of productivity increases but the long-run growth rate remains unaffected. As *Mankiw* (1995, p. 280) remarks: "It might seem that the model unravels the mystery of economic growth by assuming that there is economic growth."

If the economy is outside its balanced-growth equilibrium, output per worker converges to the steady-state growth path. During transition, output per worker is not exclusively determined by technical progress but by a combination of the latter and physical capital accumulation. If the economy is sufficiently out of equilibrium then capital accumulation explains most of the transitional dynamics of labour productivity (see *Keely – Quah,* 1998).

Extended models – The broad concept of capital

The Solow – Swan model appeared to be inconsistent with newly available international evidence. In particular, the model's predictions were inconsistent with observed differences in income, capital shares and rate of returns as well as with convergence properties. In the 1990s, empirical studies in the neoclassical spirit attempted to reconcile the Solow – Swan model with the new evidence. In a well-known empirical study, *Mankiw – Romer – Weil*

(1992) augmented the aggregate production function with human capital. In particular, they included the stock of human capital H (proxied by educational attainment) in a Cobb-Douglas production function

$$Y = K^{\alpha} H^{\beta} (AL)^{1-\alpha-\beta} \quad .$$

Mankiw, Romer and Weil found that the Solow model performs rather well in explaining cross-country differences in income levels and is even more successful when human capital is taken into account. However, their study was criticised on various grounds. *McCallum* (1996, p. 63) rejects the view that Mankiw, Romer and Weil rescued the Solow model. As *Durlauf – Kourtellos – Minkin* (2001, p. 929) observe that the current neoclassical literature "imposes very strong homogeneity assumptions on the cross-country growth process". Since Mankiw, Romer and Weil assume that the level of productivity is the same in all countries so that differences in income levels are mainly due to differences in levels of physical and human capital the actual dispersion in productivity across countries is a focus of the debate (see, e.g., *Klenow – Rodriguez-Clare,* 1997B). Refering to the fact that Mankiw, Romer and Weil assume that the rate of technical progress is the same in all countries, *Grossman – Helpman* (1994) pointed out that the estimates of the coefficient of the investment variable will be biased, if technical progress actually varies by countries.

An application of the Mankiw – Romer – Weil model in the context of Austria and Germany is *Koman – Marin* (1997). They start with a basic growth accounting exercise for both countries, attributing contributions to output growth to labour, physical capital and to "technical progress" (the Solow residual). They then proceed by augmenting the aggregate production function by human capital. The results of the simple growth accounting exercise reflect the slowdown of total factor productivity (TFP) growth affecting both countries in the 1970s, reaching its low in the first half of the eighties and recovering somewhat afterwards without coming near the TFP growth rates realised in the 1960s. In the long run, both TFP growth and the contribution of TFP to output growth is significantly higher in Austria (average annual growth of 2.53% and a contribution of 75.3% over the period 1960-1992) than in Germany (average annual growth of 1.73% and a contribution of 54.9% over the same period).

The interesting part of the Koman – Marin study is that they construct an aggregate measure of the human capital stocks of the two countries (based on a perpetual inventory

procedure for five categories of educational attainment) and use it in a human-capital augmented Solow model. Interestingly, in the case of Austria the inclusion of human capital does not affect the growth accounting results very much: Over the whole period of observation, the contribution of TFP to output growth just declines to 66.4% (as compared to 75.3% in the case reported above) while the contribution of human capital is estimated to be 8.9%. The results for Germany are quite different: Here, the inclusion of human capital reduces the contribution of TFP to output growth from 54.9% to 37.4%, with a contribution of human capital of 17.5%. Thus, human capital appears to have played a much more important role in the growth process in Germany than in Austria. In addition, the gap between the Solow residuals in the two countries increases once human capital is introduced. *Koman – Marin* (1997, p. 19) conclude that "factor accumulation appears less (and not more) able to account for the cross-country growth performance of Austria and Germany when human capital is included in the analysis".

Whether the extended neoclassical models have succeeded to rescue the Solow - Swan model remains hotly debated. This proposition is strongly denied by endogenous growth theorists.

2.3 Endogenous growth models

New opportunities were opened by the so-called "new" or "endogenous growth" models (see the survey by *Aghion – Howitt,* 1998). The basic difference to models belonging to the neoclassical tradition is that endogenous growth models generate long-term growth without relying on exogenous technical progress. This model feature can be achieved in two ways. First, by removing the diminishing-returns-to-capital property which is key to neoclassical models, second by rendering technological progress endogenous to the model in question (*Stiroh,* 2001).

The first of these avenues is directly taken by the so-called "AK" models (for an exposition see *Barro – Sala-i-Martin,* 1995) which suppose that output is a linear function of capital:

$$y_t = A * k_t$$

where the lower case variables represent output per worker and capital per worker, respectively, and capital is broadly defined. In this setting, productivity growth can continue without relying on exogenous technical progress.

The second and more demanding route is taken by R&D-based endogenous growth or "idea" models. This can be illustrated by taking a broad view based on the pioneering work of *Romer* (1986) which triggered off the wave of subsequent endogenous growth models. Romer asserts that there are externalities associated with R&D activities which affect the stock of knowledge available to all firms (although, one might add, the assimilation of this knowledge may not be costless). The production function of the representative firm may thus take the form

$$Y_i = A(R) f(K_i, L_i, R_i).$$

Here, the subscript i indicates firm-specific variables, i.e. capital, labour and R&D inputs (while time subscripts are dropped for convenience). Again "A" represents the level of technology which is now defined as a function of R, the stock of knowledge available to all firms. This formulation reflects the public-goods characteristics of knowledge generated by R&D.

In practice, $A(.)$ can be given quite different interpretations depending on the exact nature of the spillovers to be modelled. As noted, *Romer* (1986) had the stock of knowledge in mind. In contrast, *Arrow* (1962A) was concerned with "learning by doing" which means that investment in physical capital is a source of spillovers as aggregate capital increases. $A(.)$ is then determined by past gross investment. *Lucas* (1998) focused on human capital so that $A(.)$ is a function of the stock of human capital. Thus, endogenous growth theory has the potential to take into account various factors enabling innovation. In the terminology of the "AK" model sketched above, the difference between the spirit of neoclassical and new growth models can be seen as concerning the relative importance of "A" or "K", i.e. technology or capital.

As *Klenow – Rodriguez-Clare* (1997A, p. 611) emphasise, the "A" and the "K" views have different positive and normative implications: "Unlike the neoclassical growth model, technology-based models generically have scale effects because of the nonrival nature of innovation, imitation, adoption and adaptation. Technology-based models also suggest a

prominent role for openness (access to higher quality or more specialised goods through imports or access to better technology through joint ventures or technology licensing). And whereas the normative implications of the neoclassical model centre on tax rates, those of technology-based models extend to trade policy, foreign investment policy, and intellectual property protection." Of course, one has to add subsidies and other incentives to R&D.

"R&D-based" or "idea" models of endogenous growth (the terms are used interchangeably here) inspired by Schumpeter explicitly model innovation (in particular, the generation and diffusion of technological knowledge) as the driving force of long-term economic growth. In these models, ideas (in the form of blueprints for new products or new processes) are generated by investment in R&D. These models treat R&D as an intentional entrepreneurial activity performed by profit-maximising firms. Ideas generated by R&D lead to new processes and products which are used as inputs in the production of final goods. As input goods of superior quality or as more specialised intermediate or capital goods these products raise productivity. Idea models of that kind include *Romer* (1990), *Grossman – Helpman* (1991) and *Aghion – Howitt* (1992). In all these models two interrelated aspects deserve special attention: (i) the nonrival nature of ideas; and (ii) increasing returns leading to imperfect competition.

The first thing to note is that *ideas are non-rivalrous*: An organisational method used by one firm can be simultaneously used by many firms, for example. The same applies to a computer program. In contrast, the CD Rom on which the software is stored is rivalrous, and the skills to use the computer program or other "ideas" may be rivalrous, too.

Just as other economic goods, ideas are at least partially excludable. However, they vary with respect to the degree of excludability. The latter is sometimes defined as the ability to charge a fee for its use. Nonrivalrous goods which are unexcludable are called public goods. Producers of economic goods which are excludable are able to fully capture the benefits of their product. Economic goods which are unexcludable give rise to externalities, i.e. not all of their benefit is captured by their producer. Although innovation – which today is largely based on organised R&D efforts – is widely seen as a major determinant of the competitiveness of firms, it is at the same time well-understood that R&D does not exclusively affect the economic performance of those agents actually performing these activities. Rather, R&D gives rise to (mostly positive) externalities ("R&D spillovers").

Griliches (1979, 1992) distinguishes two major sources of R&D spillovers: First, innovative input goods are often traded at a price which does not fully reflect their marginal benefit. This gives rise to "rent spillovers". Griliches makes the point that the estimation of rent spillovers is entangled with problems of measurement of real output, which in turn affect the measurement of productivity. In recent years, e.g., the rapid quality change in the computer industry poses a considerable problem. This type of spillovers does not concern us here. What is of concern here is the second type of externalities which Griliches has termed "knowledge spillovers": New knowledge generated by the R&D activities of one agent can stimulate the development of new knowledge by others or may enhance their technological capabilities. This distinction between "rent" and "knowledge" spillovers will be of importance in the econometric analysis of Chapter 5.

The acknowledgement of externalities in the production of knowledge can be traced back to the contributions by *Arrow* (1962B) and *Nelson* (1959). In his seminal paper, Arrow argued that the production of knowledge is afflicted by all three basic causes for imperfections of competitive markets – indivisibilities, uncertainty and externalities. "Markets for technology" are inherently imperfect (*Geroski,* 1995, *Metcalfe,* 1995). This is the basis of the neoclassical market-failure[1] approach to the economic analysis of technology policy (see, e.g., the survey by *Stoneman,* 1987).

It is theoretically conceivable that R&D has negative externalities. This would imply that market economies tend to over-invest in R&D. A tendency to over-investment can be inferred from patent-race models of the "winner-takes-all" variety or in the case where innovative products cannibalise others (*Stiglitz,* 1994). The empirical evidence, however, supports the opposite hypothesis (mostly positive externalities of R&D). There is a huge empirical literature attempting to quantify R&D spillovers using a variety of approaches. Numerous surveys cover the results of empirical studies using the whole spectre of approaches available[2]. Econometric studies of the relationship between innovation and productivity growth are conducted both at the firm and the industry level (intersectoral R&D

[1] Probably the most fundamental form of "market failure" is the absence of a complete set of markets. *Stiglitz* (1994, p. 148) notes: "There cannot exist a complete set of markets, and in particular there cannot exist competitive markets for commodities that have not yet been conceived, let alone invented."

[2] See, e.g., *Griliches* (1992, 1998), *Mohnen* (1996), *Klette – Moen – Griliches* (2000).

spillovers). More recently, there has been a surge in the literature dealing with international R&D spillovers. They conclude that cross-border knowledge or technology flows have a significant positive impact on productivity growth[3]. These studies typically point at social returns to R&D which exceed the corresponding private returns. Using a different approach, *Jones – Williams* (1998) estimate that for the United States the optimal R&D investment is at least two to four times actual investment.

While rivalrous goods are produced each time they are sold, non-rivalrous goods such as ideas are produced only once. Therefore they are characterised by the presence of sometimes very large fixed cost and zero marginal cost. It can be very costly to produce the first copy of a computer program, whereas copying it to get additional units takes place at virtually zero cost. This implies that the economics of ideas is associated by *increasing returns* and *imperfect competition*. Since with increasing returns to scale average cost is always greater than marginal cost, producing new ideas at a profit requires "a move away from perfect competition" (*Jones,* 1998, p. 79).

For illustrative purposes we briefly sketch the structure of a representative "idea" model, the basic endogenous growth model with horizontal product differentiation due to *Grossman – Helpman* (1991). This model contains a constant-elasticity-of-substitution production function for the homogenous final output good due to *Dixit – Stiglitz* (1977), which is assembled from the set of intermediate goods existing at that time. This specification implies that TFP is a strictly increasing function of the number of intermediate goods used in the process. This property reflects gains from increasing specialisation in production. As the number of intermediate goods increases, manufacturing involves an ever larger number of finer production processes. Each intermediate good is produced by a monopolist by means of a constant-returns-to-scale technology.

An essential element of the model is an "ideas" production function borrowed from *Romer* (1990). The number of intermediate goods is increasing over time, where the increase per unit of time is proportional to the resources (R&D labour) used in R&D multiplied by the

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[3] See, e.g., *Coe – Helpman* (1995), *Coe – Helpman – Hoffmaister* (1997), *Bernstein – Mohnen* (1998), *Lichtenberg – van Pottelsberghe* (1998), *Keller* (1997), *Eaton – Kortum* (1996), *Eaton – Gutierrez – Kortum* (1998), *Eaton – Kortum* (1999).

stock of knowledge accumulated in the country. In the simple case where the accumulated stock of knowledge is set equal to the number of intermediate goods developed so far, the rate of innovation (the growth rate of the number of intermediate goods) is increasing proportionally with the R&D resources employed. The value of a representative firm manufacturing intermediate goods equals the costs incurred in product development. In addition, the model contains equilibrium conditions for the capital market (no arbitrage) and for the labour market (full employment).

The (steady-state) solution of the model has the following properties: Along an equilibrium growth path a country's rate of innovation is, ceteris paribus, the higher the larger the resource base of the country and the productivity of its R&D sector and the lower the elasticity of substitution and the subjective discount rate (the more patient are the inhabitants of the country). The growth rates of final output and TFP turn out to be a strictly increasing function of the rate of innovation.

2.4 International knowledge diffusion and economic growth[4]

Modern economies are linked through international trade, foreign direct investment, migration and knowledge flows. It is obvious that diffusion plays a potentially very important role for small countries and, as emphasised by the literature on catching-up and convergence, by countries lagging behind the technological frontier (*Gerschenkron,* 1962, *Abramovitz,* 1986; survey by *Fagerberg,* 1994). However, even for large, technologically advanced countries/areas such as the US or the European Union as an entity, diffusion of knowledge is crucial for their growth performance. Calibrating a model of international technology diffusion, *Eaton – Kortum* (1996) found that the productivity growth in each of the 19 OECD countries included in their sample can be attributed to more than 50% to innovations from just three countries (the US, Germany and Japan). Only these three countries, together with France and the United Kingdom, get more than 10% of their growth from domestic research. See also *Eaton – Kortum* (1999).

[4] This section partly draws on *Hutschenreiter* (1998) and *Hutschenreiter – Kaniovski* (1999).

Since the 1980s economic theory has shown renewed interest in examining the role of knowledge dissemination in the long-term growth of nations. So far, however, growth models have rather little to say about international knowledge diffusion. This is obvious for the Solow – Swan model. In the absence of barriers or costs of information it appears natural to assert that neoclassical growth models "postulate one world-wide rate of technical progress" (*Streissler,* 1979, p. 254). Similarly, *McCallum* (1996, p. 50) points out that the Solow "model itself suggests either the same growth rate for all economies or, depending on one's interpretation, different values about which it has nothing to say". In fact, this very assumption underlies important recent work in the neoclassical tradition.

More promising are those R&D-based endogenous growth models which are derived from a marriage of the theories of growth and international trade. Such models have been applied to examine the factors of long-term growth in the context of open economies (e.g., *Rivera-Batiz – Romer,* 1991, *Grossman – Helpman,* 1991).

Traditional international trade theory had been concerned with "gains from trade" due to specialisation. The latter is based on comparative advantages, which, in turn, arise from differences in factor endowments and technology across nations. More recently, economies of scale were recognised as an additional source of welfare gains (*Helpman – Krugman,* 1985). Finally, endogenous growth theory also deals with dynamic increasing returns and learning mechanisms (survey by *Grossman – Helpman,* 1995). This led to new insights regarding the role of international linkages (including knowledge flows) as additional "productivity transmission channels" (*Helpman,* 1997).

Technological knowledge broadly defined ranges from basic knowledge (which may serve as an input to further applications) to applied knowledge (such as "blueprints" for new products) and "know-how". Some forms of knowledge – termed "tacit knowledge" by *Polanyi* (1967) – are not codifyable and thus do not render themselves to "impersonal" modes of transfer. Knowledge may be embodied in artefacts, too. Just as there are different forms of technological knowledge there is a variety of channels for the diffusion of technology:

- First, technology is traded on markets. However, there is a rather broad consent among economists that markets for technology are inefficient.

- In addition, technological knowledge is diffused by accessing various sources of information (such as the scientific and technical literature, patent information, various databases etc.). Specifically, this applies to codifyable knowledge. The use of modern information and communication technologies and services such as the internet leads to rapid increases in such flows.

- Another important channel for the diffusion of knowledge (including tacit knowledge) is the mobility of personnel. People move across firms within a country and – through migration – across national borders taking along their knowledge and skills.

- Technological knowledge is diffused in embodied form through trade in goods and services. In particular, technology is diffused through trade in intermediate and investment goods.

- Foreign direct investment (FDI) projects are complex transactions involving a whole array of technology diffusion channels. They involve a variety of diffusion channels (such as the sharing of blueprints, organisational and managerial know-how, equipment, personnel, etc).

Endogenous growth theory provides a suitable analytical framework to assess the economic impact of international knowledge flows. In their seminal work, *Grossman – Helpman* (1991) analyse two borderline cases: The first case, which is used as a benchmark, may be termed "perfect informational autarky" since no international diffusion of knowledge takes place. The second case is characterised by perfect (complete and costless) international knowledge diffusion. This case is akin to the frictionless transferability of technology in the Solow – Swan model. In the first case, knowledge capital acts as a "national", in the second case as a "global" public good. The Grossman – Helpman model leads, among others, to the prediction that international diffusion of knowledge increases the growth rates of output and productivity. Introducing international trade in intermediate goods into the model with perfect international knowledge diffusion impacts on the attainable *levels* of output and productivity, without affecting their growth rates.

It appears more realistic to assume that while basic technological knowledge is diffused across national borders, the rate of diffusion depends on the height of the communication

barriers between the countries involved and on their "*absorptive capacities*". Here we touch upon an issue which is particularly important for understanding Austria's post-war growth performance. An endogenous growth model presented by *Hutschenreiter – Kaniovski – Kryazhimskii* (1995) examines the case where a relatively small technological follower possesses the "absorptive capacity" to adopt part of the knowledge stock of a larger technological leader, thereby raising the productivity of its own R&D activities. This model takes up an idea by *Cohen – Levinthal* (1989) that innovators must have certain capabilities – termed "learning" or "absorptive capacities" – in order to adopt and make efficient use of existing technological knowledge. In this sense, the appropriation of knowledge itself is a knowledge-intensive process. In the leader – follower model the absorptive capacity of the follower country is modelled as an increasing function of the knowledge accumulated in that country. It is shown that along an equilibrium growth path, the follower asymptotically approaches the rate of innovation (and of TFP growth) of the leader to which it is linked in terms of knowledge flows. At the same time this does not necessarily imply that the levels of TFP converge in the long-run.

A generalised model by *Borisov – Hutschenreiter – Kryazhimskii* (1999) – which contains, as special cases, both the technological leader – follower model outlined above and the extreme cases analysed by *Grossman – Helpman* (1991) – allows for mutual exchange of knowledge based on the absorptive capacities of both countries. One major implication of this model is that in the long run no country can gain by impeding the flow of basic knowledge to the partner country (rest of the world). The induced reduction of available knowledge in the rest of the world has repercussions on the country which restricts the flow of information. The long-run equilibrium growth rate of output and TFP common to both countries will fall.

Several hypotheses with respect to the impact of international technology diffusion on productivity growth can be derived from the R&D-based endogenous growth models referred to above:

- Access to a larger pool of knowledge increases the productivity of R&D activities in the countries involved[5] and thereby enhances future productivity growth. Thus, in addition to the traditionally recognised channels of technology diffusion (international trade, foreign direct investment, etc.), a country's productivity growth is positively correlated to the degree of its openness to flows of information and to its capability to absorb and utilise knowledge produced abroad. In this process, domestic R&D may be instrumental to build and maintain absorptive capacities.

- In an open economy, international trade provides opportunities to use input goods developed abroad that qualitatively differ from domestic input goods, and thus to increase productivity.

- Both international trade and foreign direct investment provide opportunities for cross-border learning about products, production processes, market conditions, etc. and may lead to a reduction of the costs of innovating and to future increases in TFP.

The models described above emphasise the role of international knowledge diffusion in the process of economic growth. Access to a larger pool of knowledge increases the productivity of R&D in the countries involved. These models lead to the prediction that the growth of TFP increases with the degree of informational openness and the absorptive capacities of the countries.

International openness is multifaceted. There are at least three aspects of "openness" which are also relevant to long-run economic performance of the Austrian economy: First, there is openness to international trade. Some recent work on economic growth has stressed the role of integration in economic growth processes. After World War II Austria had close economic ties to a rapidly growing area (the Federal Republic of Germany, in particular). A natural consequence of these circumstances was Austria's participation in the European integration process completed by Austria's accession to the European Union in 1995. To some degree, competition through imports served as a balance against the rather un-competitive environment in Austria. Secondly, there is openness with respect to FDI. Austria

[5] Closely related to the analysis of innovation is that of imitation (*Grossman – Helpman,* 1991, *Helpman,* 1993, *Barro – Sala-i-Martin,* 1997). In practice, the borderline between imitation and innovation is blurred.

has attracted a considerable amount of inward FDI. It does not only have a high share of foreign ownership in the economy, but subsidiaries of multinationals are the main performers of industrial R&D in Austria. Third, there is the issue of "informational" openness which, at a theoretical level, was referred to above but is not yet examined empirically.

One source of empirical evidence are econometric studies on the impact of foreign R&D on a country's productivity. Empirical evidence regarding international R&D spillovers is accumulating at a rapid pace but is still relatively scarce compared to the evidence on inter-firm or inter-industry spillovers. Empirical research on international R&D spillovers is comparatively young. In their well known study (which is based on panel data for 21 OECD countries plus Israel for the period 1970-90) *Coe – Helpman* (1995) regress TFP (in logs) on the domestic R&D capital stock and a spillover variable. The latter is constructed as the external (foreign) capital stock of the respective country (the sum of the import-share weighted domestic R&D capital stock of partner countries) multiplied by the import share of the country (as a measure of "openness")[6]. With respect to Austria, Coe and Helpman find evidence for an extraordinarily high elasticity of TFP with respect to the German R&D capital stock. The authors estimate a higher elasticity of TFP just for a few other countries (Canada, Israel, Ireland, Belgium, the Netherlands, Norway with respect to the US R&D capital stock and Belgium with respect to the German R&D capital stock). In contrast, the impact of changes in the US R&D capital stock on productivity in Austria appears relatively small.

2.5 The role of institutions and industrial policy

The distinction between an economy's growth potential and its realisation was emphasised by *Abramovitz* (1986, 1991). A country's potential for catching up with more advanced countries is given by its initial relative "backwardness". In order to realise these potentials, however, an initially lagging country requires a sufficient degree of what Abramovitz termed "social capabilities". As regards this latter part of Abramovitz's distinction, i.e. the realisation of the growth potential deriving from a relatively backward position, Austria

[6] For a criticism of the particular specification employed by Coe and Helpman see *Lichtenberg – van Pottelsberghe* (1998), *Keller* (1998).

evidently mobilised a sufficiently high degree of "social capabilities" to grasp the "advantages of backwardness". But what exactly were those capabilities? In the case of Austria, these capabilities seem to have included, among others, the relatively favourable levels of education and training of the labour force as well as institutional factors such as the evolution of a genuinely Austrian form of corporatism ("social partnership"), which gave rise to a distinct framework for macroeconomic and industrial policy.

Social capabilities and the potential for catching-up

Immediately after World War II, Austria had a vast potential for catching up in the sense of Abramovitz. At that time, the relative position of Austria's economy was characterised by a large productivity and income gap vis-à-vis the technological frontier (the US) and thus by large opportunities ("potential") for catching up by adopting advanced production processes and methods of organisation. The comparatively low level of productivity of Austria's industry were due to the dismal economic performance between the two wars, in particular, the low rates of capital accumulation resulting in an unfavourable age-composition of the inherited capital stock[7].

At the macroeconomic level, Austria's post-war development was marked by rapid productivity increases and positive growth differentials in per-capita income levels vis-à-vis initially more advanced countries (see *Seidel,* 1995). This rapid development was realised with a comparatively low level of domestic R&D activities. As *Josef Steindl* (1977, p. 211) who pioneered as a thinker about the role of innovation in Austria's development observed, Austria has ". . . absorbed technology faster than it can be currently produced, drawing it, as it were, from a stock of accumulated knowledge". More specifically, Steindl argued that the favourable path of economic development taken by Austria's industry after World War II was largely sustained by importing advanced capital goods (embodied technical change) from abroad. However, at the same time he insisted that the import of technology is not the complete story. He maintained that the "spurt of new technologies" built on available technological opportunities induced large-scale investments and thus

[7] However, the capital stock in place at the end of the war also included a new element. This were the industrial complexes, primarily in the domain of heavy industries, which were created during the war economy.

"contributed to the flow of effective demand". "The additional investments required locally were considerable, especially in construction. Moreover, the modern equipment in many cases was subsequently produced in, and later even exported from, Austria (paper machines)" (*Steindl,* 1977, p. 212).

It can be argued that the post-war growth experience has persistently shaped the attitude towards the role of domestic industry-related research and, more generally, the (view of the) innovation system in Austria. Once more, this was already noted by *Steindl* (1977, p. 211). Referring to the success in absorbing technology, he remarks: "This has created a certain mentality: Why should you fret and bother with the high risk and cost of R&D if the whole post-war experience shows that by drawing on a ready made stock of know-how from abroad you get much quicker results? This feeling has been in the bones of politicians and industrialists alike."

Even as late as in the eighties "progress without research" (*Marin,* 1986, 1988), based on a strategy of rapid adoption of imported equipment and production techniques without investing substantially in domestic R&D appeared, at least to some, to be a viable option for sustained economic growth. In recent years, this orientation has lost much of whatever appeal it may have had in the past. In fact, there are a number of factors necessitating a re-orientation. First of all, the process of catching-up of Austria with the advanced countries (in terms of productivity and per-capita income levels) has reached its limits. Evidently, convergence is self-defeating since it implies that the "advantages of backwardness" vanish as a source of positive growth differentials. Furthermore, in the wake of globalisation with increasing openness in the world economy and an increasing number of potential competitors, the opportunities for creating competitive advantages by adopting widely available equipment and technologies are reduced. This enhances the role of innovation (and the concomitant temporary monopoly profits accruing to innovators) as a source of economic growth in the advanced countries, as reflected in R&D-based endogenous growth models. Product differentiation based on the flexibilisation of production etc. tends to increase the importance of product innovations vis-à-vis mere process innovations.

Another factor conducive to growth is a well-trained and qualified labour force. This explanation for a favourable growth performance is plausible on theoretical grounds, in particular in the light of recent developments in the theory of economic growth. It is also

supported by the empirically observed speed of recovery of some nations which have suffered considerable damage in their physical capital stock during World War II. Empirically, however, this claim does not appear to be established well enough for the case of Austria. See, e.g., the results of is *Koman – Marin* (1997) referred to above addressing explicitly the role of human capital in Austria's economic growth.

Institutions

The work of Douglass North and others shed new light on the role of institutions and institutional change in long-run economic performance (*North,* 1994, *Eichengreen,* 1994; a recent empirical study performed in the framework of the OECD "Growth Project" is *Bassanini – Scarpetta – Hemmings*, 2001). In Austria, "social partnership", a complex set of institutions based on voluntary cooperation between the highly organised employers and employees and extending over all major fields of economic policy and beyond, is key to any institutional analysis of the post-war development (see *Butschek*, 1995). *Guger* (1992) provides a brief sketch as well as an assessment of the economic performance of the Austrian variety of "corporatism". In the area of macroeconomic policy, social partnership culminated in a set of policies which was posthumously termed "Austro-Keynesianism". Austro-Keynesianism was a combination of deficit spending, hard currency and income policies. However, in the present context it is worth recalling that *Tichy* (1984, p. 382) noted: "If Austro-Keynesianism should fail in the longer term, it will probably be because of the fact that industrial policy is definitely conserving old and outdated structures".

Certainly, social partnership (as may be said of other institutional set-ups) provided a "mixed bag" (*North,* 1994, p. 9) of incentives enhancing productivity and of incentives reducing productivity. On the one hand, *Aiginger* (1994, p. 5) stated: "The social partners helped to insert a longer time horizon into economic policy and implicitly reduced the time discount of policy makers. Making economic policy predictable and stabilising demand, prices and profit shares are important parts of a strategy to reduce future risks. Production is higher under reduced uncertainty". On the debit side of Austrian corporatism, various authors pointed, among others, at allocative inefficiencies and a slow pace of structural change (see *Guger,* 1992). These phenomena were associated with industrial policies designed to promote physical capital formation, but also with regulations and "distributional coalitions", e.g. in agriculture and the food-processing industries.

Furthermore, Guger argued that large and widening inter-industry wage differentials slowed down structural adjustment. Generally speaking, social partnership tended to favour incumbents to newcomers, producers to consumers.

Industrial policy

There is still some ambiguity in the assessment of the historical role of industrial policy in Austria. Thus, *Aiginger* (1994, p. 14) posed the seemingly paradoxical question: "Has there been an industrial policy in Austria?". In answering this question Aiginger states: "If one defines industrial policy a coherent attempt to influence the development of industry in a specific direction, into specific sectors etc., then there exists no industrial policy." A fundamentally dissenting view was put forward by *Marin* (1995). Marin argued that the above-mentioned industrial complexes created during World War II which resulted in a profound change of the structure of the Austrian economy and played a vital role in the period of re-construction were consciously targeted by industrial policy. It is controversial to which extent this view is valid. There is little dispute however that these (then) new industries – such as basic metals – emerged as an important source of industrial innovation in the post-war period. A well-known example is the basic oxygen process in steel making which Austria pioneered in the early 1950s (see *Ray,* 1984). At the same time, however, their existence induced a bias of the Austrian manufacturing sector towards the production of raw materials and semi-finished goods. Aiginger's assessment, however, neither denies that there has been a fair degree of industrial policy in Austria nor that this policy did in fact implicitly favour specific industrial sectors or activities.

Apart from providing a framework of economic activities and stabilising expectations capital formation was also targeted in an immediate fashion. Various direct and indirect (tax-based) schemes to support physical capital formation in industry have been for a long period of time a major supply-side ingredient of Austria's economic policy. Strong incentives to physical capital formation contributed to a comparatively high capital intensity of industry and a high share of capital-intensive industries. In the seventies and eighties this tendency was acerbated by state aid to the then ailing nationalised industries. Since then there has been a marked shift away from general investment subsidies.

The overall impact of social partnership and industrial policy formulated within that framework on industrial structure (*Landesmann,* 1992) remains an issue to be studied in

more detail by economic historians. On the one hand, the institutional framework prevailing in Austria was conducive to a high level of economic activity and economic policy has explicitly attempted to maintain a high rate of capital formation, in particular. On the other hand, the emphasis of the institutions of social partnership was on trust and predictability, favouring gradual change. This is in line with the observation that various measures of structural change indicate a rather slow, though sustained pace of change.

2.6 Policy conclusions

In modern growth theory attention has shifted away from the accumulation of conventional inputs such as physical capital as a primary factor of economic growth to the accumulation of human capital and knowledge. New models, in particular "R&D-based" endogenous growth models build on the economics of "ideas" thus capturing essential features of the knowledge-based economy. The new growth models presented in this section are much richer in their policy recommendations than traditional neoclassical models. In particular they suggest the use of incentives to R&D, such as subsidies and properly designed intellectual property rights, but also emphasize the openness of economies to international trade, foreign direct investment and knowledge-flows (in their various forms) as a condition for cross-boarder learning and as a factor of growth performance.

This shift in economic growth theory is congenial to the shift in the growth paradigm in the Austrian economy. In the past Austria had relied to a considerable extent on importing technology and achieved its growth by a comparatively low level of own investment in R&D. A high rate of physical capital formation was supported by extensive incentives through economic policy instruments. Stable framework conditions were conducive to a high level of economic activity; however, structural change was comparatively slow.

As one of the leading countries in terms of per-capita income, Austria is in need of a new growth paradigm beyond catching-up. This requires an improvement in Austria's innovative performance. The available evidence shows that the Austrian innovation system is not yet fully geared to the requirements of a knowledge-based economy. It was argued that the historical growth experience has shaped structures as well as attitudes of the actors involved. The paradigm embedded in the new growth theories with their emphasis on human capital and knowledge provide general guidance for such a new growth strategy.

3. THE LOSS OF THE POSITIVE GROWTH MARGIN

MACROECONOMIC PERFORMANCE OF AUSTRIA FROM 1970 TO 1999

MARKUS MARTERBAUER

3.1 Favourable macroeconomic data

The macroeconomic performance of the Austrian economy during the last decades has been generally favourable in relation to the developments in other OECD countries, in the European Union and in the economies of Austria's most important trading partners (Germany and Italy). In international comparisons, the variable cited most often in this context is Austria's favourable labour market performance. At a level amounting to 3.7 % of the total labour force, the unemployment rate in Austria is well below the European average of 8.3 percent. At nearly 70 %, the employment rate is surpassed only by Denmark, Sweden, the Netherlands and the UK (while the European average amounts to only 62 percent). The general standard of living is conceived as being relatively high: In 1999, Austria's GDP per capita in purchasing power parities amounted to $24,646. This figure is only marginally lower than those for Belgium and the Netherlands, which are ranked fourth and fifth within the European Union. Average GDP per capita in PPPs for the EU was $22,433 in 1999.

This chapter compares the macroeconomic performance of Austria to parallel developments in EU and OECD countries over the last three decades. Most of the important indicators suggest that Austria is in a good position: GDP and employment growth rates have been slightly above average, while the unemployment rate, inflation and budgetary deficits have been below average.

Despite the favourable levels of macroeconomic variables in Austria, analyses also reveal that over the decades, Austria lost its positive margin relative to other industrialised countries. From the beginning of the 1970s to the early 1980s, Austria's economic performance was superior. Since the early 1980s, performance has been near the European average, with the exception of a period during the early 1990s, when specific circumstances led to growth rates clearly above the average.

Table 3.1: Macroeconomic performance

Ø 1970/1999	GDP, volume	Consumer prices	Employment	Unemployment	Financial balance	Current balance
	Annual average percentage change			As a percentage of total labour force, p.a.	As a percentage of GDP, p.a.	
Austria	+ 2.7	+ 4.0	+ 0.5	3.3	– 2.4	– 1.1
Germany	+ 2.2	+ 3.4	+ 0.3	5.8	– 2.0	+ 0.9
EU 15	+ 2.4	+ 6.8	+ 0.4	7.5	– 3.0	+ 0.1

Source: OECD, European Commission.

Differentiated by decades, the average GDP growth rate amounted to 3.6 % p.a. in the 1970s, while the EU average was only 3.0 % (OECD 3.4 %, Germany 2.7 %). In a "growth ranking", Austrian growth rates placed 12th of 26 OECD countries, and 5th of 15 EU countries during the 1970s. Higher growth rates within the European economies were achieved only by Greece, Spain, Portugal and Ireland, where GDP levels were initially much lower than in Austria[8]. In the 1980s, GDP grew by 2.3 % p.a., in line with the EU average of 2.4 %, and was 0.8 percentage points below the OECD average. Average growth rates fell back to 16th place with respect to the 26 OECD countries, and 8th in the EU-15 category. In the 1990s, the Austrian economy grew annually by an average of 2.2 %, which again was 0.4 percentage points faster than the annual EU average. Austria's economic growth was especially more dynamic than that of Germany and Italy (+0.7 and +0.8 percentage points respectively). GDP growth rates rank only 16th among the OECD countries and 7th in the EU.

During the 1970s and 1980s, labour productivity (GDP per employment) in Austria expanded markedly faster than the EU average (3.0 % p.a. in Austria compared to 2.6 % for the EU during the 1970s, and 2.1 % compared to 1.8 % during the 1980s). Austria lost its positive margin in the 1990s (growth of 1.6 % in both Austria and the EU). The relatively high GDP growth in Austria during the early 1990s was accompanied by an enormous influx of foreign labour.

[8] Seidel (1995) discusses the importance of catching up and convergence processes to relative GDP growth.

Table 3.2: GDP growth rates in OECD countries

Price levels and PPPs of 1995 (average annual percentage change)								
		Ø 70/80			Ø 80/90			Ø 90/99
Korea	1	+7.4	Korea	1	+8.6	Ireland	1	+6.6
Mexico	2	+6.6	Turkey	2	+5.2	Korea	2	+5.8
Iceland	3	+6.2	Luxembourg	3	+4.4	Luxembourg	3	+5.6
Ireland	4	+4.7	Japan	4	+4.0	Australia	4	+3.8
Norway	5	+4.7	Ireland	5	+3.6	Norway	5	+3.4
Portugal	6	+4.7	Portugal	6	+3.2	Turkey	6	+3.1
Greece	7	+4.7	United States	7	+3.2	Mexico	7	+3.1
Japan	8	+4.4	Australia	8	+3.1	United States	8	+3.1
Canada	9	+4.3	Finland	9	+3.1	Netherlands	9	+2.7
Turkey	10	+4.1	Spain	10	+2.9	New Zealand	10	+2.7
Spain	11	+3.6	Canada	11	+2.8	Portugal	11	+2.5
Austria	**12**	**+3.6**	Iceland	12	+2.8	Canada	12	+2.5
Italy	13	+3.6	United Kingdom	13	+2.7	Spain	13	+2.4
Finland	14	+3.5	France	14	+2.5	Iceland	14	+2.3
Belgium	15	+3.4	Norway	15	+2.4	Denmark	15	+2.2
France	16	+3.3	**Austria**	**16**	**+2.3**	**Austria**	**16**	**+2.2**
United States	17	+3.2	Italy	17	+2.2	United Kingdom	17	+2.1
Australia	18	+3.2	Germany	18	+2.2	Greece	18	+2.1
Netherlands	19	+2.9	Netherlands	19	+2.2	Belgium	19	+1.9
Germany	20	+2.7	Switzerland	20	+2.1	Finland	20	+1.8
Luxembourg	21	+2.7	Belgium	21	+2.0	France	21	+1.6
Sweden	22	+2.0	Sweden	22	+2.0	Germany	22	+1.5
United Kingdom	23	+1.9	New Zealand	23	+1.8	Sweden	23	+1.5
Denmark	24	+1.9	Mexico	24	+1.8	Italy	24	+1.4
New Zealand	25	+1.8	Greece	25	+1.6	Japan	25	+1.3
Switzerland	26	+1.2	Denmark	26	+1.6	Switzerland	26	+0.6
EU 15		+3.0	EU 15		+2.4	EU 15		+1.8
OECD[1]		+3.5	OECD[1]		+3.0	OECD[1]		+2.4

Source: OECD.
[1] Total of countries mentioned above.

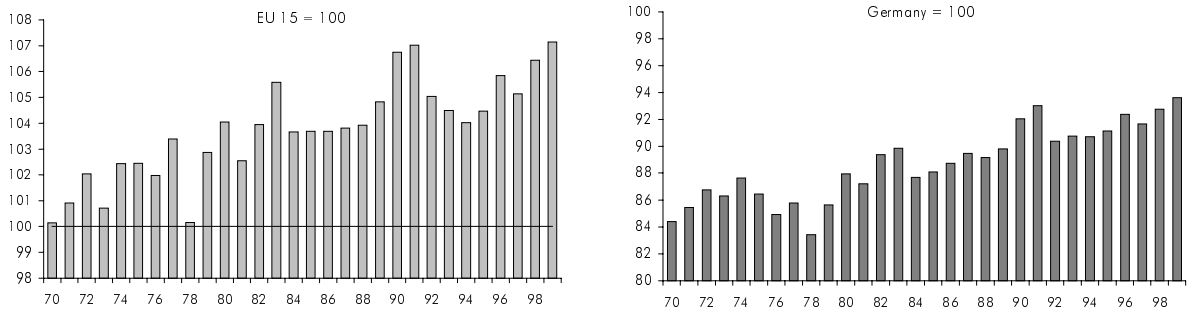
If output performance is measured by GDP per head at the prices and purchasing power parities of 1995, Austrian growth performance within the European Union again appears to have been remarkably successful during the 1970s (ranking 3rd of 15 EU member states). GDP per capita at PPP increased on average by 3.5 %p.a. during this decade, while the EU growth rate was only 2.6 % and the corresponding figure for the OECD was 2.4 %. "Welfare" per person during the 1970s increased by 10 percent in relation to the EU-average. In the 1980s and 1990s, Austrian GDP per capita at PPP grew along the lines of that in the EU and the OECD (on average, +2.1 % and +1.6 % p.a.).

Table 3.3: Labour productivity in EU countries

Average annual growth in percent, volume								
		Ø 70/80			Ø 80/90			Ø 90/99
Greece	1	+4.0	Luxembourg	1	+4.1	Luxembourg	1	+4.5
Spain	2	+3.9	Ireland	2	+3.6	Ireland	2	+2.8
Ireland	3	+3.8	Finland	3	+2.4	Finland	3	+2.8
Belgium	4	+3.2	Spain	4	+2.3	Sweden	4	+2.6
Portugal	5	+3.0	France	5	+2.2	Portugal	5	+2.2
Austria	**6**	**+3.0**	**Austria**	**6**	**+2.1**	Denmark	6	+2.0
Italy	7	+2.9	Italy	7	+2.1	United Kingdom	7	+1.9
France	8	+2.8	United Kingdom	8	+2.0	Italy	8	+1.6
Netherlands	9	+2.6	Belgium	9	+1.9	Belgium	9	+1.6
Germany	10	+2.6	Portugal	10	+1.8	**Austria**	**10**	**+1.6**
Finland	11	+2.5	Germany	11	+1.6	Spain	11	+1.6
United Kingdom	12	+1.7	Sweden	12	+1.4	Greece	12	+1.5
Denmark	13	+1.5	Netherlands	13	+1.3	Germany	13	+1.4
Luxembourg	14	+1.4	Denmark	14	+0.7	France	14	+1.3
Sweden	15	+1.0	Greece	15	+0.6	Netherlands	15	+0.6
EU 15		+2.6	EU 15		+1.8	EU 15		+1.6

Source: OECD.

Figure 3.1: Labour productivity in Austria in comparison to the EU and Germany



Source: OECD.

Figure 3.2 illustrates Austrian GDP per capita in relation to the EU 15 and to Germany from 1970 to 1999. This clearly shows that Austrian economic and social development was markedly above average during the 1970s, and since then exhibited no further improvement in relation to other European countries. With respect to Germany, Austria enjoyed a growth advantage not only during the 1970s, but also during the 1990s, when the German economy was dampened by the consequences of German unification. Since Germany has been Austria's most important trading partner as far as both imports and exports are concerned, the developments of the 1970s also point towards a catching up process.

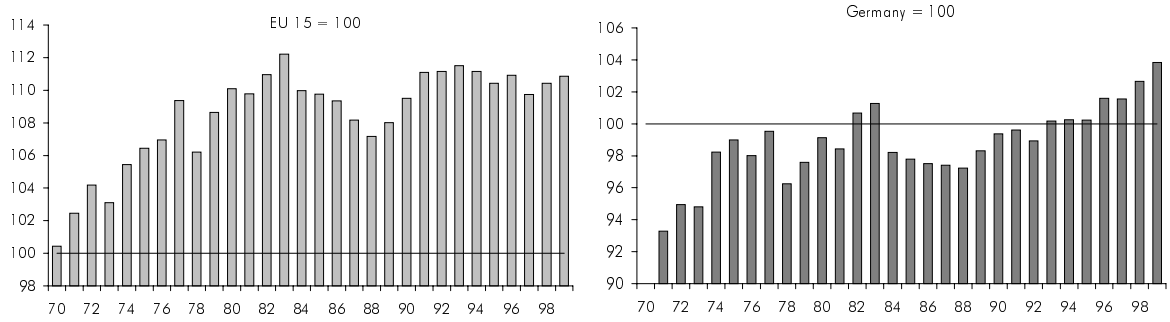
Table 3.4: GDP per capita in PPP in OECD countries

Price levels and PPPs of 1995 (average annual percentage change)

		Ø 70/80			Ø 80/90			Ø 90/99
Korea	1	+5.6	Korea	1	+7.4	Ireland	1	+5.9
Iceland	2	+5.2	Luxembourg	2	+4.0	Korea	2	+4.7
Norway	3	+4.2	Japan	3	+3.4	Luxembourg	3	+4.1
Greece	4	+3.7	Ireland	4	+3.3	Norway	4	+2.8
Portugal	5	+3.6	Portugal	5	+3.0	Australia	5	+2.6
Austria	**6**	**+3.5**	Turkey	6	+2.8	Portugal	6	+2.4
Mexico	7	+3.4	Finland	7	+2.7	Spain	7	+2.2
Ireland	8	+3.3	Spain	8	+2.5	United States	8	+2.1
Japan	9	+3.2	United Kingdom	9	+2.5	Netherlands	9	+2.1
Belgium	10	+3.1	United States	10	+2.2	Denmark	10	+1.8
Italy	11	+3.1	Italy	11	+2.2	United Kingdom	11	+1.7
Finland	12	+3.1	**Austria**	**12**	**+2.1**	**Austria**	**12**	**+1.6**
Canada	13	+2.8	Germany	13	+2.0	Greece	13	+1.6
France	14	+2.7	Norway	14	+2.0	Belgium	14	+1.6
Germany	15	+2.6	France	15	+1.9	Canada	15	+1.4
Spain	16	+2.6	Belgium	16	+1.9	Finland	16	+1.4
United States	17	+2.2	Sweden	17	+1.7	Iceland	17	+1.4
Netherlands	18	+2.1	Netherlands	18	+1.6	Turkey	18	+1.3
Luxembourg	19	+1.9	Iceland	19	+1.6	New Zealand	19	+1.3
United Kingdom	20	+1.8	Australia	20	+1.6	France	20	+1.2
Turkey	21	+1.8	Canada	21	+1.6	Italy	21	+1.2
Australia	22	+1.8	Switzerland	22	+1.5	Germany	22	+1.2
Sweden	23	+1.6	Denmark	23	+1.5	Sweden	23	+1.1
Denmark	24	+1.5	New Zealand	24	+1.1	Mexico	24	+1.1
Switzerland	25	+1.1	Greece	25	+1.1	Japan	25	+1.0
New Zealand	26	+0.7	Mexico	26	–0.3	Switzerland	26	–0.1
EU 15		+2.6	EU 15		+2.1	EU 15		+1.5
OECD[1]		+2.4	OECD[1]		+2.2	OECD[1]		+1.6

Source: OECD.
[1] Total of countries mentioned above.

Figure 3.2: Austrian GDP in PPP per capita in comparison to the EU and Germany



Source: OECD.

3.2 Successful growth orientation of economic policy, particularly in the 1970s

Each decade of economic development has its own specific characteristics. In the 1970s, Austrian economic policy employed a wide range of measures aimed at manoeuvring Austria through the world wide turbulences emanating from "stagflation" (Walterskirchen 1997, Guger 1998). Anti-cyclical fiscal policy, a stable exchange rate policy and a centralised income policy were the main instruments of "Austro-Keynesianism" (Seidel 1982), which was oriented towards stabilising the expectations of economic actors. The recession in 1975, which followed the "first oil price shock" was comparatively mild in Austria. The anti-cyclical macroeconomic policy stabilised expectations and seems to have been a distinct determinant of short and medium term economic development. Output and demand, as well as employment, were expanding markedly faster than the European average throughout the entire decade. The unemployment rate remained markedly below 3 percent until 1982. In spite of an active and expansionary fiscal policy, total net borrowing by the Austrian public sector was considerably lower than the EU average. In Austria, the general government deficit amounted on average to 0.7 % of GDP in the 1970s, compared to 2.0 % in the EU. Inflation was considerably lower than in the other industrialised countries. However, differences in the GDP growth rates relative to trading partners resulted in a large current account deficit during the second half of the 1970s.

The 1980s have been characterised as a period of heavy restructuring in the Austrian economy. This was primarily due to economic problems in the nationalised steel industry during the mid 1980s, which resulted in heavy losses in employment and output. Secondly, the need to consolidate public budgets (for instance by increasing indirect taxes in 1984), following the recession in the aftermath of the "second oil shock" dampened economic activity. Austrian GDP expanded less dynamically than average European output, especially during the period 1984 to 1987. Employment lost its positive growth margin in relation to the EU average, and unemployment began to rise, dampened somewhat only by attempts to reduce the labour supply through early retirement measures.

The 1990s were a decade of integration – characterised by the opening of Eastern European borders on the one hand, and Austria's subsequent membership in the European Economic Area, the European Union and the European Monetary Union, on the other hand. The expansion of GDP in Austria was remarkably above average during the

first half of the decade. It annually exceeded the EU average by 0.6 percentage points and the OECD average by 0.2 percentage points. This can be attributed to three facts: Firstly, the German reunification boom provided a substantial impulse to Austrian export and investment dynamics in 1990/91. Secondly, the influx of foreign labour in 1990/91 amounted to more than 4 % of the labour force; this helped to enable production expansion in times of booming foreign demand. Thirdly, the recession in 1992/93 was markedly less pronounced than in the EU as a whole or in Germany. Austria's GDP expanded by 0.4 % in 1993, while it declined by 1.1 % in Germany and by 0.5 % in the EU. Austria´s growth rates, however, were relatively low during the second half of the decade, annually lagging behind the European average by 0.1 percentage points and behind the OECD average by 0.4 percentage points.

In the 1990s, Austria's macroeconomic performance was still superior to the economic developments in Germany and Italy – Austria's two most important trading partners. In particular, differences were evident in the demand aggregates of public consumption, private consumption and construction investment. The reasons include the pronounced budgetary consolidation in Italy and the heavy burden of tax increases in Germany. However, the relative growth advantage of the Austrian economy, which continued on into the 1990s, is still surprising. One explanation could be that in general, Austria benefited from the trade creation effects attributable to the opening up of Eastern Europe, while Germany had to bear the severe financial costs of German reunification.

Nevertheless, within Austria, the labour market performance of the 1990s is viewed more critically than is often realised in international comparisons: Employment growth rates were below the European average, especially in the private sector. In contrast to other small, open economies (e.g. Denmark and the Netherlands), unemployment was on the rise between 1993 and 1998, although early retirement was implemented extensively as a policy measure. The labour force participation rate of people aged over 55 is one of the lowest among OECD countries and active labour market and training measures are still underdeveloped (Marterbauer, Walterskirchen 1999). In the second half of the 1990s, government financial deficits were, for the first time, higher than the European average and a current account deficit of around 2 % of GDP began to develop. Both factors can be partly attributed to Austria´s net payment position within the European Union, which is affecting the budgetary position by about 1 % and the current account by 0.5 % of GDP.

3.3 The contribution of demand aggregates to growth

Strong export growth – gaining market shares in Germany and benefiting from the opening up of Eastern Europe

Since exports of goods and services account for nearly half of Austria's GDP (49 % in the year 2000), export performance is of vital importance to macroeconomic development. Export growth clearly has been favoured by the gradual integration of the Austrian economy into the European Union, beginning in the early 1970s. Growth in the exports of goods and services was above the European average throughout all three decades. Between 1970 and 1999, exports grew on average by 5.8 % p.a. in Austria and by 5.0 % in the EU[9].

Internal demand in Germany is of vital interest to foreign trade in Austria, since Germany is the recipient of one third of total exports and is Austria's largest trading partner. Germany's share in Austrian exports grew during the 1970s and 1980s, but declined in the 1990s, due to the increasing volume of Eastern European trade. In the 1970s, Austrian exports benefited from the effects of the exchange rate devaluation of 10 % against the German mark in 1969. Over the long run, the stable exchange rate regime between the two countries, which prevailed since the mid 1970s, might have helped stabilise the expectations of exporters. The market shares of Austrian exports in Germany have been increasing over time. While German imports grew on average by 7.7 % p.a. between 1970 and 1999, Austrian exports to Germany increased by 10 %.

In the 1990s, the weak growth rates of exports to Germany and Italy were compensated by dynamic export growth to the transition countries. The trade creation effects attributable to the opening up of Eastern Europe were important to macroeconomic development in Austria. The share of exports to Eastern European countries (Hungary, the Czech Republic,

[9] The net export contribution to GDP-growth – measured along traditional lines in the form of the contribution to growth by the foreign balance – was, however, relatively small, as imports grew dynamically, as well. But, this "Lundberg"-method of measuring net export contribution was not adequate. If, however, import contents are directly related to exports on the one hand, and internal demand on the other hand, which both amount to about half each, the measured export contribution to economic growth is considerably higher.

Slovakia, and Poland) doubled from 5 % in 1990 to 10.5 % in 2000. Exports to these countries increased on average by 15.7 % p.a. in the 1990s, while exports in general grew by an average of 7.4 %. Austria's foreign trade account with the transition countries, which at the start of the decade was balanced, currently provides surpluses amounting to approximately 0.5 % of GDP.

High investment intensity, but low capital productivity

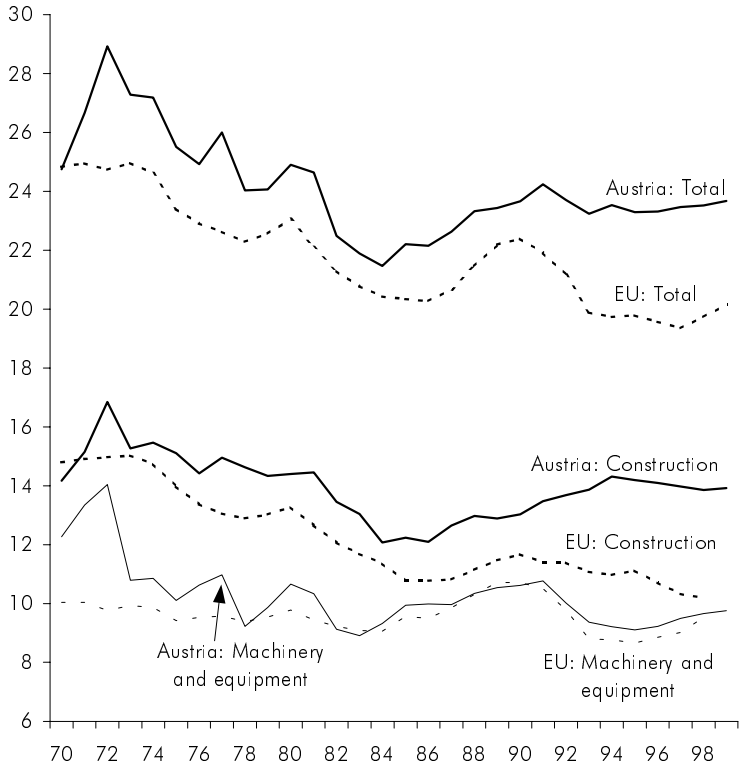
The developments which took place in investment were a primary cause of the differences between aggregate output growth in Austria and in the other European economies. Figure 3.3 shows that in Austria, investment activities with respect to GDP were continuously more dynamic than in the EU, with the greatest divergence occurring in the 1990s. During the period 1970 to 1999, aggregate investment grew on average by 2.8 % p.a. in Austria, while the growth rates in the EU amounted to only to 2.0 % and in Germany to 1.6 % p.a. At 24 % of GDP, Austria's investment ratio in real terms was remarkably higher than the European average (20 % of GDP).

Dynamic investment activities can enhance economic growth in two ways: Firstly, through income effects which help to smooth the business cycle during periods of recession and contribute to growth over the short term; and secondly, by means of capacity and restructuring effects, which support long term growth. A high level of investment implies that demand can be kept high by continuously increasing capital stock.

In the 1970s, investment expanded by 3.7 % p.a. in Austria, while investment activity in the EU and in Germany was weak (+1.6 % and +1.2 % respectively). The currency devaluation in the late 1960s provided a positive impulse, but with respect to the entire decade, this higher investment activity in Austria seems mainly attributable to the success of economic policy oriented towards the stabilisation of expectations. Investment in machinery and equipment as a percentage of GDP was clearly above the European average during the 1970s. Due to the close relationship between export activities and investments in machinery and equipment, investment dynamics also profited from intensive foreign trade. The process of catching up by importing technology from advanced industrialised economies has played a role in this context, particularly in the manufacturing industry (Seidel 1995). Austria reached the productivity level of the German manufacturing industry in the early 1990s. The process of catching up allows productivity increases to be

generated by imitation, as long as technological levels are below those of the partner economies. However, being at the forefront of productivity levels creates the necessity of an innovation strategy.

Figure 3.3: Gross fixed capital formation (as a percentage of GDP)



Source: OECD.

While in the 1980s, Austrian investment activities expanded in line with EU tendencies, major differences developed during the 1990s. In the first half of the decade, the deep recession in several EU countries was accompanied by a marked decline in investment activity. Between 1990 and 1993, gross fixed investment declined heavily in the UK (by -10 %), in Spain (-13 %) and in Scandinavia (Sweden –25 %, Finland –43 %), as well as in Germany (-4.5 %) and Italy (-11 %) during the recession year of 1993. In Austria, however, the decrease was small (-1 % in 1993).

In Austria, investment in machinery and equipment as a percentage of GDP declined during the first half of the 1990s, although less intensely than the EU-average. The orientation of macroeconomic policy towards the stabilisation of expectations, as well as

towards low volatility in aggregate demand, and in particular in private consumption, might – via capacity utilisation – have had stabilising effects on investments in machinery and equipment. In the second half of the 1990s, integration into the internal market intensified the pressure in favour of rationalisation, particularly in the sectors which previously had been sheltered. Intensified investment contributed to increased dynamics in productivity growth.

But the main difference between the development of investment in Austria and in the EU has to do with construction investment. In Austria, investment in construction as a share of GDP increased continuously during the first half of the 1990s, while in the EU as a whole, it declined. Construction is heavily influenced by the public sector. On the one hand, the public sector is itself an important investor in infrastructure, on the other hand, private investment – for instance in the construction of dwellings – is highly subsidised. The public sector was also able to influence stabilisation through the timing of infrastructure investment, which was extended during periods of recession and the years thereafter. The share of construction investment also contributed to high aggregate levels of investment. In Austria, construction investment accounts for approximately 56 % of total investment in real terms and around 14 % of GDP, while the corresponding figure is only 47 % and 10 % for the EU average (for Germany: 57 % and 13 %).

The increase in construction expenditures during the first half of the 1990s, can be primarily attributed to the migration which resulted from the opening up of Eastern Europe and to a hausse in housing prices, which led to increased public sector activity in housing programmes. This clearly had positive welfare effects and helped to counteract the recessionary tendencies of 1992/93. Investment in housing as a percentage of GDP has been increasing from 5 % in 1990 to 6 ½ % in 1999 in Austria. In the same period investment expenditures for housing stagnated as a percentage of GDP in Europe. So the marked increase in construction investment in Austria can mainly be attributed to lively investment activities in housing. In the 1990s construction expenditures have been shifted from civil engineering to structural engineering, especially concerning residential construction, where demand has been high and financing has not been restricted.

In comparison to the dynamic investment activities and high shares of investment in GDP, macroeconomic growth rates in Austria during the 1990s were quite disappointing, especially when considered relative to other industrialised economies. It could be expected

that dynamic investment expenditures initiate considerable multiplier effects and therefore lead to intensified growth in GDP. The expansion of aggregate demand and output, however, was not faster than the EU average, for which investment growth rates and investment ratios were much less intense. This points towards lower investment efficiency in a macroeconomic sense.

Table 3.5: Investment in relation to GDP

Gross fixed investment (as a percentage of GDP)

	1970	1975	1980	1985	1990	1995	1998
Austria							
Gross fixed capital formation	24.7	25.5	24.9	22.2	23.7	23.3	23.5
Machinery and equipment	12.3	10.1	10.7	9.9	10.6	9.1	9.7
Construction	14.2	15.1	14.4	12.2	13.0	14.2	13.9
Housing	5.5	6.1	5.9	5.2	4.7	6.8	6.5
EU							
Gross fixed capital formation	24.8	23.4	23.1	20.3	22.4	19.8	19.7
Machinery and equipment	10.0	9.4	9.8	9.6	10.7	8.7	9.5
Construction	14.8	14.0	13.3	10.8	11.7	11.1	10.2
Housing	6.7	6.5	6.4	5.2	5.2	5.4	5.0

Source: OECD.

An analysis provided by the OECD (Scarpetta et al., 2000) shows that business sector capital productivity in Austria went on a continuous decline since the 1970s. By the end of the 1990s, it had fallen to a level only half as high as that from which it started in the early 1970s. It is well known that massive theoretical and empirical problems (see for instance Harcourt, 1972) underlie the measurement of productivity of physical capital. Nevertheless, the OECD capital productivity data still support the presumption of grave problems in Austria's factor input structure and macroeconomic development.

Austria's capital stock as measured by the OECD increased annually by an average of 3.9 % in the 1980s and by 4.3 % from 1990 to 1998. Growth rates were among the highest of all OECD countries in the 1990s. The capital intensity of production increased enormously in comparison to other industrialised economies. On the other hand, technical progress, as measured by total factor productivity, increased very slowly in the Austrian economy. In the 1990s, only Greece, Iceland and Switzerland exhibited smaller TFP growth rates than Austria (Scarpetta et al, 2000, p.33).

Thus, while stable and high investment rates provided important impulses for economic growth in Austria over the short and medium terms, the structure of investment expenditures seems to imply considerable problems regarding investment efficiency and long term growth prospects. Investment in construction clearly leads to an increase in aggregate demand, but also pulls up imports. The current account effects are negative. Furthermore, long term growth effects might, especially in the area of residential construction, be rather low. On the other hand, investment in machinery and equipment, and particularly investment in innovation and information technologies increase demand, but also provide impulses for exports and tend to have balancing or even positive current account effects. Furthermore, structural change is enhanced, which leads to higher growth rates over the long run. Therefore a major macroeconomic problem in Austria is lying in the structure of investment, which is heavily biased towards investment in construction and especially in housing, while investment in innovation is relatively weak.

Private consumption – stabilising the economy

A relatively high rate of expansion in private consumption was a main driving force of Austrian economic growth throughout all three decades. Between 1970 and 1999, consumption expenditures grew on average by 3 % in Austria and 2.5 % in the EU. The relative growth advantage vis-à-vis the EU averaged +0.6 percentage points p.a. in the 1970s, +0.3 in the 1980s and +0.6 in the 1990s.

Growth in private consumption benefited from stable increases in disposable income, favoured by high export and investment demand. Real income growth for dependent employees in Austria was higher than the European average. Relatively low unemployment rates and the comprehensive welfare state contributed to the stabilisation of consumer expectations. An essential characteristic of the development of private consumption was the low volatility of growth rates (Hahn, Walterskirchen, 1992). Abstracting from the years 1978 and 1984 (when a discretionary and restrictive fiscal policy was implemented with the intention of dampening private consumption, in order to deal with high current account and budgetary deficits), the standard deviation for consumption growth was 1.5 percentage points p.a.

The relatively high growth rates in the expenditures of private households in Austria can be attributed to several determinants:

- Employment and unemployment are less volatile than in other countries (Marterbauer, Walterskirchen, 2001). Productivity and labour supply typically react directly and pro-cyclically towards economic growth. Therefore, mass income is less volatile in Austria than it is in the EU.

- Due to the general presence of the comprehensive welfare state, the share of transfer income in mass income is relatively high. This dampens the volatility of the purchasing power of private households.

- The savings of private households turn out to be more of a residual, rather than a planned decision. The savings ratio typically develops pro-cyclically, partly equalising the volatility of purchasing power during the business cycle. If disposable income decreases during recessions or due to restrictive fiscal policy, then the savings ratio typically declines markedly, while consumption expenditures – especially for non-durable goods and services - remain stable. In boom periods or during expansionary fiscal policy, the savings ratio increases and consumption develops less dynamically. This has important effects on the volatility of the business cycle and probably also on long term GDP growth rates.

- Expenditures on durable consumer goods, which tend to behave with greater volatility in the business cycle, play a less prominent role in Austria than in other countries.

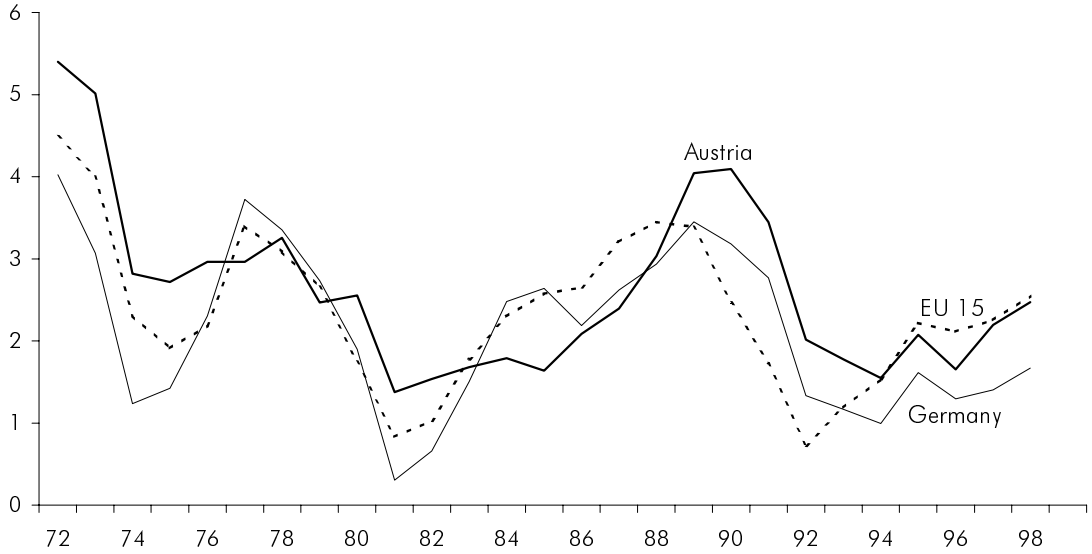
Public consumption

Public consumption grew by an average of 2.4 % p.a. in the period 1970 to 1999. This is only slightly above the European average (2.3 % p.a.), but markedly above the German rates (2 % p.a.). Public consumption was an important factor for aggregate demand in the first half of the 1990s, when it made considerable contributions to the above average growth rates of the Austrian economy. During this period, public employment rose markedly. During the period of budgetary consolidation from 1995 to 1997, public consumption stagnated, which was partly influenced by the outsourcing of activities.

3.4 Low output variability and economic policy

One important characteristic of economic development, which is specifically Austrian, is that recessions are less deep - for instance, in relation to Germany. In 1975, real GDP in Germany shrank by 1.3 %, while Austrian GDP fell by only 0.4 %; in 1981/82, GDP stagnated in Germany, while it increased by 1.8 % in Austria; in 1993, Germany faced the most severe post-war recession ever – output and demand declined by 1.1 %, while they increased by 0.4 % in Austria. During the years of general European recession, the Austrian economy gained a growth advantage which lasted for several years and had an especially positive effect on the performance of the long term labour market. Relatively mild recessions and less volatile cyclical developments seem to exert a positive influence on long term growth rates.

Figure 3.4: Gross Domestic Product (Percentage change over previous year)



Note: data refer to volumes, 3-year moving average.
Source: OECD.

Austria's relatively successful performance during recessions is the most striking characteristic of its macroeconomic development. Small decline in employment and only slight increase in unemployment during periods of low economic activity have been the

result. According to the "hysteresis hypothesis", this might contribute to low unemployment rates over the long term, as well. An important component of low unemployment rates in Austria can therefore simply be traced back to the successful prevention of unemployment hikes during periods of international economic turmoil, especially in the mid 1970s. However, during the decades that followed, the dynamics of unemployment developed, to a great extent, parallel to the EU average. In the 1980s and 1990s, early retirement schemes were important in preventing unemployment from rising.

Comparatively low output variability, especially during periods of recession, has been a distinctive outcome of Austria's economic policy orientation which (especially during the 1970s - the most successful era of "Austro-Keynesianism") has been explicitly dedicated to macroeconomic stabilisation. The principal elements of this policy were:

- Demand management through fiscal policy, which over the short term was used to mitigate cyclical fluctuations, and over the long term was an instrument of stabilising business expectations and fostering investment and growth. The most important factors of stabilisation stem from the built-in flexibility of the federal budget, the comprehensive welfare state, and an extensive system of tax incentives and subsidies, such as accelerated depreciation, tax credits, low interest loans and export guarantees. Fiscal policy lost its anti-cyclical bias in the second half of the 1990s and seems since then to have been characterised by a political business cycle.

- Pegging the Austrian schilling to the German mark was a tool for stabilising the expectations of exporters and investors. This technique therefore gave economic policy a long term perspective and helped to secure price stability.

- Wage policy within the system of economic and social partnership was macroeconomically oriented towards the long-term (Guger 1992, 1998). It recognised counter cyclical needs (in the sixties), current account developments (in the seventies), industrial restructuring processes (in the eighties), and exchange rate appreciation (in the nineties). It contributed in general to the stabilisation of expectations.

Demand oriented macroeconomic policy, implying fiscal, monetary and wage policies, focused on stabilising the expectations of relevant economic actors (Tichy 1986). The intention was to stabilise the business cycle, thereby leading to enhanced economic

growth. This policy was relatively successful in the 1970s, but lost much of its importance over the following decades. Macroeconomic policy had much less room to manoeuvre in the nation state, during the process of integration and liberalisation. During the process of European integration, Austrian macroeconomic policy gradually lost its (formal) responsibility in the areas of monetary and – in part - fiscal policy (due to the Pact for Stability and Growth and its aggravating restrictions). As the process of catching up (towards German levels of productivity) came to a close, growth rates were lower; the need for innovative strategies had increased, as distributional conflicts became more intense. Nevertheless, the fading away of an autonomous macroeconomic strategy certainly also results from the declining political will to develop and enact an economic policy which distinguishes itself from the European mainstream.

3.5 Macroeconomic policy and structural change

Macroeconomic policy has, in several ways, been either contributing to or hindering structural change.

- Stable currency policy: The effective exchange rate appreciation, which was an outcome of the link between the schilling and the German mark, led to losses in the competitiveness of Austria's export industry in the short run, especially during the European exchange rate crisis (for instance from 1992 to 1995), dampening GDP growth. However, this strategy might in the long run have promoted the process of economic restructuring. Consequently, the increases in labour productivity in the highly exposed manufacturing sector were exceptionally high, compared to those of Austria's main trading partners.

- Wage policy at the levels of branches and firms, which resulted in high inter-industrial wage differentials, might have hampered the process of structural adjustment by keeping labour and capital in marginal areas of production for too long and impeding the process of reallocation (Guger 1998).

- The promotion of investment activities through tax incentives might have increased the dynamics of restructuring, especially in the 1970s. Dynamic investment did play a role in this decade and in the second half of the 1990s, when the restructuring efforts in formerly sheltered sectors increased, due to Austria's accession to the European Union.

- Measures of capital productivity and total factor productivity provided by the OECD, however, point out massive problems in capital efficiency in the Austrian economy. Investment in construction is much more intensive than investment in innovation and human capital (Tichy, 2000A).

- Low capital efficiency also seems to be due to incentives given by fiscal policy. Tax incentives for investment in hardware have traditionally been very high, and capital taxation in general has been among the lowest in the European Union (European Commission, 2000). Furthermore, investment is – especially in the area of construction – heavily subsidised by the public sector. For a long time, incentives for increased investment in innovative areas were rather weak.

- The high share of construction investment, which amounts to 14 % of GDP in Austria (and 10 % in the EU) can be seen as one specific negative element in this context of high investment/low growth. An increasing share of investment in construction increases GDP growth over the short run, but dampens long run growth prospects.

3.6 Conclusions

Austrian macroeconomic performance distinguishes itself from developments in the EU and the OECD in two respects:

- Firstly, in the 1970s, economic and social performance was markedly more successful than in other industrialised economies. The positive growth margin can be traced back to a specific conception of macroeconomic policy. The 1970s were the most successful period of economic development.

- Secondly, Austrian macroeconomic performance is in general superior to the EU and OECD average during periods of recession. The orientation of policy towards anti-cyclical impacts and the stabilisation of expectations has led to a less volatile business cycle in comparison to other industrialised countries. A more stable macroeconomic development also had favourable implications for important variables over the long term, especially in the labour market.

However, Austria lost its long term growth advantage in the 1980s and 1990s. It was only during the early 1990s, that a combination of specific factors enabled a positive growth margin for a short period of time. GDP growth in the EU average contrasts with very high investment activities, which during the 1990s were clearly above the EU average. This points out inefficiencies in the structure of investment, which is heavily dominated by construction expenditures. The importance of investment in construction points to problems concerning the process of restructuring and innovation, which already seems to have had a macroeconomic impact.

4. SPEED OF CHANGE AND GROWTH OF MANUFACTURING

KARL AIGINGER

4.1 The topic and the project

This section investigates the interrelation between economic dynamics and the structural change of production. The importance of structural change, flexibility, and a quick reaction to new challenges facing growth, welfare and competitiveness seems to be a foregone conclusion explicitly or implicitly present in the statements of politicians, managers and experts and often, of such organisations as the OECD, the European Commission, the World Economic Forum, Lehman Brothers, etc. Economics presents several arguments explaining not only why growth will be easier to achieve if structures do change, but also why structures have to change if incomes change. This two-way causality prevents the falsification (and of course also the scientific support) of the hypothesis, since tests for significance become very difficult under these circumstances. The result is that the relation between structural change and growth seems to be under-researched relative to its alleged importance. One indication of this is, that from the large number of studies conducted for the OECD Growth Project, very few relate to structural changes and their impact on growth.

This chapter summarises theoretical hypotheses about the relation between structural dynamics and growth (Section 2), provides a very short overview about the empirical work in these fields (Section 3) and provides references to related fields, such as the dynamics of specialisation and regional concentration. We present the data, and choose indicators for growth and for structural change in Section 4. We investigate in the next section the closeness of the correlation between the speed of change of industry structure within manufacturing and the growth of manufacturing in 14 EU countries, in the USA and in Japan. We report which countries are the driving force in the existing positive relation and which countries do not follow the trend, how the speed of change evolved over time, and which differences between Europe, the USA and Japan are evident. In a specific section

(6), we focus on Austria's position, which combines high growth with a rather traditional structure. We then investigate in Section 7, whether the direction of change into high/low growing sectors, high/low productivity sectors is important. Next we try to find tentative evidence of which way the causality is stronger: from growth to change or from change to growth. Finally, we run a regression and a panel estimate to show at least partially how growth is related to change and to the specialisation of countries at the beginning of the observation period (1985). The ultimate objective of the chapter is not to prove or falsify a specific hypothesis, but to learn more about the speed and direction of change, about country differences and their relation to growth.

4.2 Theoretical considerations regarding structural change and growth

That there is a connection between structural change and growth has been common knowledge in economics for a very long time. The channels, which relate the two phenomena, are diverse, and the direction of causality (whether growth promotes change or whether change is necessary for growth) is an open question.

The three sector hypothesis

The empirical regularity according to which growth in per capita income fosters structural change is one of the messages of the Three-Sector Hypothesis (Fourastier, 1954, Clark 1957). It reads that the share of the primary sector decreases with rising income, that the secondary sector (manufacturing, construction and utilities in today's language) first wins, but then in later stages of development loses shares in total production and demand, and that the service sector continuously grows and finally takes the lion's share of production. The hypothesis was extended towards a fourth sector – which, as early as the seventies, was labelled the information sector (Bell, Schmoranz: empirical studies aggregated teachers, administrations, postal services etc.). Today, we would relate the information sector primarily to the use of computers, electronic devices and telecom and define an information and communication technology sector (ICT). A large and rising share of these sectors is said to increase productivity and growth, and is one of the constituent features of the "New Economy Paradigm".

Income elasticities change the shares of individual industries

The hypotheses that rising per capita income drives changes in production and demand was transferred to changes w i t h i n the manufacturing sector. The structural changes within manufacturing stem from differences in the income elasticities of product groups: it is widely accepted as an empirical fact that demand e.g. for food, lodging, and textiles increases under-proportionally relative to total income, while demand for durable consumer goods, electronic goods, and leisure related luxury goods increases faster than total income.

Capital deepening, product innovation and the ability to shift demand

Complementarily to demand induced change, supply forces may lead to systematic changes in production structures. The substitution of labour by capital in production (capital deepening) leads to increasing shares of capital goods. First the share of machinery increases, then that of electrical machinery and finally electronic equipment and computers (OECD, 2000). Furthermore, due to capital deepening and technical progress, material inputs and natural resources can be implemented with greater efficiency, thus leading to decreasing shares of basic and resource related goods, like ores and steel, non ferrous metals, basic chemicals etc. Capital intensive homogenous inputs therefore lose shares as incomes rise, while industries which constantly increase demand specificity, such as special purpose machinery, electronic equipment, or innovative consumer products, increase their shares.

Older theories would call this product innovation, modern industrial organisation stresses that there are industries in which market size is exogenously defined, while other industries can shift demand curves by means of product innovation, product differentiation and advertising. The latter industries are labelled endogenous sunk cost industries, since there is no technically fixed capital input defined by capacity needs, but rather, the amount of intangible investment is derived from optimisation. See Sutton (1991) for the main theoretical contribution, the European Commission (1998, 1999) and Peneder (2001) for the implementation of this idea into a taxonomy.

Summing up, this implies that technical progress and active strategies of firms can change structures even for a given income. The first channel was already stressed by Fourastier:

the higher potential for productivity growth in manufacturing decreased the share of manufacturing at the expense of the service sector at least when sector shares were measured in nominal terms: even if manufacturing goods and service goods were constant in real demand, the share of manufacturing would decline if prices decrease; the share of employment in manufacturing could decrease due to higher productivity growth. Higher productivity would however – via declining prices - boost demand for a given income, a feature intensively studied in computer technology. A constant race between lower prices and the addition of new features and characteristics makes it difficult to measure sector shares. The second channel means that there are some industries, which face a demand curve depending on income and endowments, while other industries can use innovation and marketing to shift the demand curve. It is likely that the second group will win shares over time, and this is consistent with empirical findings.

A positive theory of structure

A specific slant of the hypothesis that structure is influenced by rising income is given if we switch from the analytic level to the normative. If each income level implies a specific industry structure, we can calculate a hypothetical income dependent "norm structure" (Görgens, 1975). The expectation is that countries, which exhibit this norm structure, may grow faster, while countries whose structures deviate from the norm will grow more slowly. The policy implication is that impediments to structural change are detrimental to growth. This simple "single variable norm structure" hypotheses was then extended insofar as the norm was defined more elaborately: country specific material resources were allowed to be used as additional determinants of the "optimal" structure; skills and research potential were included.

Links to trade theories

An extended "norm theory" provides a bridge between the norm structure and an endowment based explanation of structure. If all endowments are taken into account, and if the technological position is considered, this becomes a dynamic corollary of trade theories. Of course, extended norm theories have a normative notion and relate to growth explanations, while Ricardo, Heckscher-Ohlin or technology oriented trade theory focus on trade patterns in a general equilibrium framework. However, there is some literature in

trade theory, which is less formal and assumes a link between certain types of specialisation and growth. Kaldor (1981), Thirwall (1979), Fagerberg (1988), and Amable (1993, 2000) argue that some patterns of international specialisation, associated with high income elasticities for exports, are more favourable for growth. Sometimes, a second stream of consequences is added, if higher demand then induces technological change and productivity improvements, which in turn foster growth through a mechanism of cumulative causation (Amable, 2000, p.413).

The upshot of this is that structures change and probably should change with rising income and changing endowments (analytical version); and that countries with optimal structures – defined by resources and income - may attain the "highest possible growth" (normative version). Countries lacking in adjustment would suffer a growth penalty, as would countries with too rapid change (premature change, senility effects).

The other direction: rigidities may impede growth

The three sector hypothesis and the norm structure hypothesis specifically, and in general all hypotheses which stress changes in demand and in endowments relative to income per capita, imply that the causality runs from growth to changing structures. During periods of slow growth, the idea emerges that structures changed too slowly. This was the case in Germany, as growth decelerated during the sixties, following the extraordinary post war growth; in the United Kingdom, as it deplored its industrial decline; and in the USA, as it complained that it was losing competitiveness with respect to the Japanese during the late eighties. This diagnosis returned in the nineties, as Europe also experienced a period of slow growth compared to its performance over the past decades, as well as compared to the USA. It was believed that political or institutional factors prevented adequate change; specifically, it was said that the labour market was not flexible enough; product market distortions were added (OECD Job Markets Study, OECD indicators on labour and product market regulation).

The diagnosis of inadequate speed of structural change leads to two different strands of policy conclusions. One strand has to do with increasing government interference, for example by defining the industrial sectors in which investment and research should be concentrated. Variants of this were the French sectoral planning system, the German "Strukturpolitik", the English "Industrial Policy", the Japanese "structural targeting" or other

systems of picking the winners. This strand dominated – with variations according to the country involved – in the late sixties and early seventies. The opposite strategy was followed during the eighties, namely one of eliminating rigidities and blockades to structural change, through liberalisation, privatisation and abandoning wage and job rigidities. Strategies designed to increase flexibility and liberalisation support structural change by decreasing government interference.

The burden of change

There is, however, also a strand of literature, which stresses that changes can be too fast. It stresses the burden of change on infrastructure, firms and people. On the one hand, it has to do with sociology or political science, which stress the social costs to specific groups. But it also is related to the integration literature and economic geography. It was expected that the Single Market would lead to fundamental changes in industry structure, which could imply drastic changes, combined with high costs of adjustment and the fear that regions on the periphery might de-industrialise. This gloomy forecast was extended to a globalising world, in which large differences in wages were thought to endanger many low cost industries in developed countries. This implies high costs of adjustment specifically to less qualified and less mobile workers in the developed countries and probably lower wages. Some studies stress that the necessity to change from one industry to another (inter industry change) infers larger adjustment costs, than intra industry change. The latter was intensively measured by indicators of intra industry trade. Structural and regional programs initiated by the EU were designed on the one hand to decrease the burden of sudden change on less developed regions; and secondly, to provide infrastructure and skills, enabling the necessary specialisation into products for which these regions had comparative advantages. But the upgrading of infrastructure and of skills takes time, so that the speed of change is sometimes too fast.

Restructuring and cycles

Schumpeter (1934, 1942) links the performance of countries to the degree that the industry structure uses scarce resources most effectively, opening the debate on how industrial economics defines the optimal structure. Part of the literature stresses optimal size structure, with the one extreme being that progressive industries are dominated by

economies of scale and that monopoly rents are necessary for stimulating research and innovation. The other extreme view is that any deviation from marginal cost pricing constitutes inefficiency and social loss. The literature on size and innovation represents one outcome, the discussion on the efficiency and profitability of mergers, on the emergence of multinationals and product differentiation is another.

An antithesis to the hypothesis that growth fosters change, is the hypothesis that crises are necessary for fundamental changes. This hypothesis was previously the general presumption of standard business cycle hypotheses (the virtue of crisis), but is also present in many case studies of the turnarounds of firms and technological breakthroughs. Examples of such economic policy are available for the Netherlands, which developed a consensual tri-party model for decision making (government, trade unions, and industrialists), favouring low costs and flexible labour, following a crisis in international competitiveness (Polder model); or Finland and Sweden, which managed the switch from resource based structures to telecom in the midst of a severe budget and currency crisis during the nineties.

Shift and share analysis

A pragmatic strand of literature relating structural change to growth is the exercise which decomposes growth into "shift and share" components. Constant Market Shares Analyses (CMA) decompose export growth into market growth, the impact of structure and of structural change, and increases in the market shares of a country or firm (within industry performance). Other studies decompose productivity increases into increases of the "within" and "between" types. One recent variant is to calculate the impact of the information and communication technologies on growth and productivity.

Higher specialisation and growth

Another question deals with the relation between specialisation and growth. Most economists will agree that specialisation is the basis for high income levels and productivity. And probably most will translate this idea in principle to the country level and to dynamics. This would imply that countries which are more specialised will grow faster. However, in general, there are advantages as well as disadvantages to specialisation. They can be grouped into an efficiency effect, a risk effect and a dynamic effect. At the firm

level, a specialised firm is supposed to be able to exploit economies of scale, to reap the effects of learning, and to use specialised inputs etc. (efficiency increases). On the other hand, risks increase for less diversified firms (risk effect) and thirdly, specialisation can be disadvantageous, if the firm is locked in a mature, declining industry. Both effects translate to the regional and national levels. Countries with more specialised industries can enjoy higher productivity if the specialisation occurs in dynamic markets; countries specialised in low wage industries, in mature industries or in industries with a low potential for product differentiation will not be able to grow fast (dynamic effect). Countries enjoy benefits from increasing specialisation, if they have specific endowments, which can be exploited, and if their primary industries produce under the condition of significant economies of scale. The geographic concentration of industries increases competitiveness if significant spillovers exist, or if there is cost savings through the supply of industry specific inputs or a complementary service sector.

The risk effect at the macro level has become a major policy issue as Europe is turning into a Monetary Union. This issue is discussed in the literature dealing with the optimal regional extension of areas with a common currency. If the member countries of a Monetary Union are too highly specialised in narrow product markets, then external shocks will lead to asymmetries in demand, which can no longer be dampened by changes in the external value of currencies. The flexibility of the labour market must be increased, in order to prevent persistent differences in demand. If countries are specialised in different industries, it is advantageous for the specialisation to be in unrelated industries (diversified production).

4.3 Empirical work so far

There is surprisingly little recent empirical work available on the relation between speed of change and the structure of manufacturing and growth. Most of the empirical studies date from the sixties. Recent studies related to the topic investigate the specialisation of countries and the regional concentration of industries. If these studies focus on the dynamics of specialisation, they implicitly analyse changes in the structure. Relating "changes in specialisation" to manufacturing growth then more closely approaches our question. Another related field has to do with studies of the entries and exits of firms,

labour churning, growth and mobility. These studies are usually performed at the firm level.

Structural change and growth

Dorner (1964) investigates the relation between structural change and growth for ten countries and nine industrial sectors and finds a weak statistical relation. Görgens (1985) uses more disaggregated data and reports a statistically significant influence of inter-industry change on manufacturing growth, as well as on the economy as a whole.

Bombach (1959) and Mertens (1964) investigate the influence of changes in industry structure on productivity. In these studies, the effect of shifts from agriculture to manufacturing and then from manufacturing to services is investigated. For a survey of other studies examining the sectoral composition of production and productivity see Görgens (1985). In trade analysis, "shift and share analyses" are applied to estimate the influence of structure on the dynamics of exports (CMS-analyses; for an overview see Breuss, 19.). Similarly, investigations are made in regional studies, explaining growth differences according to either structure, structural change or "within dynamics". Austria is revealed to be specialised in slow growing regional and product markets, and in industries for which prices define the competitive edge; however it is able to increase its overall market share by increasing market shares and upgrading quality within given industries (Aiginger, 1999, 2000).

The role of dynamics and specialisation

Another group of studies investigates specialisation in industries which are considered to be important for future growth, specifically in high tech industries (OECD, 2000), in technology and marketing driven industries (Peneder, 2000), or in information and communication technology (Amable, 2000). In general, the empirical studies prove that a high share of "promising industries" supports growth, but the contribution of structure to growth remains weak. Many intervening variables exist and the problem of two-way causality is also present in this relation. If we switch to the question whether growth is related to the degree of specialisation, the null hypothesis is that higher specialisation should imply higher productivity. Aiginger (1999, p. 119) finds no general support for the

growth of manufacturing, neither exports nor employment depend on the degrees of specialisation.

However, we do have the following stylised facts:

- At the industry level, growth in extra trade relates significantly positively to specialisation, a weak indication that a strong base is needed for global expansion, or that a minimum scale is necessary to defend export capacity in a toughening environment. The correlation is much weaker for intra trade and for total trade, and there is no relation between change in the degree of specialisation and export growth. The results are replicated weakly at the sectoral level.

- The second significant result is that more highly specialised countries have smaller productivity gaps compared to the USA. This result can be attributed to the high productivity and high specialisation in Ireland, and to the combination of low specialisation and large productivity gaps (relative to the USA) for Italy, Spain, Portugal and the United Kingdom. The results are significant at the sectoral and industrial levels.

- Thirdly, the increase in specialisation is negatively correlated with employment growth, implying that restructuring and repositioning decrease employment at least over the short run. This is well in line with evidence that firms which are merging and/or restructuring, streamline production and reduce employment first, thus becoming more competitive.

These results, and the many correlations which did not show any significant relations, indicate the importance, as well as the complexity, of the link between structural changes and competitiveness. The data underline the fact that adapting to new conditions and rapidly making use of new opportunities and challenges increase the growth potential. Exploiting new opportunities always requires changes, which sometimes lead in the direction of specialisation and concentration, and sometimes make use of a firm's own capabilities to extend operations into other countries. This is consistent with the stylised fact that growth and speed of structural change correlate more closely than growth and specialisation. The lower productivity gap of more specialised countries relative to the USA, and the correlation between extra-export growth and specialisation, are consistent with larger economies of scale for exports into distant countries and with the role of

multinational firms in technology transfers. Laursen (2000) emphasises that specialisation does indeed matter with respect to economic growth, showing that sectoral growth rates depend on intra sectoral specialisation patterns of international trade.

Reallocation, microevidence

Haltiwanger's (2000) summary of the recent empirical literature exploring micro datasets for a look at questions of aggregate growth, is "that reallocation does contribute significantly to aggregate productivity growth. For the US manufacturing sector, roughly half of total productivity growth can be accounted for by the reallocation of input and output away from less productive to more productive businesses". He warns, however, that it would also be wrong to always claim that a faster pace of reallocation has to be a signal of greater efficiency or that one would predict a monotonic relationship between the pace of reallocation and growth. Caballero and Hammour (2000) claim that the magnitude and timing of reallocation may be inefficient. Thus, while the evidence suggests that reallocation does contribute positively to growth, there can also be too many micro changes, and there can be inefficiencies in the pace and timing of reallocation.

4.4 The design of the empirical evidence

For the empirical implementation, we have to decide how we will measure growth and the speed of structural change, and whether we want to test a specific theory or primarily look for stylised facts.

Growth indicators

We focus on the growth of manufacturing, since the data permit us to disaggregate for 23 sectors (2-digit NACE) and 99 industries (3-digit NACE). We calculate growth for three variables: nominal and real value added, and employment. Of these variables, the growth of nominal value added is our favourite indicator, firstly since it includes quality changes, and secondly, because the calculation of nominal data is not flawed by differences in adjustment methods for inflation. In general, the measurement of inflation is different for a sector with continuously changing products, and this problem grows with the degree of disaggregation. Quality changes are treated differently in different countries and in

different industries. Thirdly, value added (as compared to employment) is preferred, since it is an output indicator reflecting demand and productivity. However, nominal growth has disadvantages too: growth may be high, if inflation is large; and nominal growth may be low, if a country experiences a devaluation. This disadvantage becomes smaller, the more highly disaggregated the data are, and a common trend of inflation is cancelling out in shares.

The robustness of the estimates calculated by using nominal value added is checked according to the other indicators. In one experiment, we construct a superindicator of growth, which combines information on nominal and real growth and the dynamics of employment.

Indicator of the speed of change

As an indicator of the speed of change, we choose the absolute sum of all changes in value added shares for a specific country. That means - since we have data from 1985 to 1998 - that the indicator of the speed of change is the sum of all available changes in industry shares between the first year (1985) and the last year (1998); each difference in shares is counted, whether or not it is positive or negative. The advantages and disadvantages of this indicator are summarised in Box 1. It is heavily used in the literature, and is sometimes called the Michaeli index. An intuitive reaction – although it is not done here – is to divide it into 2; in this case, it could be interpreted as an "average share of changes". In our case, the index lies between zero and 200.

Having chosen nominal value added as a favourite growth variable, we measure the speed of change consequently by adding up the changes in the structure of nominal value added. This can be done at the 2-digit level (adding changes in the shares of sectors only) or at the 3-digit level (adding changes in the shares of industries). In tests of robustness, the speed of change is, however, also calculated for total exports, intra exports, extra exports and employment. Five indicators of change, plus two levels of aggregation, result in 10 correlations as a first indication of the concordance of these variables. Furthermore, we calculate a superindicator of growth, by calculating an unweighted average of the growth indicators and of the speed of change indicators. This has disadvantages from the standpoint of economic interpretation, but helps to cancel out measurement problems connected with the individual indicators.

Box 1: Measuring the speed of change

As is usual for complex processes, the speed of change of an economy is difficult to measure by simple indicators.

We calculate the indicator for the speed of change in two steps: first, we calculate differences between the share of an industry i in total manufacturing over a time period starting in year (t-n) and ending in the final year (t). Then we sum over the industries. Each change for an industry share contributes to this indicator, independent of its direction (plus or minus) and independent of whether it originates from mature or dynamic industries. The variable used is nominal value added, the shares are calculated as part of a sector (2 digit) or industry (3 digit) from total manufacturing. The shortcomings of this indicator should be kept in mind. Several problems relate to statistical issues, others to the economic content or to its interpretation.

Speed of Change = $\sum_i | a_{i,t} - a_{i,t-n} |$, where $a_{i,t}$, $a_{i,t-n}$ shares in final year, starting year for industry i

Statistical caveats:

- Adding up absolute changes in shares without regard to the size of the sectors, and the degree of disaggregation. It is recommended to compare countries only for identically classified sectors, and to limit the comparison if the sectors have extremely different structures in the beginning (e.g. highly concentrated versus highly dispersed structures). It recommends not focusing too much on the contribution of a large vs. a small industry to total change.
- Stochastic elements and errors in the variables further contribute to a potential bias. Large countries will exhibit a lower value for this indicator than smaller countries, since for larger countries, a stochastic influence such as the entry or exit of a firm of given size will result in a smaller change in shares. Growing countries will tend to have stochastically somewhat larger changes than countries of stagnating size.
- Economic caveats
- Changes in the shares of an industry can originate for different reasons and are of varying importance to long run competitiveness. Changes due to the loss of a firm's competitiveness in a mature industry will have a different impact, than changes which evolve when firms switch into dynamic, innovative industries. We therefore distinguish in Section 6 between positive and negative, or active and passive changes, for example by looking at whether the shares of a country increase in industries with high growth (high productivity, strong productivity growth) or in less attractive industries.
- Adaptability is a complex process, in which the speed of change of shares can highlight only one aspect. A more comprehensive picture would need an investigation of the entry and exit process, and of the financing of small, risky, fast-growing firms. Ideally even the nature of the change in the environment – to which adaptation seems desirable – and its causes should be investigated.

Finally, any proof or hint that speed of change and competitiveness or growth are interrelated – be it suggested by graphs or by correlations and regressions – involves many complications. The main problem is that of causality, since we expect that growth needs adaptability, but measured speed of change is also higher if growth accelerates (two way causality). With all these reservations in mind, we can use this as an indicator of an important economic characteristic.

Character of evidence searched for

Having screened the literature, we see no challenging operational hypothesis which predicts a stable uni-directional impact of growth and structural change. Growth induces changes in structure, for example via income elasticities, but on the other hand, a change in the production structure is a precondition or at least an accelerator for growth. We therefore try to find stylised facts which confirm the closeness of the relation, differences in the speed of change across countries, and the direction of change. We then show that of the two streams of causality – whether growth depends on past change or whether growth promotes future changes – the first tends to be stronger. Technically, this allows us to include more than one variable into a regression of growth on speed of change and opens the possibility of panel analyses.

4.5 Evidence of the concordance and its country and time patterns

The overall result

Table 4.1 shows the correlation between six indicators of growth and five measures of the speed of change in structure (plus one summary relation). The overall result is that all correlations are positive and all but 9 of 31 in Table 4.1 are significant at least at the 90 % level. If we start with the nominal value added we see that it has the closest relation to speed of change in exports, and to both of its components - intra and extra exports. The correlation is rather close, with speed of change in employment at the 3-digit level. Nominal growth and the speed of change of value added are positively related but not significant. There is no definite hierarchy depicting whether real or nominal growth is more closely related to change, nor whether 2- or 3-digit indicators of change are more closely related to growth.

Table 4.1: Correlation between growth and speed of change

Growth		Speed of change: Nominal value added	Employment	Total exports	Extra exports	Intra exports	Super-indicator
Nominal value added							
	2 digit	0.3924	0.4057	0.5212**	0.5393**	0.5680**	
	3 digit	0.2873	0.4190*	0.4721*	0.6130**	0.5588**	
Real value added							
	2 digit	0.4007	0.7209**	0.6696**	0.6886**	0.7056**	
	3 digit	0.2787	0.4836**	0.6420***	0.5918**	0.7005**	
Employment							
		0.7314	0.5130	0.2452			
	2 digit	0.0741	0.3465	0.4722*	0.4885*	0.5888**	
	3 digit	0.0480	0.3242	0.4445*	0.4539*	0.5825**	
Superindicator							
							0.5336**

*, **, *** denote significance at 90%, 95%, 99%.

Source: EUROSTAT (NEW CRONOS), COMEXT, WIFO calculations.

Country pattern behind

The correlations are partly driven by Ireland and Portugal. Both countries share high growth and rapid structural change according to all indicators. On the other hand, there are large countries like the United Kingdom, France, and to a much lesser extent Italy and Germany, which combine slower growth with less structural change. Both these groups contribute to a close relation.

The country, which reduces the closeness of the fit, is Greece. Its manufacturing sector stagnates, but structural change is considerable, according to production and exports. Structural change is moderate, if measured by employment. This combination of rapid change in output and exports with a rather constant pattern of employment hints at rigidities, which prevent growth. Belgium, the Netherlands and Spain are better placed in growth than in structural change. Sweden and Finland exhibit considerable structural change, but growth (specifically in nominal figures) is low. In both countries, real growth is above average, specifically if we consider the period after 1993. The explanation is that both countries suffered severe crises and devaluation in the early nineties and that the full impact of changes towards the telecom sectors was evident only in the second half of the

nineties. Sweden and Finland decrease the overall closeness of the fit between nominal value added and speed of change.

If we compare structural change in Europe with that of Japan and the USA, we see that structural change is somewhat slower in Europe than in the USA, but the difference is not large. Both the USA and Japan have higher levels of growth than Europe over the 14 year period.

Noise elimination by superindicators

If we summarise growth indicators into a "superindicator" of growth, and the speed of change indicators into a "superindicator" of the speed of change, this "noise decreasing" procedure enables us to attain a very close fit between growth and speed of change:

- Of the 14 countries, six have an identical rank for growth and for speed of change or only one rank difference (Belgium, France, Ireland, the Netherlands, Portugal, and the United Kingdom). One country differs by 2 ranks (Austria is 3rd in growth, 5th in speed of change).

- Three countries have a difference of three ranks, two differ by 6 ranks. Denmark and Germany experience higher growth (5th and 10th) despite a rather low speed of change (8th, 13th). Spain (number 4 in growth, but 10th in speed of change) and Italy (9th in growth, 14th in speed of change) perform in the same direction, but with wider differences.

- Greece is the outlier with the slowest growth and second highest speed of change. This development will be analysed below. The statistical impact of this is that the rank correlation among European countries is $R = 0.53$ (significant at the 5 % level), including Greece, and increases to $R = 0.75$ (significant at the 1 % level) if we exclude Greece.

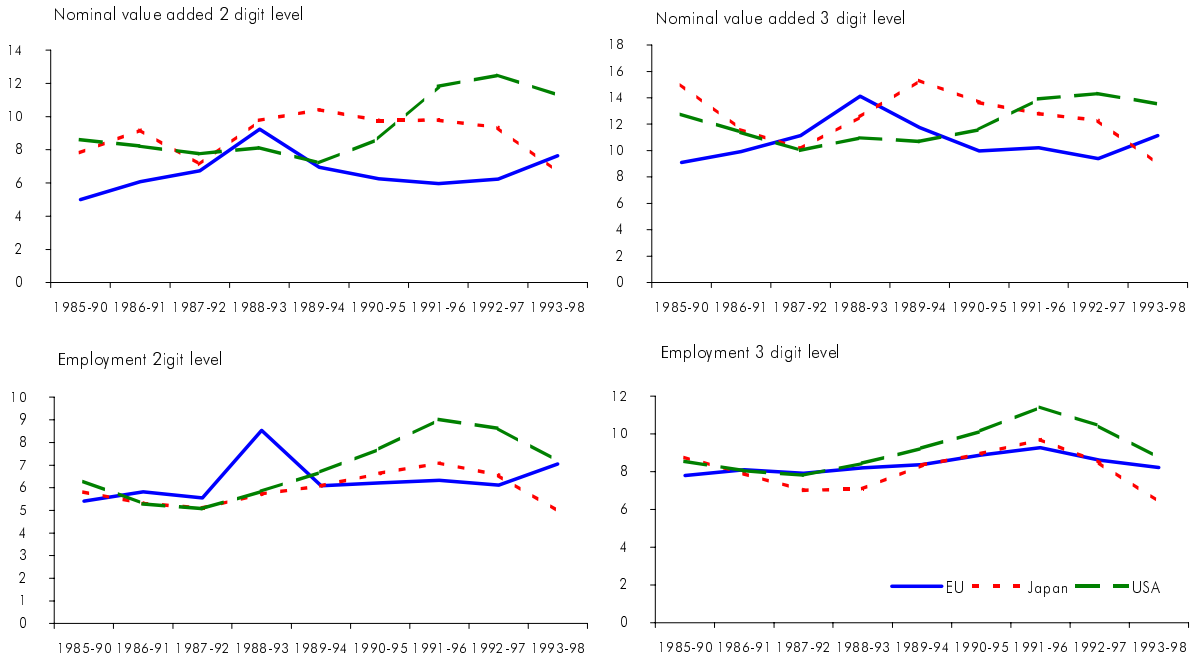
Table 4.2: Indicators on growth and on structural change 1985-1998

	Growth of nominal value added		Growth of real value added		Growth of employment		SPOCH of value added		SPOCH of exports		SPOCH of employment		SPOCH of value added		SPOCH of exports		SPOCH of employment		Superindicator growth[1])		Superindicator SPOCH[2])	
	3 digit		3 digit		3 digit		3 digit		3 digit		3 digit		2 digit		2 digit		2 digit					
	1985-1998	Rank	1985-1998	Rank	1985-1998	Rank	1985-1998	Rank	1988-1998	Rank	1985-1998	Rank	1985-1998	Rank	1988-1998	Rank	1985-1998	Rank		Rank		Rank
Belgium	3.95	7	2.49	6	–1.26	10	28.11	10	27.28	10	33.76	4	19.35	10	21.26	9	21.75	6	1.73	8	25.25	9
Denmark	4.79	4	2.28	7	0.39	2	36.40	6	28.42	9	32.83	5	20.24	7	19.60	11	19.48	8	2.49	5	26.16	8
Germany	3.87	8	1.74	11	–1.21	9	24.50	12	19.63	14	25.27	10	12.28	14	12.18	13	18.43	10	1.47	10	18.71	13
Greece	2.38	13	0.25	14	–2.12	14	58.27	1	45.88	2	26.17	8	45.84	1	37.76	3	20.03	7	0.17	14	38.99	2
Spain	4.64	6	2.57	5	0.26	4	29.68	9	32.07	8	25.51	9	19.83	8	22.01	8	16.11	12	2.49	4	24.20	10
France	2.87	12	1.41	13	–0.90	7	25.60	11	23.41	12	22.49	13	17.54	11	17.20	12	16.70	11	1.13	11	20.49	11
Ireland	7.86	1	10.18	1	2.18	1	46.62	3	66.85	1	37.61	2	39.39	2	63.79	1	33.13	1	6.74	1	47.90	1
Italy	3.61	9	1.76	10	–0.58	6	23.80	14	21.16	13	22.90	12	14.54	12	12.07	14	11.99	14	1.60	9	17.74	14
The Netherlands	4.71	5	1.85	9	0.36	3	31.82	8	42.61	4	24.94	11	19.57	9	37.37	4	19.29	9	2.31	6	29.27	7
Austria	5.34	3	3.93	2	–1.45	12	43.27	4	35.29	6	27.71	7	32.04	5	23.68	7	22.00	5	2.61	3	30.67	5
Portugal	7.75	2	2.21	8	–0.08	5	49.57	2	44.48	3	40.46	1	32.18	4	38.61	2	22.49	3	3.29	2	37.96	3
Finland	3.17	10	3.76	3	–1.33	11	42.78	5	40.99	5	33.98	3	33.66	3	35.28	5	26.62	2	1.87	7	35.55	4
Sweden	1.07	14	3.23	4	–1.01	8	34.59	7	34.43	7	32.68	6	23.95	6	27.70	6	22.33	4	1.10	12	29.28	6
United Kingdom	3.05	11	1.69	12	–1.68	13	24.12	13	26.01	11	18.34	14	13.73	13	20.30	10	15.11	13	1.02	13	19.60	12
EU	3.67		2.04		–0.89		19.27		21.33		17.48		11.47		16.01		12.58		1.61		16.36	
Japan[2])	4.53		1.38		–0.72		22.13		20.91		16.75		12.17		9.63		12.99		1.73		15.76	
USA[2])	4.42		3.19		–0.03		20.50		17.03		18.61		14.40		13.29		12.45		2.53		16.05	

Remark: Correlation between superindicators R = 0.5336 (R without Greece = 0.7460)
rank correlation between superindicator R = 0.3934 (R without Greece = 0.6796)
SPOCH for extra EU exports (better for comparision with Japan and the USA) = 23.24.

[1]) Superindicator on growth = average of growth of nominal value added, real value added and employment 1985 to 1998. – [2]) Superindicator on speed of change = average of speed of change of nominal value added, exports, employment (3-digit level and 2-digit level).

Figure 4.1: Speed of change over time in EU, Japan and the USA



Source: EUROSTAT (NEW CRONOS), WIFO calculations.

Differences according to time periods

The correlations are positive for all subperiods. However, the closeness of the fit increases over time and the correlation is closest for the last period (1993-1998). One of the significant changes of this period is that Sweden and Finland also join the top countries with respect to growth. The data indicate an increase in the speed of change, taking place about 1990. Using a five year moving average, most indicators indicate a maximum in 1988-1993. For employment at the industry level, the maximum is in 1990-1995 (see Figure 4.1). Greece is an outlier in the correlation in all subperiods, however speed of change (which was moving in an unfavourable direction) slowed down in the nineties. Italy and Germany exhibited a slow speed of change in all periods, but their growth position was more favourable in the late eighties. Both these trends support the correlations between growth and speed of change (see Figures 4.2 and 4.3).

Figure 4.2a: Country pattern for growth and speed of change 1985-1998 (Superindicator)

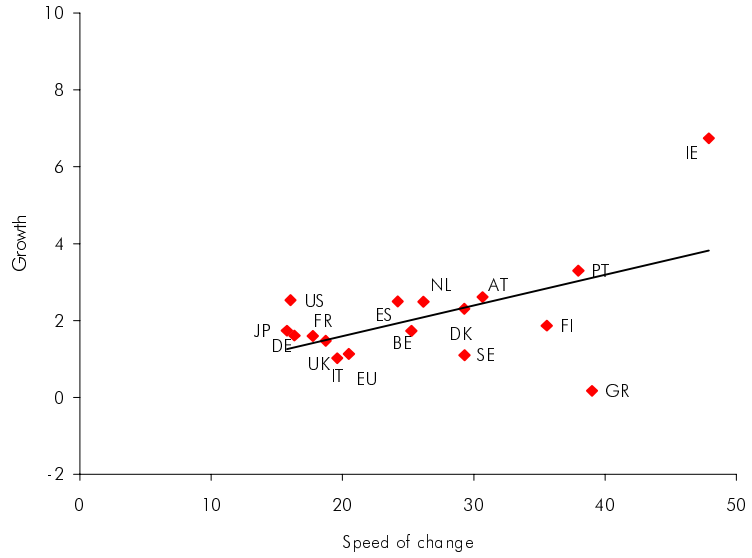
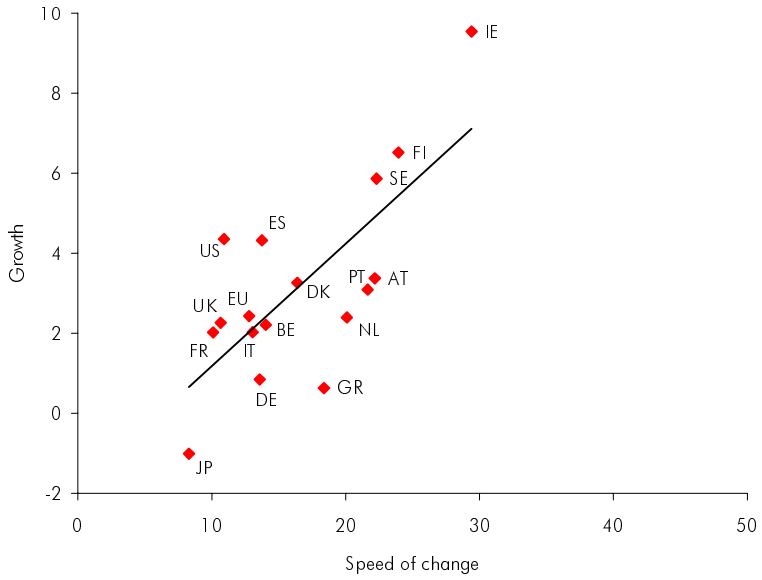


Figure 4.2b: Country pattern for growth and speed of change 1993-1998 (Superindicator)



Remark: Growth=average of nominal, real growth of value added and employment.
Speed of change= aberage of speed of change in value added and employment (2 digit and 3 digit)

Source: EUROSTAT (NEW CRONOS), WIFO calculations.

Figure 4.3a: Growth and speed of change of value added 3 digit level 1985-1998

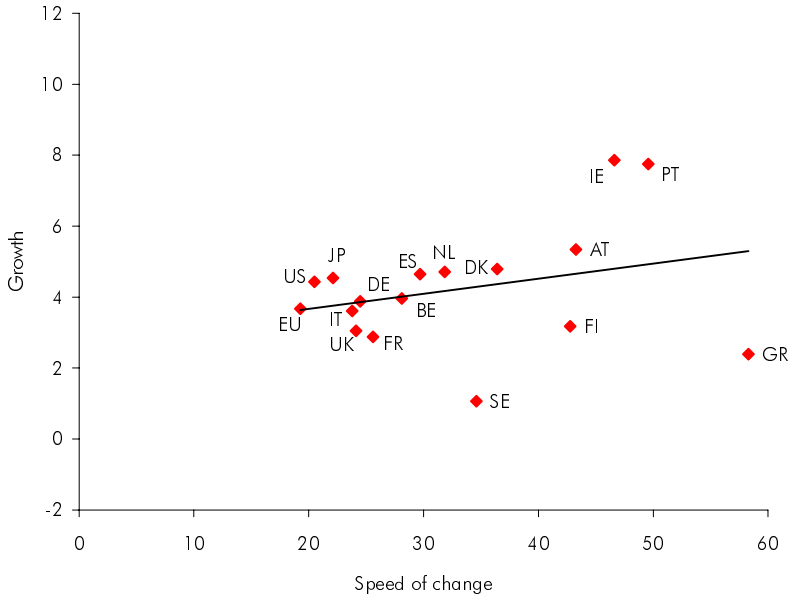
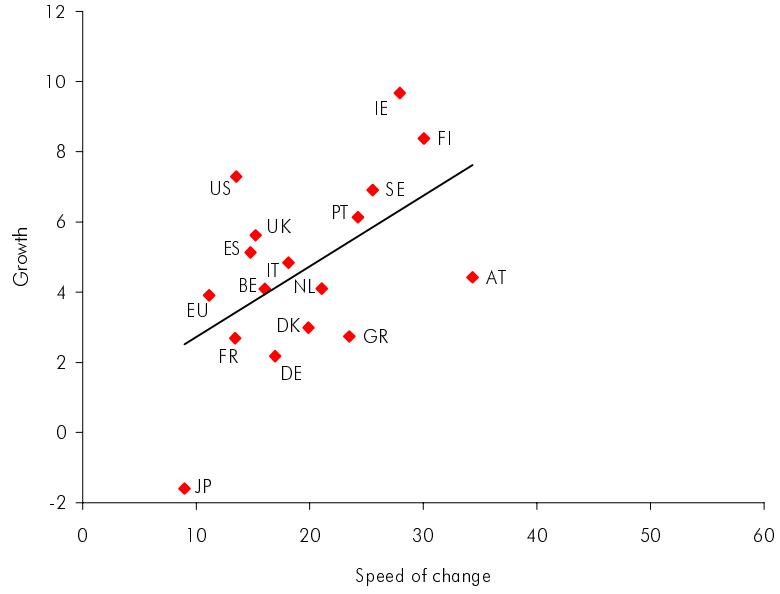


Figure 4.3b: Growth and speed of change of value added 3 digit level 1993-1998



Source: EUROSTAT (NEW CRONOS), WIFO calculations.

4.6 The case of Austria

General development

Austria has a fast growing manufacturing sector, ranked 2nd and 3rd in real and nominal growth of value added, respectively. The share of manufacturing in total production is above average (21 % 1998), though declining as in most other countries. Austria's share in European production rose from 2.2 % to 2.8 %. Productivity growth is specifically high, partly in the wake of privatisation and the restructuring of formerly nationalised or bank owned firms, partly due to the success of medium-sized firms in increasing their market shares in market niches. Absolute value added per employee is now the third highest in Europe. The export ratio is high, with increases near to the average rate. Export growth is much higher versus non-member countries, reflecting increasing trade surpluses with the accession countries in Central and Eastern Europe, as well as dynamic exports to the USA. Openness is in general higher than in other small countries.

The unit values of exports are above average, but less than the unit values of imports and Austria's performance according to this indicator is less convincing than in the productivity comparison. This stems from a certain persistence of the production structure in formerly traditional strongholds or, in other words, from slow inter industry shifts of production. However, within industry exports move into higher quality segments (6th largest share in the highest quality segment within industries). The share of technology driven industries is smaller than in the EU, as is the share of industries with specifically high inputs of knowledge and the share of high skill industries. The share of labour intensive and of mainstream industries is larger. The absolutely largest sector is machinery. The highest increase in exports is to be seen in motor vehicles. This is also the second highest sector in exports; Austria now supplies sophisticated parts to European and US car manufacturers. Higher-than-average market shares in exports are evident in traditional strongholds like the pulp and paper industry, the leather industry, metal products and basic metals. The largest increase in the production share occurred in the publishing and printing sector, partly due to the emergence of a cluster around recorded media. Industries with a market share in Austria at a level about or above 10 % of European exports, include, on the one hand, sawmilling, wood boards and panels, and builders carpentry; and on the other hand, railway locomotives and sports goods.

Growth and speed of change

Austria is the third fastest growing country according to the "supergrowth" indicator; it is placed only 12th in employment growth, reflecting the high increase in productivity. With respect to the speed of change indicator, it is ranked 5th, with exports and employment changing less than value added. The total period conceals different trends in subperiods. In the second half of the eighties, growth was only average and the speed of change in employment was the lowest of all countries. In the nineties, however, the speed of change for value added was the fastest. This difference mirrors the restructuring of larger firms, specifically the privatisation of several large companies, which were formerly nationalised or bank owned. The speed of change moved into high growth industries (the second highest share of all countries), specifically into printing, publishing and the reproduction of recorded media, but also telecom equipment and motor vehicles. Low growth industries, like food, tobacco, steel and oil, decreased their shares. There is no trend into industries with higher absolute levels of productivity, and there was no majority of changes into industries with fast growing productivity. High productivity growth is the consequence of productivity increases within industries and of catching up in quality. For the latter, see Aiginger (2000), where he shows that Austria has a low share of industries in which quality competition dominates, but that it does specialise in the highest price segment within industries.

4.7 Towards explanations of the connection

Active versus passive change

Theory predicts that rising incomes will change demand structures, and that countries will specialise according to their endowments. If incomes (domestic and worldwide) change, and if the endowments and relative advantages of countries change over time, countries which actively and quickly adjust production according to changing demand and endowments will perform better than those passively hit by external shocks. This suggests that we differentiate between active changes in structure and those changes which will happen sooner or later, due to losses of competitiveness or shrinking demand. It is not possible to distinguish easily between these two types of "positive" or "active" or "voluntary" change on the one hand, and "negative", "passive" or "involuntary" change on the other

hand. But, we can suggest that active strategies could be indicated by increases in the share of

- fast growing industries (measured first at the European level with respect to value added and production)
- high productivity industries
- industries with high productivity growth
- industries with comparative advantages at the beginning (measured in relative productivity)
- industries with first mover advantages (measured in above-average shares at the beginning)
- industries requiring high skill levels

Increases in these industries, and decreases in opposite categories (increases in slowly growing industries) were labelled "active change"; while increases in slowly growing industries and decreases in fast growing industries may reflect passive, involuntary change. The net balance of active change minus passive change is later used in regressions as the "positive speed of change".

Taking long term growth of value added in the EU as a first criterion, an average of the EU countries reveals that 8.7 points of the "speed of change" can be attributed to increasing shares in sectors in which growth is above average, and 8.8 points can be attributed to decreasing shares in sectors with low growth. This amounts to 17.5 points, implying that more than two thirds of the "total speed of change" is active change (in the sense of either shifting into high growth or leaving stagnating sectors; shares of change go into sectors with higher growth rates). About 3.5 points are derived from increases and decreases "against the tide"; meaning growth of sectors in specific countries, despite moderate overall growth and declining shares in growth industries. Greece is the only country in which the structural change "against the tide" dominates. This is due to the fact that the textile industry is increasing its share, but also to the slow growth of oil and basic metals and the large decline in the metal products industry.

Table 4.3a: Speed of change in subperiods and in directions of change

	Speed of change in value added (2 digit)				Share of "active" change (total period) according to . . .				
					High/low growth of value added	High/low productivity	High/low productivity growth	1985 comparative advantage[1])	1985 specialisation[2])
	1985-1998	1985-1990	1990-1995	1993-1998	In percent				
Belgium	19.4	9.9	11.4	12.4	70.8	78.3	61.6	26.6	24.6
Denmark	20.2	10.3	7.5	13.9	89.5	54.0	35.9	57.9	46.1
Germany	12.3	6.9	10.1	9.9	90.5	37.9	39.2	65.0	58.8
Greece	45.8	28.7	28.6	20.3	19.3	59.2	12.4	10.1	30.0
Spain	19.8	14.5	11.2	12.1	91.2	57.4	35.8	11.8	22.1
France	17.5	10.8	9.7	7.8	88.4	57.2	60.6	5.8	29.3
Ireland	39.4	10.8	31.4	24.9	70.8	77.4	48.5	63.7	51.7
Italy	14.5	7.0	13.3	14.7	92.6	43.6	66.5	38.9	32.3
The Netherlands	19.6	9.6	9.7	17.2	66.7	44.8	24.2	35.0	29.7
Austria	32.0	9.9	18.1	28.6	81.5	57.9	51.7	21.7	26.4
Portugal	32.2	21.2	12.0	13.2	68.3	58.4	55.8	30.3	31.8
Finland	33.7	13.0	29.4	24.1	73.5	78.9	51.8	63.4	32.5
Sweden	24.0	12.9	23.1	18.4	89.5	69.2	40.8	36.3	64.7
United Kingdom	13.7	8.4	10.7	8.4	82.4	62.4	50.6	45.7	75.8
Average over EU countries	24.6	12.4	16.1	16.1	76.8	59.8	45.4	36.6	39.7
EU	11.5	5.0	6.3	7.6	–[3])	55.0	48.7	50.0[4])	50.0[4])
Japan[5])	12.2	7.8	9.8	6.7	78.4	51.5	38.5	42.5	29.9
USA[5])	14.4	8.6	8.7	11.3	85.6	85.5	28.5	50.0	58.5

[1]) Relative productivity of industry in country i versus EU. – [2]) Relative share of industry in country i versus EU. – [3]) By definition 100 percent. – [4]) By definition 50 percent. – [5]) Last year 1997.

Source: EUROSTAT (NEW CRONOS), COMEXT, WIFO calculations.

Table 4.3b: Speed of change in subperiods and in directions of change

	Speed of change in value added (3 digit)				Share of "active" change (total period) according to . . .					
	1985-1998	1985-1990	1990-1995	1993-1998	High/low growth of value added	High/low productivity	High/low productivity growth	1985 comparative advantage[1])	1985 specialisa-tion[2])	High skill industries
Belgium	28.1	18.9	17.8	16.0	72.5	44.6	50.9	29.6	19.7	46.3
Denmark	36.4	22.0	14.3	19.9	84.7	52.8	69.2	46.4	46.8	53.1
Germany	24.5	10.6	15.0	16.9	94.5	46.4	60.2	44.5	46.2	51.1
Greece	58.3	40.4	31.9	23.5	57.0	59.6	70.4	15.4	35.3	50.3
Spain	29.7	18.4	16.3	14.8	86.3	45.4	52.6	25.4	33.1	54.5
France	25.6	13.6	14.4	13.4	89.7	45.5	64.5	32.2	28.0	45.0
Ireland	46.6	20.7	34.8	27.9	68.0	52.2	57.9	53.8	53.2	60.1
Italy	23.8	12.0	18.7	18.1	83.7	38.0	58.5	57.3	32.2	51.0
The Netherlands	31.8	15.6	16.1	21.1	86.9	54.1	53.8	30.2	30.2	57.9
Austria	43.3	12.2	29.4	34.3	78.9	35.8	53.0	35.0	28.2	55.2
Portugal	49.6	32.7	19.6	24.3	76.9	58.7	64.4	29.7	21.5	55.5
Finland	42.8	17.2	37.5	30.0	63.8	72.8	74.5	51.5	52.8	53.0
Sweden	34.6	12.2	29.5	25.5	69.7	64.7	62.4	41.3	51.6	56.1
United Kingdom	24.1	15.1	16.2	15.2	85.7	51.0	60.0	38.7	51.4	54.9
Average over EU countries	35.7	18.7	22.2	21.5	78.5	51.5	60.9	37.9	37.9	53.1
EU	19.3	9.1	10.0	11.1	-3)	46.2	63.9	50.0[4])	50.0[4])	52.7
Japan[5])	22.1	15.0	13.6	9.0	79.8	52.3	54.6	31.8	42.3	50.1
USA[5])	20.5	12.8	11.6	13.5	69.7	68.5	70.1	44.4	49.1	39.4

[1]) Relative productivity of industry in country i versus EU. – [2]) Relative share of industry in country i versus EU. – [3]) By definition 100 percent. – [4]) By definition 50 percent. – [5]) Last year 1997.

Source: EUROSTAT (NEW CRONOS), COMEXT, WIFO calculations.

Ireland, on the other hand, had the largest "positive" component, increasing its share of chemicals, and decreasing its food share. Sweden, Finland and Portugal follow. Portugal, successful in catching up (with rapid growth and speed of change), achieved this position by increasing its share of motor vehicles and by decreasing its share of all textile related industries. Italy and Germany excelled, having only a 1 point share of change in the wrong direction (i.e. out of growth sectors plus entry into slow growth sectors). A substantial part of the shifts against the tide is evident in the two countries with fastest overall change (Ireland and Portugal), but also in Finland, Belgium and the Netherlands.

If we look for changes driven by productivity, the results are as follows: On average, changes are driven by the productivity level, i.e. the share of high productivity industries increases. However, this trend is not as strong as the shift into high growth industries. And structural change does not move into industries with high productivity growth.

- Starting with the level of productivity: on average (across countries), 15 % of the changes in sector shares follows absolute productivity (implying increasing shares in high productivity industries and decreasing shares in low productivity industries), but 9.3 % move in a different direction. In Italy and in the Netherlands, movements against the tide dominate; in Greece, Spain, France and Portugal, the "positive" change is only slightly larger than the negative. The large share of negative effects can be attributed mainly to capital intensive basic goods industries (basic metals, oil), as well as to tobacco, which have above average labour productivity, but declining shares in value added. However, smaller countries are also specialising in office machinery and telecom, driving shares away from others (larger countries, as well as the Netherlands), which would otherwise contribute to this trend.

- Productivity growth is not really driving sectoral changes. On average, the "against the tide" effect dominates slightly (10.7 : 13.9); strong counter effects are evident in Greece and in the Netherlands; effects which are somewhat less negative are revealed for Denmark, Spain and Sweden. Strong switches into industries with above average growth are shown for Belgium, France, Italy and Portugal. It is interesting that in Ireland and Austria (two fast growing countries), neither effect dominates.

Two indicators show the declining influence of specialisation according to comparative advantages: First, specialisation according to relative productivity (Ricardian comparative

advantage) and then specialisation according to revealed strongholds in 1985. According to both indicators, countries moved production out of former strongholds. On average across countries, 4.7 % of the changes in structure were in the direction of sectors in which the countries had higher (relative) productivity and 4.1 % of the changes were away from sectors with relatively low productivity, for a total of 8.8 % which were intensifying original comparative advantage. On the other hand, 15.2 % were changes away from the original specialisation, either by shifting into sectors with relatively low productivity or by abandoning positions with higher productivity levels. However, there are four countries which moved their structures into sectors with higher productivity: Ireland and Finland, and to a lesser degree Germany and Denmark. Quite similar trends become evident if we define strongholds according to revealed comparative advantages (above average shares of sectors in 1985), rather than relative productivity: 9 % are intensifying specialisation and 15 % are downgrading past specialisation. Four countries create an exception: again, they are Germany and Ireland, joined this time by Sweden and the United Kingdom.

Robustness and the influence of high skills

The results were reported for the average of countries, and then for individual countries and for the 2-digit level. The results are also the same for the EU as an aggregate (changes follow growth, somewhat less for productivity, but not for productivity growth, and they run contra to past specialisation). All these trends are replicated for the USA and Japan.

At the 3-digit level, the results are replicated as far as changes which follow growth differences are concerned, and run counter to past specialisation. The unique character of Greece is underlined, as it specialises counter to the overall growth trends. The excellent positions of Germany and Italy (with nearly no specialisation against the tide) is replicated; Belgium, France, the United Kingdom and Austria are the countries with less than a 3 % change against growing sectors. Portugal has the second highest share of shifts against the tide, for 3 digits, as well. Ireland and Finland have much less, implying that the structure shifted into high growing 3-digit industries, within lower-growth 2 digits.

For productivity, results change for 3 digits, as compared to broader sectors. The speed of change into industries with productivity levels above and below average is about the same; however, countries change into industries with above average productivity growth. This

implies that data on disaggregated industries are highly necessary for structural analysis. Specialisation is not lead by absolute productivity (which depends on capital intensity), but by productivity growth, which may be fostered less by capital deepening than by upgrading skills and quality. Data on the share of skilled workers show that specialisation follows skill levels.

About the direction of causality

To attain information about the direction of causality, we look at the time shape of the correlation. If growth is connected to past, as well as to concurrent speed of change, this indicates that the speed of change influences later growth and is the independent variable. If, on the other hand, speed of change is more closely related to past growth, this indicates that growth leads to changes. This test was popular in business cycle analyses, where long datasets with high periodicity are available. Even then it was questioned whether, under all circumstances, "post hoc" also implies "proper hoc". Here, we have only three time periods. Therefore, we test the time pattern for several variables to get at least a hint.

Table 4.4: The time structure of the relationship

	SPOCH 2 digit			SPOCH 3 digit		
	t	t-1	t-2	t	t-1	t-2
Growth						
Value added nominal	0.5026**	0.4724***	0.0269	0.5370**	0.5238**	0.0205
Value added real	0.6542*	0.6434*	-0.0534	0.5826**	0.6319*	–0.0975
Employment	0.6916*	0.2169	0.5236**	0.6087*	0.3315	0.4209***
Average	0.6161	0.4442	0.1657	0.5761	0.4957	0.1146
		Growth[1])			Growth[2])	
Speed of change						
Value added nominal	0.5026**	0.2350	0.0260	0.5370**	0.1876	0.0014
Value added real	0.6542*	0.5855**	0.1877	0.5826**	0.4692***	0.1867
Employment	0.6916*	0.0514	-0.1676	0.6087*	0.0312	–0.1971
Average	0.6161	0.2906	0.0154	0.5761	0.2293	–0.0030

Remark: The same specification is calculated for upper part and lower part of the table.
Upper part: Yt/Xt, Yt/Xt-1, Yt/Xt-2
Lower part: Xt/Yt, Xt/Yt-1, Xt/Yt-2

[1]) Correlation is calculated between growth variable and speed of change on the 2 digit level. – [2]) Correlation is calculated between growth variable and speed of change on the 3 digit level.

Source: EUROSTAT (NEW CRONOS), COMEXT, WIFO calculations.

In general, the growth of value added is related approximately as well to past speed of change as to concurrent; the results remain significant for all four correlations in the upper half of Table 4.4 (real, nominal growth which is related to the speed of change at the 2- and 3-digit levels). For real growth and speed of change measured at the industry level, the correlation coefficient is even slightly higher, if the latter is lagged. For two lags, the correlation collapses. For employment, there is a drop if the speed of change lags by one period, and then an increase if it lags by two periods (this is not easy to explain).

If, on the other hand, we correlate speed of change to past growth, the correlation coefficients drop faster, becoming insignificant for nominal growth and decreasing by 0.7 resp. 11 points for real growth. The relation to the speed of change in employment is practically zero, if growth lags by one period.

These results indicate that the causality between speed of change and growth might be more important than the other one. We maintain, however, that both streams will be present, as proposed by the theoretical considerations.

4.8 Econometric evidence assuming growth as the independent variable

The correlations between speed of change and growth are all positive; due to the data noise and the small number of data points (14 countries) they are sometimes not significant (9 of 31 cases in Table 4.1). The closeness of the fit is excellent, if we eliminate some of the "noise" by averaging indicators (see results for the "superindicator" above). It also improves, if we relate growth to the "active" speed of change, defined as structural change in a country in the direction of growing industries (measured at the EU level). As an indicator, we take the share of change following demand, minus the share against the tide.

The result is that the speed of change follows demand, but runs counter to past specialisation and it suggests that we incorporate these two variables into the regression. Explaining production growth according to the dissimilarity at the start, and following the speed of change into fast growing industries, provides the expected results. Growth is higher, the more industry changes there are, and the more different it was in the beginning; this result is significant for nominal value added (see BB in Table 4.5).

The results are supported in a panel in which the total period is subdivided into three subperiods. Now, each variable corresponds to three time data points and 14 countries. Both variables are significant in a model without fixed effects. In models with fixed country effects, the contribution of the positive speed of change remains to be seen, while significance is given for real value added. However, part of the explanatory value of the variable is now hidden by fixed country effects.

Table 4.5: OLS and panel explanations of growth by speed of change and dissimilarity

Value added on 3 digit level

		Speed of change		Positive speed of change		Dissimilarity		
Growth		T	R^2 if single	T	R^2 if single	T	R^2 if single	R^2 if double
A: Single equation 1985-1998								
Value added nominal		1.21	0.1095	2.41**	0.3262	2.15*	0.2777	
Value added real		0.96	0.0710	–0.04	0.0001	1.69	0.1929	
B: Multiple equation OLS 1985-1998								
Value added nominal	A	–1.66				2.44**		0.4218
	B			3.34***		3.11***		0.6410
Value added real	A	–1.36				1.94*		0.3084
	B			0.06		1.62		0.1931
C: Panel, 1 variable								
Value added nominal		0.32	0.0042	2.45**	0.0364	2.80***	0.3182	
Value added real		0.35	0.0000	1.47	0.0348	2.15**	0.0859	
D: Panel, 1 variable with fixed country effects								
Value added nominal		–0.42	0.0042	1.25	0.0364	3.55***	0.3182	
Value added real		–0.01	0.0000	1.22	0.0348	1.59	0.0859	
E: Panel, 2 variables								
Value added nominal	A	–0.81				2.69***		0.0825
	B			3.69***		3.03***		0.2011
Value added real	A	0.73				1.60		0.0922
	B			3.26***		2.29**		0.2198
F: Panel, 2 variables with fixed country effects								
Value added nominal	A	–0.02				3.48***		0.3183
	B			1.65		3.09***		0.3830
Value added real	A	0.91				1.54		0.1140
	B			2.23*		1.05		0.2326

A . . . Speed of change value added + Dissimilarity. B . . . Positive speed of change value added + Dissimilarity

Source: EUROSTAT (NEW CRONOS), COMEXT, WIFO calculations.

Table 4.6: Favourite panel – growth as a function of positive speed of change and dissimilarity

Fixed-effects (within) regression	Number of obs	=	42			
Group variable (i) : co1	Number of groups	=	14			
R-sq: within = 0.2326	Obs per group: min	=	3			
between = 0.3115	avg	=	3.00			
overall = 0.2683	max	=	3			
	F(2,26)		3,94			
corr(u_i, Xb) = –0.4996	Prob > F		0,0320			
grr3va	Coef.		Std. Err.	t	P>t	[95% Conf. Interval]
sp3ava	0.1750428		0.0784993	2.23	0.035	0.013685 0.3364004
dis3va	0.1312898		0.1251026	1.05	0.304	–0.1258622 0.3884419
_cons	–5.20084		6.315986	–0.82	0.418	–18.18354 7.781855
sigma_u	2.4487147					
sigma_e	1.9356521					
rho	0.61544009		(fraction of variance due to u_i)			
F test that all u_i=0:	F(13, 26) =		2.83			Prob > F = 0.0115

. predict fixed, u
(14 missing values generated)

. table co1, c(m fixed)row

co1	mean(fixed)
Belgium	0.3575212
Denmark	–1.677391
Germany	0.949039
Greece	–5.956641
Spain	1.974682
France	1.331256
Ireland	1.88364
Italy	1.421728
Netherlands	–1.353771
Austria	0.2766223
Portugal	–3.851935
Finland	0.0519358
Sweden	2.505619
United Kingdom	2.087696
Total	–5.32E-09

Source: EUROSTAT (NEW CRONOS), COMEXT, WIFO calculations.

4.9 Caveats and conclusions

Speed of change and dynamics are two economic features, which support each other. Any change in income and activity implies changes in structure, since some industries grow less than total production, for example when there is an opportunity to economise on inputs, or when more and more basic needs have been fulfilled. Other inputs are used increasingly, particularly when they add new features to products and/or when demand increases overproportionately with rising incomes. Therefore, rising income levels make changes in the structure of an industry necessary. If these changes are feasible, production will follow demand closely and allow growth, partly by winning market shares at the expense of economies with less flexibility. This two-way causality between growth and structural change imposes difficulties in the use of usual statistical techniques like regressions, which basically need a one way causality.

The empirical data support the idea that growth and speed of change are related. Most of the indicators of structural change are significantly related to growth, specifically if we eliminate noise by combining information contained in different data sets (each flawed by measurement errors or by eliminating fixed industry or country effects). The correlations seem to increase over time; the fit is much closer for the most recent years than for the total period. Changing export structures are at least as closely connected with growth as changes in value added, indicating that changing structures may be specifically important for external competitiveness and for open economies. If we want to determine the direction of causality (whether growth makes structural change necessary, or whether change is the precondition of growth), we find evidence that growth depends on past structural change more closely than the other way round. In principle, however, the data are too limited and too noisy to prove this; above all, theory suggests an intrinsic two-way relationship.

The country hierarchies are similar in growth and speed of change, but there are some notable exceptions. Industrial structures have been changing fast, but growth is inadequate in Greece. In using production growth at the European level to discriminate between high and low growth industries, we see that Greece is specialising in low growth industries, while the vast majority of other countries is changing into high growth sectors. Countries with better positions in growth, but with inadequate structural change, are Italy and Spain, and to a lesser extent Germany and Denmark. Sweden and Finland are experiencing rapid

structural change, but were only able to transfer this into higher growth during the latest subperiod. In the nineties, however, they successfully reaped the benefits of their excellent position in the telecom sector. For a long time, Austria had slow structural change specifically relative to growth, but in the nineties, structural changes were achieved specifically by shedding employees in formerly nationalised industries.

All countries abandoned, at least in part, positions in which they were specialised during the eighties. This is the consequence of a re-shaping of specialisation, which originally was based on larger endowment differences, but which now is primarily linked to intra industry specialisation. Panel analysis confirms that growth is highest if it follows restructuring away from past strongholds and towards fast growing industries.

Comparing the EU and the USA, the speed of change is larger in the USA and in Japan than in Europe. The extent is not dramatic, but is evident for all indicators. The time shape indicates an increase in changes in Europe, with a maximum during the 5-year period 1988 – 1993; while in Japan, the maximum occurred later; and in the USA, not until the very last period. During the period 1992 – 1997, the speed of change was 50 % to 100 % higher in the USA than in Europe.

In general, Austria fits into the picture, insofar as growth and speed of change is larger than for most other countries. Austria was lacking in speed of change in the eighties, but experienced fast changes in the nineties. Change moves in the direction of high growth industries, not in the direction of industries with high levels and growth of labour productivity. The nevertheless strong productivity performance seems to be the consequence of productivity growth and supplying quality within industries.

The upshot of the study is, that despite all the problems of how to define aggregate dynamics and structural change, and how to assess the direction of causality, there is a link between structural change and growth. European countries with high growth also have rapidly changing structures. Structural change is increasingly supportive, if the change is in the direction of faster growing industries and if the change upgrades quality and product differentiation (intra industry specialisation; abandoning old strongholds). And European change, as well as growth, seems to have been insufficient in the nineties, at least when compared to the impressive acceleration of productivity growth in US manufacturing.

5. STRUCTURAL CHANGE AND AGGREGATE GROWTH

MICHAEL PENEDER

5.1 Introduction

Our concern for the Austrian paradox has been founded on an implicit assumption that the sectoral composition of production is more supportive of aggregate performance, the higher its share of specific industries; whereby, for example, labour skills and intangible investments in marketing or technology are particularly important. Despite its general appeal to common-sense, this assumption is anything but trivial and requires closer scrutiny. The specific purpose of this chapter is to investigate whether this hypothesis can also be substantiated by empirical facts. Only then can we reasonably confirm its general relevance and begin to consider potential consequences for economic policy.

Theoretically, the relationship between industrial structure, development and growth is less obvious than might be expected. The traditional neo-classical growth theories offer no clues as to how the dimension of industrial structure can be integrated into their exclusively macroeconomic agenda. Their preoccupation with optimisation analysis imposes strong assumptions about the homogeneity of what is called the representative agent in the economy. The new endogenous growth theories must be credited for integrating increasing returns (e.g. via learning and R&D investments) into the canon of formalised theory. In some of these models, especially those with an inclination towards the Schumpeterian idea of creative destruction (Aghion-Howitt, 1998), industrial structure has a role to play. But it appears only in a very rudimentary form, e.g. by separating a research sector, which generates spillovers to the rest of the economy. These models remain strictly within the realm of steady state analysis, regarding all deviations from the path of constant rate, balanced growth as mere transitional dynamics. Two of the most deserving proponents of endogenous growth theory are very precise about the limitations of steady state analysis: "The economy is always a scaled up version of what it was years ago, and no matter how far it has developed already the prospects for future developments are always a scaled-up version of what they were years ago" (Aghion-Howitt, 1998, p. 65). The analysis of structural change obviously does not fit within such a framework.

A distinct view of the growth process is developing within the evolutionary paradigm. Being less tolerant towards the exclusion of relevant issues for the sake of analytic tractability, it generally tends to rely more on appreciative theory (Nelson, 1995). Scattered attempts have also been made towards the mathematical formalisation of the growth process; examples are presented e.g. in Silverberg (1988), Silverberg-Verspagen (1998), Montobbio (2000), and Metcalfe (2001). For surveys focusing more on the empirical evidence of technological change and growth from an evolutionary perspective see Fagerberg (1994) or Verspagen (2001).

Most important to the task at hand is the observation that evolutionary theory characterises the market economy as a process of continuous change and transformation. Its dynamics are driven by innovation; but "[i]nnovation is a matter of differential behaviour and differential behaviour is the basis for structural change" (Metcalfe, 1998, p.37). As the fundamental diversity of micro-behaviour involves dynamics which are much richer than in steady state growth, simple aggregation cannot do away with the fact that the potential paths of development are various and depend on the idiosyncratic characteristics of an economy, including its sectoral composition of production. From the evolutionary perspective, structural change is therefore an inevitable companion of growth and development.

The diversity of individual behaviour implies much variation in performance and accordingly differential rates of growth at the micro-level. But structural change also requires differential rates of growth at the meso-level. Montobbio (2000, p. 20) describes the two basic mechanisms as "sorting" and "selection". Sorting refers to the differential growth of sectors caused by exogenous forces, such as shifts in the composition of demand towards goods and services with a higher income elasticity. Conversely, in order to have an effect on differential growth rates at the sectoral level, selection requires some substitutability between the outputs of firms in various industries for given income levels. But we must also consider that the environment in which the selection process takes place differs from sector to sector (Nelson, 1995). If at least at the most general level, firms within different industries compete for their shares in the overall allocation of time[10] and

[10] See Metcalfe (2001) for a recent integration of the budget and time constraints into a demand model of evolutionary growth.

budgets, differences between industries, particularly regarding their average propensity to undertake investments which increase the consumers' willingness to pay, might effectively shift the sectoral composition of production.

Any selective environment which stimulates the competition for the perceived quality of output generates investments e.g. in research and development, advertising, or higher inputs of skilled labour. Provided that such technological opportunities exist and that customers are receptive to the supply of new combinations, differential growth at the sectoral level becomes endogenous to entrepreneurial choices. For each economy, a higher share of such `entrepreneurial´ types of industry would then also imply a larger overall capacity to generate growth by means of investments e.g. into quality upgrading. In this capability-based rationale, structural change must have a directly observable impact because of the differential contributions of industries to aggregate growth.

A second rationale for the meso-structure/macro-performance linkage refers to the indirect effects generated by positive externalities between industries (see Chapter 2). We speak of user related "rent spillovers" when positive externalities come into effect through the application of certain products and services. This is the case for intermediary goods, whereby the marginal benefits of embodied technology is not fully captured in the prices the customer pays. Conversely, producer related "knowledge spillovers" emanate from the easier diffusion of productive knowledge within common territorial boundaries. This can be due to spatial proximity, as well as shared institutional frameworks.

At this point, we must however issue an additional warning: Acknowledging the fundamental heterogeneity of economic behaviour also implies a certain hierarchy of ontological layers, where diversity and change are only visible to different degrees. Many differences which are observable at the micro level necessarily cancel each other out when attention is concentrated on the development of macroeconomic variables. Because of the aggregation mechanisms, we must expect that variation in performance is largest at the lowest level of economic activity, i.e. individuals and firms, followed by intermediate amounts of variation at the meso level of markets and industries and comparatively smooth developments at the macro level. We therefore do not expect a corresponding amount of turmoil and variation at more aggregate levels. What we nevertheless do expect are systematic shifts in the distribution of various kinds of activities, which is tantamount to the observation of structural change.

This chapter longs for an empirical validation of the meso-structure/macro-performance hypothesis, which postulates that structural change is a significant determinant of macroeconomic development and growth. The investigation proceeds in three consecutive steps. Section 2 deals with a general visualisation of the growth process introduced by Harberger (1998). Lorenz-type curves which depict the relative concentration of an industry´s contributions to aggregate labour productivity growth reveal that the impact of differential growth at the industry level is considerable, but also varies largely between countries and different time periods. Applying a common shift-share analysis, Section 3 summarises the direct effects of the static and dynamic structural components of aggregate growth. Consistent with other calculations presented in the literature, structural change appears to have a direct impact, especially in the case of tertiarisation. Nevertheless, the within industries component of aggregate productivity growth clearly dominates over the often countervailing structural effects. Section 4 then takes the analysis an important step further, presenting panel econometric estimations of typical cross-country growth regressions, while also including indicators of structural change. In contrast to shift-share analysis, the econometric analysis also captures the indirect effects via spillovers between industries. Similar sets of panel regressions are applied for (i) the levels of GDP per capita reflecting the long run relationship between economic growth and industrial structure, and (ii) rates of growth in GDP per capita as its short-term counterpart. Although we acknowledge that structural change and growth are clearly interdependent phenomena, the specific purpose of this chapter is to test for the causal relationship from the meso- to the macro-level. Problems of endogeneity will be dealt with by the use of lagged values of the explanatory structural variables. The final section presents a brief summary and conclusions.

5.2 "Mushrooms versus yeasts": two visions of the growth process

In addition to the enormous heterogeneity of behaviour and performance at the micro level[11], Arnold C. Harberger (1998) has recently demonstrated the large amount of variation we can find at the meso-level of economic activities. In the "sunrise diagrams", he offers a visualisation of what he calls the *"yeast versus mushroom*" issue: "The analogy with

[11] For a survey see e.g. Haltiwanger (2000).

yeast and mushrooms comes from the fact that yeast causes bread to expand very evenly, like a balloon being filled with air, while mushrooms have the habit of popping up, almost overnight, in a fashion that is not easy to predict" (Harberger, 1998, p. 4).

Each analogy illustrates a different mechanism in the micro-macro link in productivity growth. The yeast analogy corresponds to a vision of the growth process driven by economies of scale and broad externalities applicable to the entire economy. Conversely, the mushroom analogy refers to advances in productivity[12] "stemming from 1001 different causes" (p. 5) and appearing in irregular, often clustered patterns, which are more prevalent in some industries than in others. This implies that within specific periods of time, productivity growth would be highly concentrated in relatively few industries, but over time the clustered appearance of productivity growth might also shift between different branches of production. Based on his empirical results, Harberger argues much in favour of the `mushroom´ analogy and ultimately relates his vision of the growth process directly to Joseph Schumpeter and the idea of `creative destruction´.

We are now going to present similar illustrations, based upon data for manufacturing industries in the EU member countries plus Japan and the USA. Due to the more disaggregated breakdown of industries and the according data limitations, we only use nominal values of labour productivity, in contrast to Harberger, who based his work on total factor productivity (TFP). We must be prepared for the case that this departure from the original approach will tend to generate somewhat smoother patterns in overall productivity growth. The reasons are twofold. First, on purely conceptual grounds, TFP growth is closer to the Schumpeterian agenda of technological change, whereas labour productivity additionally encompasses the effects of the presumably less idiosyncratic process of capital deepening. Secondly, due to the lack of industry specific price deflators, nominal values are boosted by the effects of general price inflation. If the mushroom story still appears to play a relevant role in aggregate labour productivity growth, we might consequently categorise this observation as particularly robust.

The cumulated shares of each of *i* industries in the total value added of manufacturing in the base year (*by*) are indicated on the horizontal axis:

[12] Or "real cost reductions" as he prefers to label it.

$$CS(VA_{i,by}) = \frac{\sum_{c=1}^{i} VA_{c,by}}{VA_{tm,by}}, \qquad (1)$$

CS = cumulated shares; VA = value added; tm = total manufacturing

The cumulated contributions of each industry *i* to the changes in aggregate labour productivity between the final year (*fy*) and the base year (*by*) of the observation period are indicated on the vertical axis:

$$C\Delta(LP_i) = \frac{\sum_{c=1}^{i} (LP_{c,fy} * \frac{L_{i,fy}}{L_{tm,fy}} - LP_{c,by} \frac{L_{i,by}}{L_{tm,by}})}{LP_{tm,fy} - LP_{tm,by}} \qquad (2)$$

CΔ=cumulated changes; LP = labour productivity; tm = total manufacturing

Before the cumulated shares can be calculated, industries must be sorted according to the ratio of their share in productivity growth and their share in value added during the base year. The resulting Lorenz-type curve is a visual representation of the degree of concentration with regard to the contribution of individual industries to the changes in aggregate labour productivity. Finally, we re-scale the vertical axis, so that it corresponds to the average annual growth of value added per employee for total manufacturing.

The graphs in Figure 5.1 are easy to interpret. A straight line from the origin to the end, where the cumulated shares of value added in the base year amount to 1, implies that the contribution of all industries to the aggregate growth of labour productivity was in exact proportion to their initial size. Conversely, a strong curvature of the line indicates that the contributions to aggregate productivity growth are unevenly distributed across industries, although checks were made for variations in initial size.

Despite the differences resulting from the use of nominal labour productivity, the graphs are very similar to Harberger's and generally lead us to reject any strict form of the yeast analogy. As it appears, productivity growth exhibits a more uniform pattern in some periods and a more varied performance in others. For example, in Austria and Germany between 1985 and 1992, the curve comes close to being a straight line and would correspond much better to the analogy of yeasts than mushrooms. In many other cases

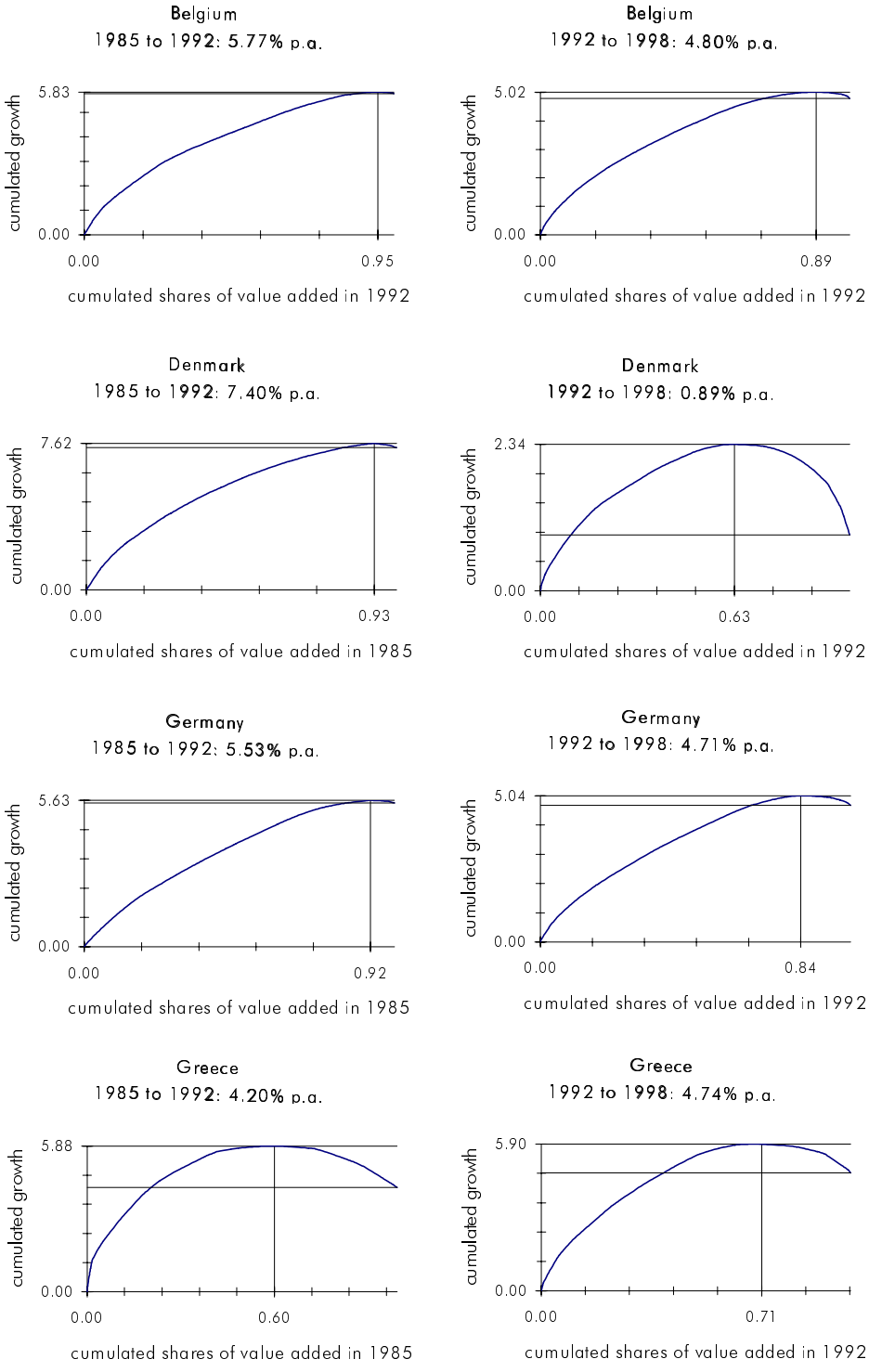
however (e.g. Ireland, Sweden, and Finland), the presence of structural change is clearly visible and has an obvious impact on aggregate productivity growth in manufacturing.

In the European Union, between 1985 and 1992 most member states seem to have experienced a rather uniform contribution to aggregate productivity growth by industries; however, a sharp increase in structural change is evident during the years following 1992. During the period 1985-1992, average annual growth in labour productivity in the EU amounted to 5.17 %, whereas during the latter period it was only 3.93 %. For the United States, the reverse pattern can be observed: much structural change but low aggregate productivity growth (1.39 %) took place during the first period. During the second period, the distribution between industries was relatively uniform, while the growth rates of aggregate labour productivity in total manufacturing were extraordinarily high (8.29 %). To sum up, I suggest the confirmation of the following general lessons from this section:

- First, industries generally do not contribute equally to overall growth in labour productivity. The amount of variation observed implies that diversity and heterogeneity at the level of markets and industries are undeniable facts of economic development.
- Secondly, structural change itself is not a uniform process. It appears in clusters, and is more pronounced for some industries in certain periods, and less in others.
- Thirdly, the graphs suggest a certain tendency for structural change to be more pronounced during eras of low aggregate growth, whereas smoother developments are often evident in conjunction with larger productivity increases on average.

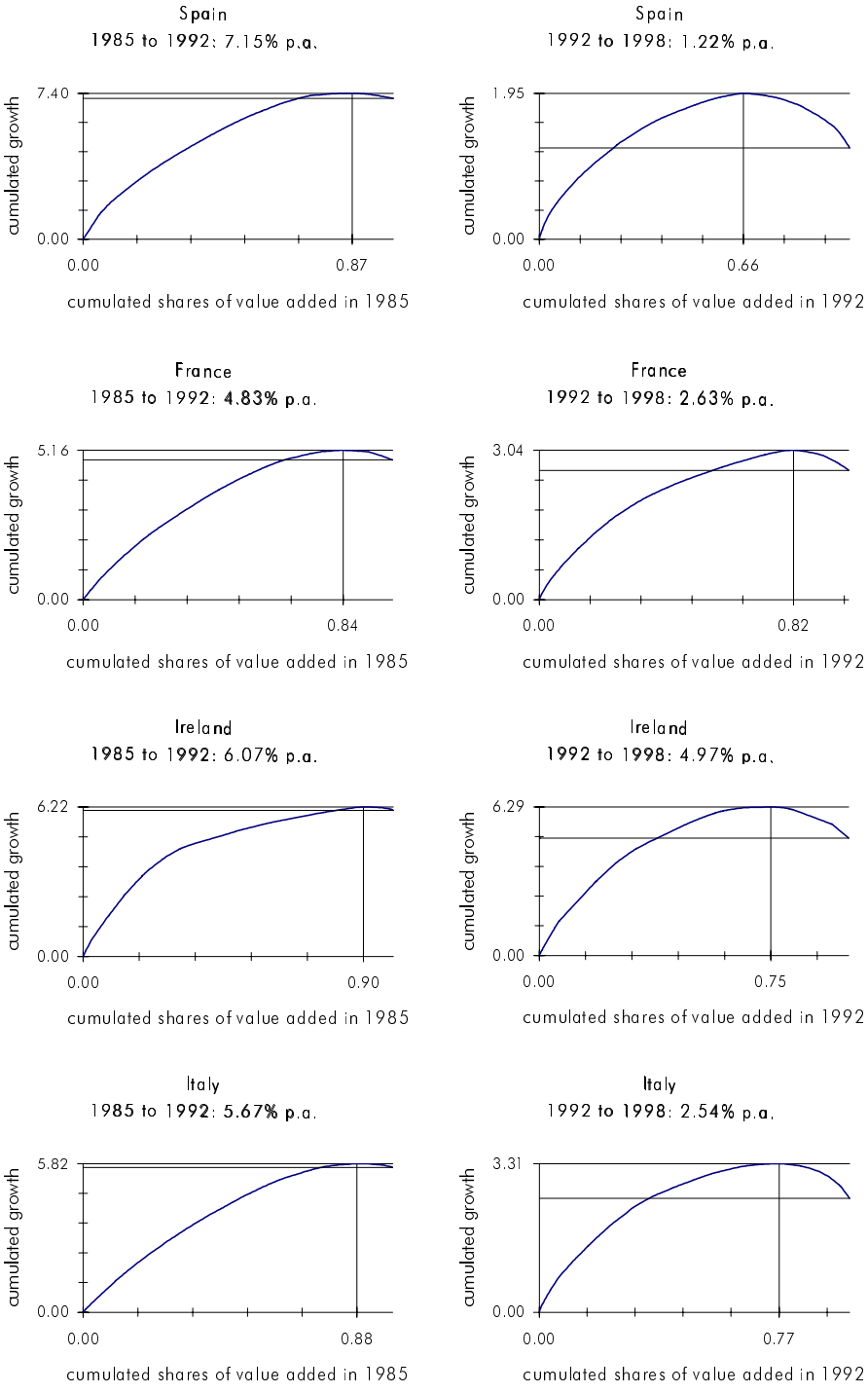
The last point is, of course, the most speculative and no direct causal interpretation is readily available. The reason is that we do not have sufficient knowledge regarding the sequence of mutual influences. Is the lack of structural change a cause of higher aggregate growth, or are both a consequence of substantial restructuring during prior periods? The latter interpretation is consistent with Schumpeter´s notion of creative destruction, clustered in certain periods of major technological breakthroughs, enabling productivity growth to be more evenly distributed during the time thereafter. The impressive productivity surge in the USA throughout the 1990s might best illustrate this pattern of development. For the EU, which is currently passing through a process of intense restructuring, this offers an optimistic outlook on the prospects for future growth.

Figure 5.1: Contributions to the aggregate growth of labour productivity in manufacturing



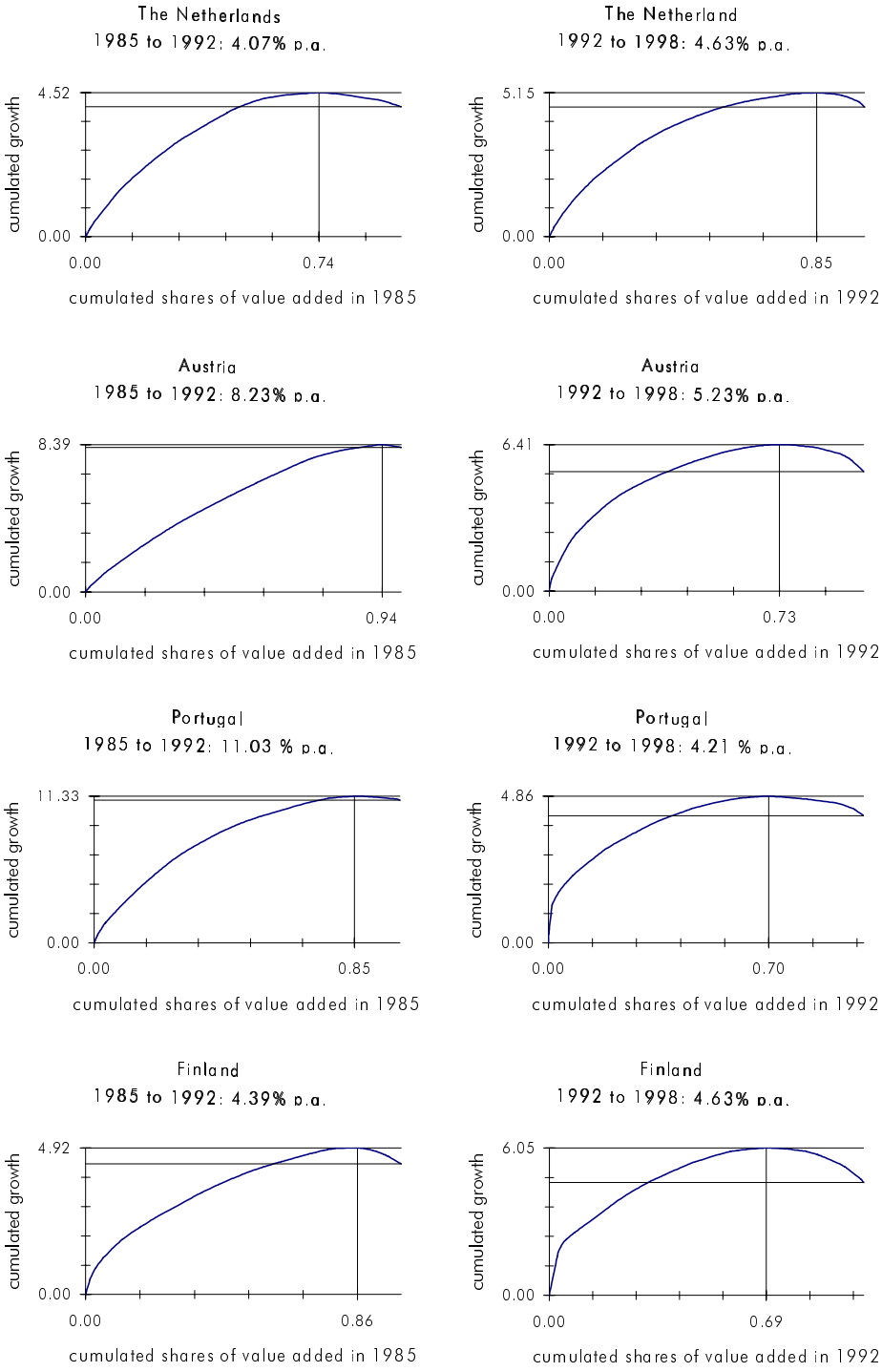
Source: EUROSTAT, WIFO calculations.

Figure 5.1: Contributions to the growth of labour productivity in manufacturing (continued)



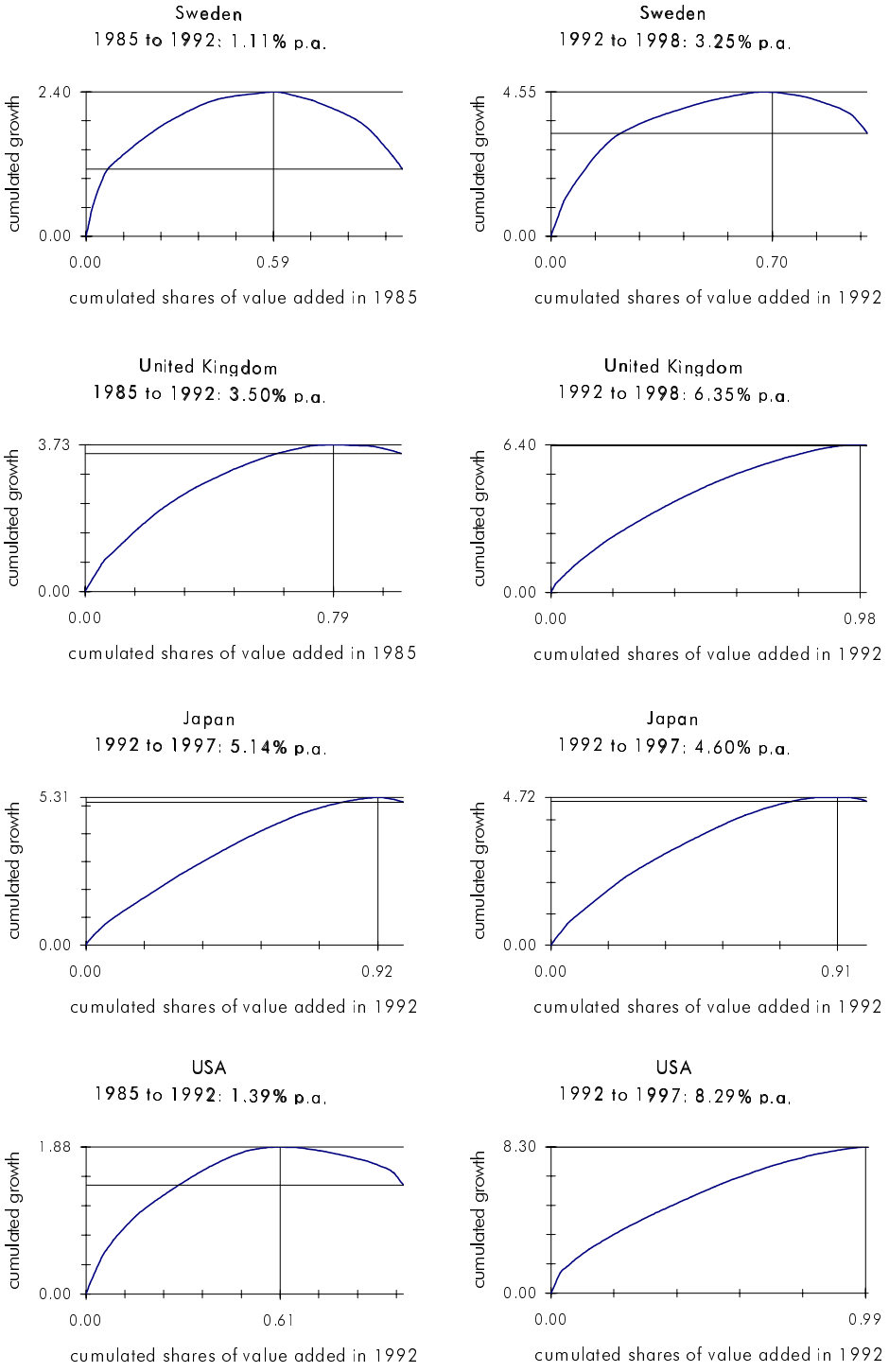
Source: EUROSTAT, WIFO calculations.

Figure 5.1: Contributions to the growth of labour productivity in manufacturing (continued)



Source: EUROSTAT, WIFO calculations.

Figure 5.1: Contributions to the growth of labour productivity in manufacturing (continued)



Source: EUROSTAT, WIFO calculations.

5.3 "Structural bonus or burden": a decomposition analysis

What the sunrise diagrams do not reveal, is to what extent the observed variations across industries have a net impact on macroeconomic developments. Do they cancel each other out, or are there more systematic forces, so that as an aggregate their combined impact makes a difference? The common *structural bonus hypothesis*, for example, postulates a positive relationship between structural change and economic growth, based upon the assumption that during the process of economic development, economies upgrade from activities with relatively low productivity levels to industries with a higher value added per labour input (Timmer and Szirmai, 2000). This hypothesis is presented primarily in reference to the manufacturing sector. Although the prediction it implies is not always quite precise, we can, at least for the purpose of the following analysis, take it as an expectation that the reallocation of labour favours industries with higher *levels* of labour productivity.

In contrast, the famous "cost disease" argument of unbalanced growth presented by Baumol (1967) and Baumol et al. (1985) supports a hypothesis based on the *structural burden* of developed economies, primarily related to services. It basically states that because of the limited potential to increase labour productivity through technological progress and the cumulation of complementary inputs to production, industries such as most of the personal, social and public services, cannot compensate for the rise in wage levels, forced upon them by the more progressive industries with high productivity growth. The consequence is a natural and unavoidable rise in the cost of production, as well as increasing shares in employment and nominal output. Hence, the specific hypothesis with respect to Baumol´s cost disease is that labour resources gradually shift from dynamic industries with high productivity growth towards less progressive industries characterised by lower rates of productivity growth. It implies a negative impact of structural change on the prospects for aggregate growth.

Shift-share analysis provides a convenient means of investigating both the structural bonus hypothesis and the relevance of Baumol´s cost disease. Applying the same methodology as presented e.g. in Fagerberg (2000) or Timmer and Szirmai (2000), we decompose the aggregate growth of labour productivity into three separate effects:

$$growth(LP_T) = \frac{LP_{T,fy} - LP_{T,by}}{LP_{T,by}} = \frac{\overbrace{\sum_{i=1}^{n} LP_{i,by}(S_{i,fy} - S_{i,by})}^{\text{I: static shift effect}} + \overbrace{\sum_{i=1}^{n} (LP_{i,fy} - LP_{i,by})(S_{i,fy} - S_{i,by})}^{\text{II: dynamic shift effect}} + \overbrace{\sum_{i=1}^{n} (LP_{i,fy} - LP_{i,by})S_{i,by}}^{\text{III: within growth effect}}}{LP_{T,by}} \quad (3)$$

T= Σ over industries i; SL_i = share of industry i in total employment (= L_i/L_T); n = number of industries

First, the structural component is calculated as the sum of relative changes in the allocation of labour across industries between the final year and the base year of the period under observation, weighted by the initial value of labour productivity in the base year. This component is called the *static shift effect*. It is positive/negative if industries with higher productivity attract more/less labour resources and hence increase/decrease their share of total employment. For the purpose of this section, we specify the structural bonus hypothesis in terms of the positive effect this first component has on the aggregate growth of labour productivity:

The *structural bonus* hypothesis of manufacturing: $\sum_{i=1}^{m} LP_{i,by}(S_{i,fy} - S_{i,by}) > 0$, (4)

m = number of manufacturing industries

Secondly, *dynamic shift effects* are captured by the sum of interactions of changes in labour shares times changes in labour productivity of industries. If industries increase both labour productivity and their share of total employment, the combined impact is a positive contribution to overall productivity growth. (Of course, the same applies if industries are characterised by a simultaneous fall in labour productivity and employment shares). In other words, the interaction term becomes larger, the more labour resources shift towards industries with fast productivity *growth*. The interaction effect is however negative, if industries with fast growing labour productivity cannot maintain their shares in total employment. The negative effect is larger, the more industries with high productivity growth are faced with declining employment shares. This interaction term seems to be a convenient tool for capturing the essential argument of Baumol´s story of "unbalanced growth", which predicts that employment shares will shift away from progressive industries towards those with lower labour productivity growth:

The *structural burden* hypothesis of services: $\sum_{i=1}^{n} (LP_{i,fy} - LP_{i,by})(S_{i,fy} - S_{i,by}) < 0$ (5)

The third effect corresponds to growth in aggregate labour productivity under the assumption that no structural shifts have ever taken place and each industry has maintained the same amount of shares in total employment as during the base year. To avoid a common fallacy, we must however recall that the frequently observed near equivalence of within industry growth and aggregate growth cannot be cited as evidence against large variations in industrial structure. Even in the case that all the positive and negative structural effects net out, Harberger´s mushroom story can still be counted as a correct description of economic activity at disaggregated levels. However, its relevance to the comprehension of macroeconomic developments would be diminished.

Table 5.1 displays the results of the shift-share analysis for the European Union as a whole, whereas the according numbers for individual member countries of the EU plus Japan and the United States are reported in the appendix. Corresponding to the decomposition in equation (4), the sum of the static and the dynamic shift effects, as well as the within-industry effects, is equal to the average growth of labour productivity in the according aggregate (i.e. the first cell of each sub-table). This is how the data sums up horizontally. Vertically, for each of the three components, the contributions made by each sector or type of industry also sum up to the according number in the first line of each sub-table. The numbers in brackets are displayed as additional information about the average growth of labour productivity within the individual sectors and industry types and sum up neither in the horizontal nor in the vertical dimension.

Due to the effects of general price inflation, it is always difficult to detect structural effects, while relying on nominal labour productivity data. Conversely, the comparability of international data on real labour productivity growth is very limited, due to the lack of reliable price deflators at the level of individual industries. Therefore, wherever available, the tables in the appendix provide the numbers on both nominal and real values for the rather aggregate shifts between the three sectors of agriculture, industry and services. This helps us to acquire a broad impression of the relative importance of general price inflation with respect to the within-growth effects. It is thus easier to gain a better perspective on the large differences in the more detailed disaggregations of the manufacturing sector, for which meaningful disaggregated data were only available at current prices.

For the European Union as a whole, comparable data on productivity growth in the primary, secondary and tertiary sectors are only available for the rather short period

between 1995 and 1999 (Table 5.1). Measured at constant prices, the relatively modest annual growth rate of 0.82 % is almost identical to the within-growth effect, i.e. the general contribution of actual growth rates, keeping employment shares constant over the entire period. However, looking at this decomposition only from such an aggregate perspective hides important structural changes at the level of individual sectors. This is particularly relevant for the services sector, where the overall contribution to total value added per employee is almost evenly split between the static shift and the within growth component. In other words, the services sector contributes to GDP per capita via two distinct channels. First of all, through its overall growth in value added per employee, just as in any other sector. Secondly, and in contrast to the two other sectors, by means of its growing employment shares. However, the negative effects from losses in employment shares in the other two sectors, where on average, labour productivity was higher than in services, more than compensate for the positive contribution to the static shift effect. Measured at current prices, the overall picture is the same, except that the within-growth component is much larger, due to general price inflation.

The time span under consideration is, of course, too short to allow us to draw general conclusions based on this evidence alone. The appendix provides detailed tables for individual member states of the European Union, as well as for Japan and the USA. In most cases, the time period covered is considerably longer and the numbers are therefore more reliable. In the following paragraphs, we take a few individual countries as illustrative examples and then try to summarise some stylised facts.

Beginning with the United Kingdom as an example of a large European economy, the average annual rate of real growth in labour productivity amounted to 1.71 % between 1989 and 1999. Due to the negative contributions of the static and the dynamic shift effects, average productivity growth would hypothetically even have been 0.16 % higher per year, if no structural change had occurred at all. The tables provide a detailed explanation. Structural change mostly comprised shifts in employment from high-productivity primary and secondary sectors towards the tertiary sector, characterised by (i) a comparatively low level of labour productivity, which in turn led to the negative static shift effect and (ii) a lower rate of productivity growth, which resulted in a negative dynamic shift effect. Being by far the largest sector of all, services still contribute about half of all

within-growth effects, despite the comparatively low annual increases in labour productivity in this sector.

The overall patterns differ somewhat in France, Germany, and Italy, as well as in other countries, in so far as besides the negative dynamic shift effect, the static component of structural change is positive. The reason is that in all these countries, the expanding services sector exhibits a higher level, but a lower growth rate for labour productivity in comparison to the sectors of industry and agriculture. As a consequence, static and dynamic shift effects work in different directions and partly offset each other. The same pattern applies e.g. to Austria, where the static shift effect was positive, but the dynamic component of structural change was negative. From an aggregate perspective, both are rather small compared to the within-growth effects, assuming constant shares in total employment. However, examining the services sector in greater detail reveals that more than half of its contribution to overall growth in labour productivity is due to its increasing share of labour resources.

Focusing only on manufacturing industries allows us to take a closer look at the structural changes occurring between the different taxonomic groups. Distinguishing industries according to their typical factor input combinations, the two groups which exhibited the highest overall rates of productivity growth simultaneously experienced a decrease in total employment shares. For technology driven industries, this effect is of negligible size, but in the group of capital intensive industries, the decrease in employment shares was very sharp and consequently resulted in a negative structural component for the static and the dynamic shift effects. The downscaling of labour inputs in highly productive capital intensive industries overshadows all the positive contributions of structural shifts in marketing driven industries or mainstream manufacturing. In the case of Austria, this aspect is particularly pronounced: The decline of capital intensive industries has had a larger impact on growth in total labour productivity than the positive static and dynamic shift effects in all four other industry types. The consequence is a negative direct impact of structural change on the aggregate labour productivity of total manufacturing.

If one takes the same industries, but looks at them from the perspective of the human resources dimension, the structural effects even assume a positive character, due to the fast downscaling of low-skill industries characterised by weak productivity performance. Distinguishing manufacturing industries according to their typical inputs of external services

also reveals positive shift effects. This can be attributed to the rising employment shares in industries with relatively large purchases of knowledge-based services, as well as retail and advertising services, which on average exhibit higher levels and growth rates of labour productivity than the two other industry types.

Supported by the above examples and the additional details provided in the appendix, we can summarise the following stylised facts:

- First of all, offsetting effects of shifts in employment shares of industries with high and low levels of labour productivity, as well as high and low productivity increases, explain why shift share analyses regularly fail to reveal substantial positive direct contributions of structural change to aggregate growth.

- Secondly, the structural bonus hypothesis of manufacturing must be rejected as a general force of economic growth in developed nations. Several branches with especially high levels of labour productivity, such as the group comprising of capital intensive production, could not escape passing through the stages of maturity within their respective industry life cycles. The combination of high productivity growth together with limited opportunities for expansion necessarily leads to decreasing employment shares. If the positive effects of the other industries are not sufficiently large to offset this tendency, the structural effects must be negative. In the aggregate, the static shift effect is positive in some countries, but negative in others. But it is in any case of comparatively modest size.

- Thirdly, a detailed look beyond the aggregate results and into the contributions of individual sectors or industries included in the decomposition analysis demonstrates that structural change is nevertheless an apparent fact of economic development. It is particularly pronounced in the continuous shifts of labour resources from primary and secondary sectors towards the service industries.[13]

[13] A more detailed empirical analysis of this aspect is presented in Peneder, Kaniovski, and Dachs (2001). Basing their investigation on input-output analysis, they demonstrate that this process of tertiarisation is itself driven by large structural changes within the services sector.

Table 5.1: Decomposition of growth in labour productivity in the European Union

EU					
	Total		static shift	dynamic shift	within-growth
1995-1999 constant prices					
Total	*+0.816*	=	*+0.023*	*–0.008*	*+0.800*
			=	=	=
Agriculture	(+4.05)		–0.051	–0.006	+0.078
Industry	(+0.86)		–0.327	–0.012	+0.276
Services	(+0.68)		+0.402	+0.011	+0.447
1995-1999 current prices					
Total	*+3.287*	=	*+0.023*	*+0.017*	*+3.247*
			=	=	=
Agriculture	(+1.97)		–0.051	–0.003	+0.038
Industry	(+2.57)		–0.328	–0.037	+0.827
Services	(+3.61)		+0.402	+0.057	+2.382
1985-1998 current prices					
Manufacturing	*+6.097*	=	*–0.033*	*–0.114*	*+6.245*
Taxonomy 1	*+6.097*	=	*–0.056*	*–0.048*	*+6.201*
			=	=	=
1. MM	(+5.83)		+0.038	+0.032	+1.556
2. LI	(+4.27)		–0.019	–0.015	+0.951
3. CI	(+8.22)		–0.213	–0.164	+1.038
4. MDI	(+5.55)		+0.139	+0.101	+1.127
5. TDI	(+8.44)		–0.002	–0.002	+1.528
Taxonomy 2	*+6.097*	=	*+0.016*	*+0.010*	*+6.071*
			=	=	=
1. LS	(+5.52)		–0.187	–0.153	+2.018
2. MBC	(+5.59)		+0.142	+0.117	+1.297
3. MWC	(+6.72)		+0.043	+0.031	+1.739
4. HS	(+7.07)		+0.018	+0.014	+1.018
Taxonomy 3	*+6.097*	=	*+0.023*	*+0.021*	*+6.052*
			=	=	=
1. IKBS	(+6.86)		+0.061	+0.049	+1.132
2. IR&A	(+6.41)		+0.106	+0.084	+1.620
3. ITR	(+6.41)		–0.043	–0.036	+1.527
4. Other	(+5.16)		–0.102	–0.075	+1.773

Source: EUROSTAT, OECD, WIFO calculations.

- Fourth, according to most of the data sets, services exhibit the lowest annual rates of productivity growth when the measurement is made in real terms, but appear to fare much better when the measurement is made at current prices. This means that in general, the basic assumptions of Baumol´s unbalanced growth argument do apply. Consequently, in almost all the observed cases, the *structural burden hypothesis* of the services sector (which predicts negative dynamic shift effects) is confirmed when productivity is measured in real terms.

- Fifth, some types of industries systematically achieve higher rates of productivity growth than others. Besides the capital intensive branches, these are above all the groups of industries which are characterised as particularly technology driven, high-skilled, and exhibiting an exceptionally high demand for knowledge-based services. Since these industries typically exhibit the greatest potential for positive contributions to aggregate growth, enabling structural change in favour of such activities remains a relevant task of growth oriented economic policy.

Although the above results have a welcome, sobering effect on overly optimistic expectations regarding the aggregate benefits of structural change, the limited nature of the methodology cannot be accepted as an adequate settlement of the issue. Based upon the information presented in this section, we cannot draw the general conclusion that structural change did not affect aggregate growth in the nineties. Instead, we have learned that the relationship is more complex than mechanical shift share analysis can reveal. There are different effects with different signs for different industries. In the aggregate, many – but not all of these net out.

Consistent with the conclusions drawn by Fagerberg (2000, p. 405), our results confirmed that *on average* structural change has a rather weak impact on the aggregate growth of labour productivity. But structural change in favour of some *specific types* of industry might still be more conducive to aggregate growth performance than other forms of structural change. In the following econometric analyses, we will therefore include structural variables on specific types of industries.

5.4 "Producer & user related spillovers": the econometric evidence

As a pure accounting procedure, decomposition analysis can only detect the direct effects of structural shifts at the industry level on aggregate growth performance. In contrast, an econometric approach offers two important advantages: First of all, the potential impact of structural change on productivity growth is not limited to effects which are directly accountable, but additionally captures indirect effects resulting from spillovers between different kinds of economic activities. Such spillovers might result from the implementation of new, state-of-the-art products and services (user related *"rent" spillovers*), as well as through the diffusion of knowledge about, for example, technologically sophisticated methods of production (producer related *"knowledge" spillovers*). In the former case, externalities are intrinsic to the goods purchased and need not be related to any kind of spatial proximity in production. In the latter case, however, the near presence of certain kinds of businesses is advantageous to other activities as well.

The second major advantage of an econometric approach is the ability to control for the impact of other important growth determinants. Our analysis will be based upon a data panel comprised of $i = 27$ OECD countries over a period of $t = 9$ years (1990 to 1998). The panel structure is important, because in traditional cross-country regressions, we can only account for those determinants, which are tangible enough to enable the proper measurement of internationally comparable indicators. If it is however true that intangible factors such as knowledge, organisation, and institutions (Nelson, 1998), which comprise many dimensions of social interaction that cannot be readily observed or measured, have a decisive impact on an economy´s path of development and growth, then the use of a panel framework offers great advantages over cross-country analysis. The simple reason is that it allows to control for heterogeneity in unobservable individual country effects.[14]

[14] For a detailed discussion of the benefits and limitations of panel econometrics see Baltagi (1995). Its application to growth analysis was pioneered by Islam (1995), who allowed for heterogeneity only in intercepts. The same approach is also taken in this report. The controversy as to whether or not allowances should also be made for heterogeneity in slope parameters is presented in Lee, Pesaran and Smith (1998) and Islam (1998). An intermediate approach, the so-called "pooled mean group estimation", was recently applied by Bassanini and Scarpetta (2001) as well as Bassanini, Scarpetta, and Hemmings (2001). Mean group estimations were not pursued in this study, because of limited sample size.

Industrial structure and economic development

To begin with, we focus our attention on the *levels* of economic development, measured by GDP per capita at purchasing power parities (PPP). Additionally, we implement a set of structural variables, which define for each country *i* the share of services (*SOS*) in total value added and the shares of specific types *j* of manufacturing industries in total exports (*XSR*) and imports (*MSR*) relative to the OECD:

$$SOS_i = \frac{VA_i^{services}}{VA_i^{total}} \qquad XSR_i^j = \frac{\frac{X_i^j}{X_i^{tm}}}{\frac{X_{oecd}^j}{X_{oecd}^{tm}}} \qquad MSR_i^j = \frac{\frac{M_i^j}{M_i^{tm}}}{\frac{M_{oecd}^j}{M_{oecd}^{tm}}} \;;$$

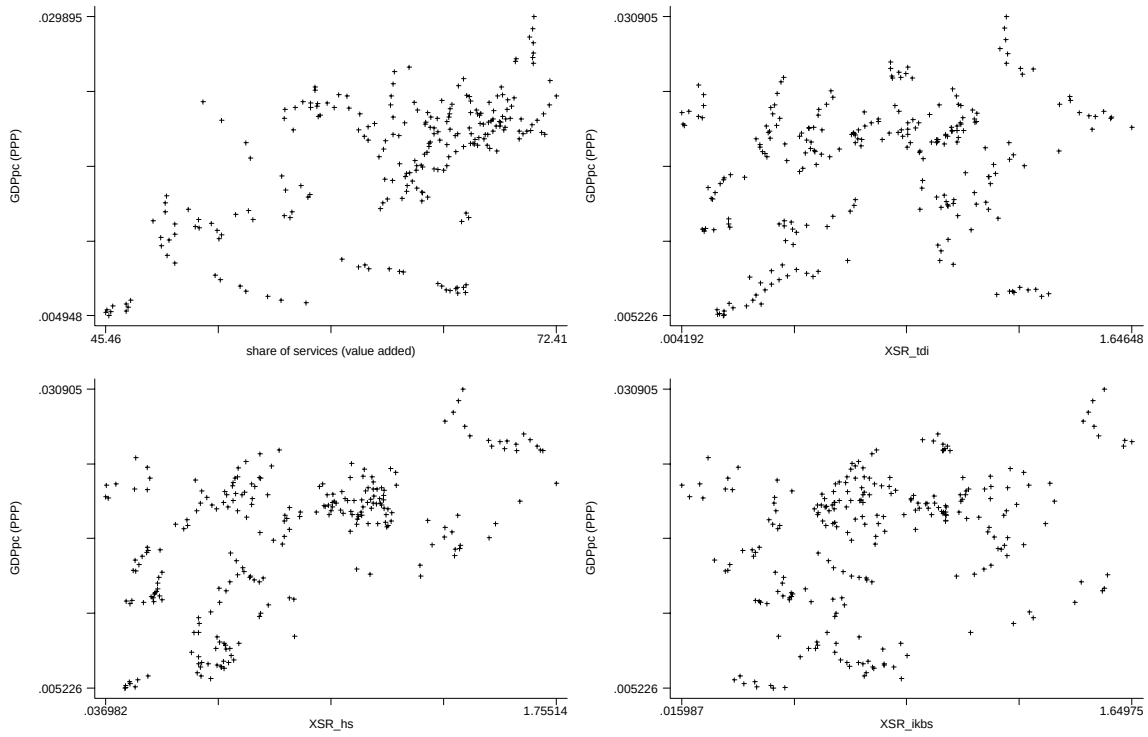
Note: SOS = share of services; XSR = relative export shares of industry type; MSR =relative import shares; tm = total manufacturing.

The scatterplots in Figure 5.2 already suggest that indicators of relative size for particular kinds of economic activities are positively related to the level of economic development. The first graph demonstrates that over the course of time, countries not only tend to increase their GDP per capita, but also experience systematic increases in the size of the services sector relative to the rest of the economy. In other words, income growth and shifts in the sectoral composition of output are simultaneous features of economic development.

But the positive relationship between industrial structure and economic development cannot be reduced to the simple correlation in time between income growth in general and some specific, fast-growing sector. This is demonstrated by the three other charts, in which GDP per capita is related to the shares in total exports/imports relative to the OECD for specific types of industry.

These structural variables are not affected by the general increase in the trade shares. They are characterised only by their relative position vis-à-vis the rest of the OECD countries. More than merely indicating general shifts in the composition of output, the XSR variables indicate an economy´s competitive performance with respect to these industries. In all three cases, correlations are positive and between the range of 0.25 (for technology driven industries) and 0.53 (for skill intensive industries).

Figure 5.2: Industrial structure and GDP per capita: 27 OECD countries, 1990 to 1998

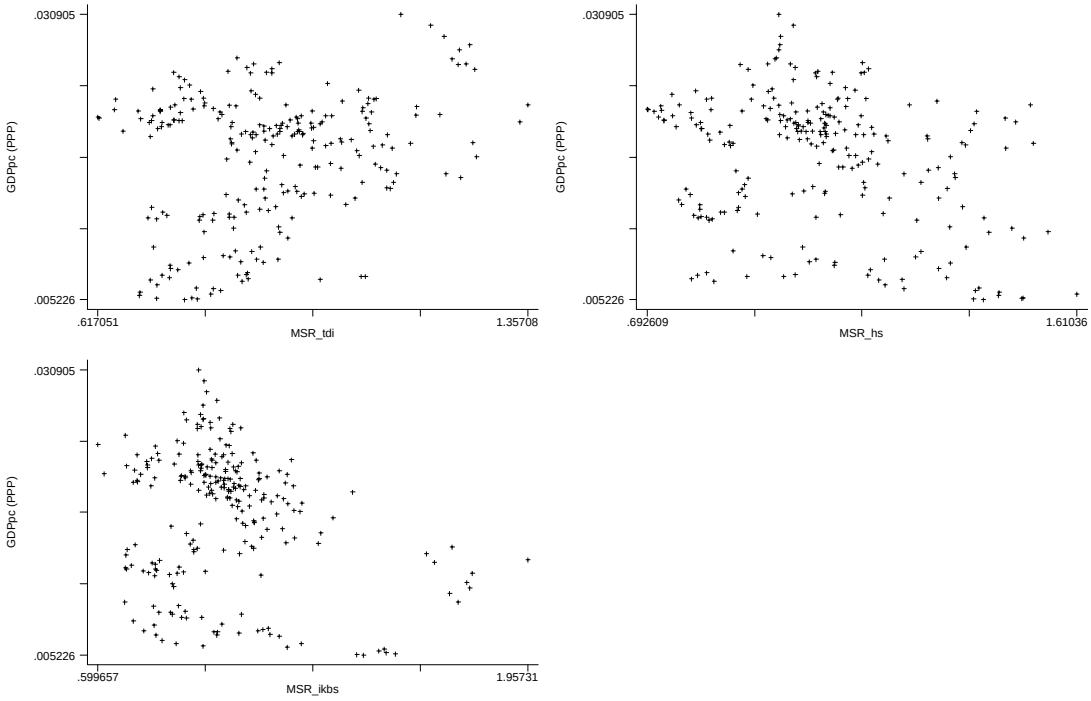


Note: XSR = shares in total exports relative to OECD; tdi = technology driven industries; hs = high skill industries; ikbs = industries with many external inputs of knowledge based services.

Source: OECD, UNO, WIFO calculations.

Replacing relative shares in total exports with respective import shares confirms a visible relationship, which this time, however, heads in different directions for the distinct types of industry (Figure 5.3). The import shares of technology driven industries are positively related to the level of GDP per capita, and the size of the correlation coefficient (0.27) is approximately the same as for relative export shares. Nevertheless, a negative correlation is found between the relative import shares of high skilled industries (-0.31) and industries with many external inputs of knowledge based services (-0.22). A possible interpretation is that technology driven industries generate both positive producer and user related spillovers. For the two other types, the observed distribution in Figures 5.2 and 5.3 is only consistent if positive externalities require proximity to its production, but are not fully embedded in tradable goods. In these cases, an increasing share of imports might indicate a lack of competitive performance with corresponding negative effects on productivity growth.

Figure 5.3: Import shares and GDP per capita: 27 OECD countries, 1991 to 1999



Note: MSR = shares in total imports relative to OECD; tdi = technology driven industries; hs = high skill industries; ikbs = industries with many external inputs of knowledge based services.

Source: OECD, UNO, WIFO calculations.

For the following econometric analysis we use a fixed effects panel regression of the form:

$$lY_{i,t} = \alpha + \beta_1 lPOP_{i,t} + \beta_2 lPOPWA_{i,t} + \beta_3 EMR_{i,t} + \beta_4 EMR_{i,t-1} + \beta_5 lINVT_{i,t-1} + \beta_6 \Delta lINVT_{i,t} + \beta_7 EDU_{i,t-1} + \beta_j \mathbf{X}_{i,t-1} + \eta_t + \mu_i + \varepsilon_{i,t} \quad (6)$$

The dependent variable $lY_{i,t}$ is given by the logarithm of GDP per capita at purchasing power parities for country *i* in year *t*. The following explanatory variables have been included in order to capture different determinants of economic development:

The logarithms for the total population (*lPOP*) and the total population at working age (*lPOPWA*) were included as a means of evaluating the influence of *demographic changes* in the population of a country. Ceteris paribus, GDP per capita falls when the population grows; therefore, the expected sign of the coefficient β_1 is negative. In contrast, if the general size of the population is taken into consideration, a larger fraction of the

population at working age is expected to have a positive impact on overall productive capacity, increasing overall GDP. Thus we expect β_2 to be positive.

We use the employment rate (*EMR*) to control for country specific differences in the *business cycle*. The regression also includes the time dummies η_t , which enable us to control for global business cycle effects. As labour productivity should develop in a procyclical manner, we expect β_3 to be positive. The opposite applies to the lagged employment rate (EMR_{t-1}), for which a higher value of β_4 signals *tighter labour markets*. Investment in physical capital is captured by two variables: first, by the lagged value of total investments in the previous year ($lINVT_{t-1}$) and secondly, by its growth rate ($\Delta lINVT$). The coefficients β_5 and β_6 thus reflect the short and long run impact of *capital deepening* on GDP per capita and should be positive. The same applies to the *human capital* variable, which is given by the lagged level of the average number of years in training or education (*EDU*).

What then follows is a vector of structural variables (*X*) which, in varying combinations, capture different aspects of relative size in certain types of activities. Since tertiarisation was one of the most impressive processes of structural change throughout the 20th century, the lagged share of services in total value added (SOS_{t-1}) was introduced first. For manufacturing industries, variables on the two very special groups of technology driven and human capital intensive industries turned out to be valuable additions to the regression. The shares of industries with large inputs from knowledge based services was barely significant in any analogously defined specifications and is therefore omitted.

In order to avoid problems of endogeneity, all the structural variables are entered as lagged values (*t-1*); in the case of the *XSR,* variables are also combined with the past growth rates of the respective ratios. The signs of the coefficients for the relative export shares of technology driven and skill intensive industries are expected to be positive, if there are producer related spillovers. In contrast, relative import shares will only turn out to be significant, if there are also user related spillovers from intrinsic characteristics of the goods purchased. Recalling the simple correlations and the scatterplot above, at first sight, the share of services also seems to be positively related. However, the potential consequences of Baumol´s unbalanced growth argument warn us to be equally prepared for a negative impact.

The OECD ECO database was the source of all the data on GDP, population, employment, and physical investment. Data on education were taken from Bassanini and Scarpetta (2001)[15]. Value added shares in the services sector were extracted from OECD (2000B). All the other structural variables stem from the UN world trade database, whereby SITC 4 digits were recoded into NACE 3-digits, before aggregation into the according industry types of the three taxonomies. The results are presented in Table 5.2, whereby Specification I is the basic model, with no variables for industrial structure. Specification II adds the value added shares of the services sector to the explanatory variables. In Specifications III and IV, the set is expanded by the structural variables for technology driven and skill intensive industries. Finally, Specification V combines indicators of the share of services with the relative export shares of technology and skill intensive industries.

Of the many variables, *EDU* is the most critical. Its limited availability means that the initial sample of 28 countries was reduced by one quarter. As a consequence, we present two tables in which the specifications are all identical, with the exception that Table 5.2 includes the education variable, whereas it is excluded in Table 5.3. The latter refers instead to a larger set of countries. Although the size of coefficients differ somewhat between the two tables, the results turn out to be surprisingly robust, despite this variation in the number of available observations.

The demographic variables exhibit the correct signs but are not always significant. As expected, the coefficient for population size is negative but only significant when variables on technology driven and skill intensive industries are included. Population at working age has a positive influence on GDP per capita, but is only significant as long as data on skill intensive industries are excluded. The employment rate coefficient is significantly positive (except for Specification II) and seems to work well in capturing some procyclical effects of the general business climate. The negative impact of the lagged employment rate, indicating the relative tightness of the labour market, works as expected. Interestingly, its significance tends to improve with the inclusion of further structural variables. The lagged levels and the growth rates of investment in physical capital are by far the most robust

[15] They gained the data from De la Fuente and Donénech (2000) and complemented it with information from the regular OECD series "Education at a Glance".

explanatory variables. With coefficients ranging between 0.20 and 0.43, capital investment appears to be the single most important determinant of GDP per capita. It is again surprising to see that the average years of education are only a significant determinant when the structural variables concerning technology driven and skill intensive industries are included. In all these specifications, its coefficient is of about the same magnitude: an increase in the average length of education by one year raises the income level by 7 %.

In striking contrast to the positive relationship clearly visible in Figure 5.2, an evaluation of the above set of standard explanatory variables reveals that the share of services turns out to be only weakly related to GDP levels. Indeed, its coefficient for the lagged variable is even negative, very small, and only significant if no other structural variables are included. An obvious explanation would be that in the case of services, causality mostly works the other way round: Higher levels of GDP per capita lead to larger shares for the services sector, due to its comparatively higher income elasticities of demand. Although this is a plausible explanation, it is not our concern here. Using the lagged value of SOS, we only permitted causality to run from industrial structure to growth and not in the reverse direction.

The impact of the relative shares of technology driven and skill intensive industries is more robust. Their lagged values for relative shares in total exports are significantly positive in all the specifications, even when all three structural variables are included. In Specification V, the quantitative impact of an increase in export shares of skill intensive industries relative to the OECD by one unit amounts to a 7 % increase in GDP per capita. For the group of technology driven industries, the same effect results in additional productivity growth of 13%. For skill intensive industries, an increase in the growth of relative shares by one percentage point has an additional effect of 10 %. In the respective specifications in which relative import shares were included, the group of technology driven (but not skill intensive) industries appears to generate positive user related rent spillovers in addition to the positive knowledge spillovers related to production.

Table 5.2: Fixed effects panel regression of Log GDP p.c.: 1990 to1998 (with education)

Log GDP per capita at PPP – LSDV					
	I	II	III	IV	V
lgdppc	β (t)	β (t)	β (t)	β (t)	β (t)
lPOP	–2.3498***	–2.2253***	–0.2477	–0.4102	0.2876
	(–7.23)	(–6.59)	(–0.87)	(–1.30)	(0.88)
lPOPWA	1.5694***	1.3403***	0.5499**	0.4345	–0.1233
	(6.55)	(5.39)	(2.10)	(1.49)	(–0.42)
EMR	0.4490**	0.2877	0.4179*	0.6544**	0.5970**
	(2.25)	(1.16)	(1.73)	(2.42)	(2.35)
EMR $_{(t-1)}$		0.0317	–0.3553	–0.6553**	–0.5875**
		(0.17)	(–1.54)	(–2.56)	(–2.31)
lINVT $_{(t-1)}$	0.2018***	0.2089***	0.2426***	0.2782***	0.2733***
	(4.98)	(4.94)	(5.56)	(5.73)	(5.67)
Δ lINVT	0.2479***	0.2525***	0.2685***	0.3009***	0.2652***
	(5.81)	(5.43)	(6.01)	(6.07)	(5.47)
EDU $_{(t-1)}$	0.0226	–0.0024	0.0717***	0.0680***	0.0721***
	(1.56)	(–0.14)	(7.13)	(5.94)	(6.50)
SOS $_{(t-1)}$		–0.0052***			–0.0006
		(–2.83)			(–0.31)
XSR_tdi $_{(t-1)}$			0.0991***		0.1342***
			(3.20)		(3.88)
Δ XSR_tdi			0.0803*		0.0562
			(1.84)		(1.03)
MSR_tdi $_{(t-1)}$			0.1156***		
			(3.63)		
XSR_hs $_{(t-1)}$				0.1145***	0.0701*
				(3.30)	(1.95)
Δ XSR_hs				0.0898**	0.1012**
				(2.45)	(2.41)
MSR_hs $_{(t-1)}$				0.0186	
				(0.62)	
year dummies (η_t)	yes	yes	yes	yes	yes
No. observations	178	152	156	156	136
No. countries	21	19	21	21	19
R-sq within:	0.9144	0.9333	0.9390	0.9242	0.9483

Note: XSR = shares in total exports relative to OECD; tdi = technology driven industries; hs = high skill industries; ikbs = industries with much external inputs of knowledge based services.

Source: OECD, UNO, WIFO calculations.

Table 5.3: Fixed effects panel regression of Log GDP p.c.: 1990 to1998 (without education)

Log GDP per capita at PPP – LSDV					
	I	II	III	IV	V
lgdppc	β (t)	β (t)	β (t)	β (t)	β (t)
lPOP	–2.3186***	–2.1263***	–0.6054*	–0.6049*	–0.2577
	(–8.26)	(–7.12)	(–1.90)	(–1.83)	(–0.75)
lPOPWA	1.5103***	1.2487***	0.6007**	0.4517	0.0872
	(6.48)	(5.15)	(2.16)	(1.57)	(0.30)
EMR	0.3135**	–0.3223	–0.1441	0.2771	–0.0382
	(2.10)	(–1.26)	(–0.51)	(0.94)	(–0.13)
$EMR_{(t-1)}$		0.3020	–0.7895***	–1.1745***	–0.9871***
		(1.37)	(–3.09)	(–4.51)	(–3.75)
$LINVT_{(t-1)}$	0.2331***	0.2824***	0.3930***	0.4077***	0.4262***
	(9.10)	(8.51)	(12.87)	(12.91)	(13.91)
Δ lINVT	0.2196***	0.2970***	0.2990***	0.2838***	0.3166***
	(8.04)	(8.49)	(8.08)	(7.34)	(8.18)
$SOS_{(t-1)}$		–0.0038*			0.0014
		(–1.81)			(0.63)
$XSR\_tdi_{(t-1)}$			0.1693***		0.1347***
			(4.55)		(3.15)
Δ XSR_tdi			0.0909***		0.0210
			(2.69)		(0.47)
$MSR\_tdi_{(t-1)}$			0.0794**		
			(2.41)		
$XSR\_hs_{(t-1)}$				0.1982***	0.1322***
				(5.31)	(3.06)
Δ XSR_hs				0.1221***	0.1267**
				(3.12)	(2.50)
$MSR\_hs_{(t-1)}$				–0.0210	
				(–0.84)	
year dummies (η_t)	yes	yes	yes	yes	yes
No. observations	232	201	202	202	181
No. countries	28	26	28	28	26
R-sq within:	0.8837	0.8984	0.8844	0.8752	0.9026

Note: XSR = shares in total exports relative to OECD; tdi = technology driven industries; hs = high skill industries; ikbs = industries with much external inputs of knowledge based services.

Source: OECD, UNO, WIFO calculations.

Structural change and economic growth

After having demonstrated the existence of a systematic relationship between industrial structure and income levels, we examine in this final analytic section the impact of structural change on economic *growth*. The scatterplots in Figure 5.4 already warn us that no simple linear relationship should be expected.[16] Nevertheless, the fact that these pictures are not able to capture any systematic relationship does not mean that structural change has no influence. There are many other variables that play a role and which cannot be controlled for by simple correlations.[17]

The hypothesis of conditional convergence (i.e. convergence after checks have been made for differences in the steady state growth rates between countries) especially gives us reason to go ahead. It implies that, ceteris paribus, higher growth rates are more difficult to achieve, the more developed an economy already is. However, the previous section also demonstrated a clear, positive relationship between the levels of economic development and specific kinds of industrial structure. Hence, we must expect that any positive impact by specific kinds of economic activities on economic growth will be counterbalanced by the effects of conditional convergence. Consequently, the only way to settle the issue is to apply an econometric approach, which enables both to be controlled for separately, in addition to any other potential determinants of aggregate growth.

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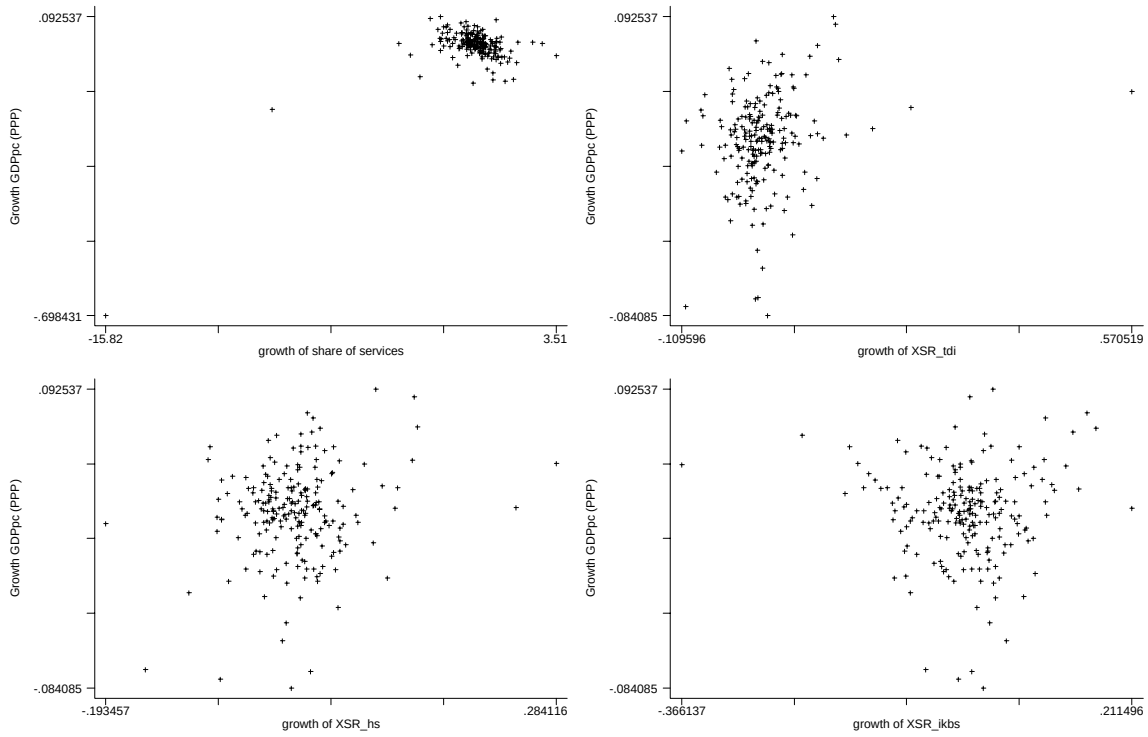
[16] Applying the same format to relative shares of imports in place of exports is no more revealing. We therefore omit the scatterplot analogue to Figure 5.3.

[17] There is one specific detail about the scatterplots, which deserves special attention. The one outlying case at the far right in the second picture refers to the growth of shares in technology driven industries in Hungary between 1996 and 1997. At first sight, this seemed to be an obvious error in the data and consequently, I nearly dismissed it. However, on second thought, my curiosity prevailed; fortunately, I asked Janos Gacs at IIASA for his advice. He explained to me that "in 1995, IBM established a company in Hungary (at Szekesfehervar) for the production of hard disk storage facilities. By 1996, it was already the 4th largest manufacturing firm in the country (in terms of net sales); since 1997, it has remained the 2nd largest. Its production quadrupled from 1996 to 1997, and production in 1998 was 2.5 times greater than in the previous year. 100% of its production is exported, amounting to USD 1.7 to 1.9 bn in 2000." It also deserves to be mentioned that when the robustness of the tests was estimated, the eventual omission of the data for Hungary did not substantially alter the results of the regressions.

Figure 5.4: Structural change and growth: 27 OECD countries, 1990 to 1998



Note: XSR = shares in total exports relative to OECD; tdi = technology driven industries; hs = high skill industries; ikbs = industries with many external inputs of knowledge based services.

Source: OECD, UNO, WIFO calculations.

In contrast to the previous estimation, the following growth regression operates in first differences, also including the lagged dependent variable among the regressors. This dynamic specification requires special instrumentation of the lagged endogenous variable, for which we use the one-step and the two-step GMM (general method of moments) estimators developed by Arellano and Bond (1991)[18]. The regressions rely on the Huber-White sandwich estimator of variance, which is robust with respect to the problems of heteroscedasticity. Since taking the first difference removes the country specific effects μ_i, our basic model assumes the form:

[18] The GMM estimator used by Arellano and Bond implements lagged levels of the dependent variable and the predetermined variables, as well as differences between the strictly exogenous variables as instruments.

$$\Delta lY_{i,t} = \alpha + \beta_1 \Delta lY_{i,t-1} + \beta_2 \Delta lPOP_{i,t} + \beta_3 \Delta lPOPWA_{i,t} + \beta_4 \Delta EMR_{i,t} + \beta_5 \Delta EMR_{i,t-1} + \beta_6 \Delta lINVT_{i,t-1} + \beta_7 \Delta 2lINVT_{i,t} + \beta_{j>7} X_{i,t} + \Delta\eta_t + \varepsilon_{i,t} \quad (7)$$

Note: Δ var = variable in first differences; Δvar_{t-1} =.. lagged differences; Δ2var = .. second differences

Tables 5.4 and 5.5 present the corresponding estimations for both the one-step and the two-step GMM estimator. While the two-step estimator should theoretically be preferred, experimental evidence reports problems concerning a downward bias in its estimates of the standard errors (Arellano and Bond, 1991; Islam, 2000). Although in our case, both procedures appear to produce very similar outcomes, we nevertheless follow the recommendation made by Arellano and Bond, and use only the one-step results for inferences regarding the coefficients. The two-step results were mainly used to assess the validity of the specification.

A critical assumption underlying the estimations is the lack of any second-order autocorrelation in the residuals from the first differences. The Arellano-Bond tests for first and second order autocorrelations are reported in the bottom lines of the tables. Estimates would be inconsistent if the null hypothesis of no second order autocorrelation in the A-B test (2) is rejected at a significant level.[19]

The dependent variable $Y_{i,t}$ is given by the annual growth rate of GDP per capita at PPPs. The education variable was not included, as Arellano and Bond's GMM estimator turned out to be very sensitive to the implied loss of observations. The lagged level of GDP per capita checks the general effects of conditional convergence. With annual data, the logarithm for β_1 provides the conditional convergence parameter -λ, which (in the neo-classical framework) would explain by what percent per year the initial gap between per capita income relative to its "steady state" level tends to diminish. In our estimates, the coefficients are highly significant but surprisingly low, which would imply an unrealistically fast speed of convergence.[20] This anomaly can however be explained by the short time

[19] In contrast to A-B(2), significant values in the A-B test(1) do not imply inconsistent estimates.

[20] In the one-step estimation, all of them fall within the narrow range of 0.44 (in the specification where structural variables on technology driven industries were included) up to a value of 0.56 (in the basic specification without structural variables). If we take the highest value, the according λ would be 0.58, implying that half of the gap is closed within almost 14 months (=ln(2)/ λ). For its initial interpretation in

span covered by the panel and the use of annual data, both of which tend to intensify the impact of short term fluctuations.

The variables on demography work as expected, with negative coefficients for total population growth, and a positive impact of growth in the population at working age – at least in the basic equation. The impact of *IPOPWA*, however, is not robust for the inclusion of structural variables. Similar problems arise with employment rates. As expected, the first differences in the employment rate act pro-cyclically and hence have a positive effect, but only remain significant within the one-step estimation. The lagged levels exhibit the appropriate negative sign, which is consistent with its interpretation of relative shortages in the labour market. Again, the coefficients are not always significant, performing better in the two-step than in the one-step estimation. Throughout all the specifications, investment in physical capital is the most consistently significant determinant of productivity growth. It exhibits a positive impact for lagged differences (0.12), and second differences (0.23).

In contrast to the visual inspection of the scatterplots, the chosen set of specific structural indicators also constitute significant determinants of aggregate growth. Increasing shares of services, which are included as lagged levels, have a consistently negative impact on the aggregate growth of GDP per capita. This result is again in line with the structural burden hypothesis of the services sector, but should not be overstated, as the coefficients are extremely small (all of them below 0.0005). It is also important to recall that the vast heterogeneity within the service industries has not been taken into account.[21]

However, within the manufacturing sector, the lagged differences and the second differences of relative export shares for both technology driven and skill intensive industries have a significant and positive impact on aggregate growth. Their coefficients range between 0.24 and 0.67, providing empirical evidence of substantial producer related spillovers. These are complemented by positive but somewhat smaller user related externalities, with significant coefficients for the lagged levels of relative import shares in technology driven and high skill industries (about 0.01 for both).

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cross-country regressions see Barro (1991) or Barro and Sala-i-Martin (1995, p. 37). Influential critical views have been put forward by Quah (1996) as well as Lee, Pesaran, and Smith (1997).

[21] For an empirical assessment of the sources of tertiarisation see Peneder, Kaniovski and Dachs (2001).

Table 5.4: Dynamic panel regression of growth in GDP per capita: 1990 to1998, one-step Arellano-Bond estimator

Δ Log GDP per capita at PPP – A-B (1)				
	I	II	III	IV
Δ lGDP	β (t)	β (t)	β (t)	β (t)
Δ lGDP $_{(t-1)}$	0.5615***	0.5212***	0.4426***	0.4673 ***
	(6.03)	(6.57)	(5.37)	(5.92)
Δ lPOP	–0.8231***	–0.4515**	–0.2491	–0.3761
	(–3.32)	(–2.02)	(–1.07)	(–1.37)
Δ lPOPWA	0.5226**	0.1351	–0.1228	0.0204
	(2.22)	(0.56)	(–0.50)	(0.08)
Δ EMR	0.3597**	0.3697**	0.3295*	0.3424*
	(2.32)	(2.06)	(1.86)	(1.89)
Δ EMR $_{(t-1)}$	–0.4183**	–0.2224	–0.1550	–0.1907
	(–2.33)	(–0.98)	(–0.66)	(–0.82)
Δ lINVT $_{(t-1)}$	0.1283***	0.1178***	0.1212***	0.1138***
	(4.20)	(3.72)	(5.22)	(5.60)
Δ2 lINVT	0.2213***	0.2310***	0.2448 ***	0.2382***
	(5.87)	(6.27)	(8.33)	(7.64)
SOS $_{(t-1)}$		–0.0003*	**–0.0005** ***	**–0.0002****
		(–1.76)	**(–2.85)**	**(–1.89)**
Δ XSR_tdi $_{(t-1)}$			0.0641 ***	
			(2.73)	
Δ2 XSR_tdi			0.0244 ***	
			(3.07)	
MSR_tdi $_{(t-1)}$			**0.0124** **	
			(2.58)	
Δ XSR_hs $_{(t-1)}$				0.0499**
				(2.42)
Δ2 XSR_hs				0.0372***
				(3.25)
MSR_hs $_{(t-1)}$				0.0094**
				(2.31)
Year dummies (η_t)	yes	Yes	Yes	Yes
No. observations	201	174	173	173
No. countries	27	26	27	27
A-B test (1)	0.0934	0.0596	0.0166	0.0227
A-B test (2)	0.0892	0.1589	0.2712	0.1617

Note: Δ var = variable in first differences; Δvar_{t-1} =.. lagged differences; Δ2var = .. second differences; XSR = shares in total exports relative to OECD; tdi = technology driven industries; hs =high skill industries.

Source: OECD, UNO, WIFO calculations.

Table 5.5: Dynamic panel regression of growth in GDP per capita: 1990 to1998, two-step Arellano-Bond estimator

Δ Log GDP per capita at PPP – A-B (2)				
	I	II	III	IV
Δ lGDP	β (t)	β (t)	β (t)	β (t)
Δ lGDP $_{(t-1)}$	0.6259***	0.4234***	0.4776***	0.5013***
	(5.64)	(5.67)	(3.17)	(3.22)
Δ lPOP	–0.6174**	–0.3405	–0.5746*	–0.1704
	(–2.02)	(0.88)	(–1.90)	(–0.42)
Δ lPOPWA	0.3679	–0.5592	0.4057	–0.1915
	(1.43)	(–1.60)	(1.54)	(–0.70)
Δ EMR	0.2936**	0.3715*	0.1273	0.0967
	(2.40)	(1.82)	(0.43)	(0.39)
Δ EMR $_{(t-1)}$	–0.4433***	–0.2450***	–0.2541	–0.8315**
	(–6.48)	(–3.90)	(–1.32)	(–2.20)
Δ lINVT $_{(t-1)}$	0.1204***	0.1576***	0.1411***	0.1922***
	(3.56)	(5.72)	(3.02)	(2.80)
Δ2 lINVT	0.2179***	0.2317***	0.2264***	0.2423***
	(12.86)	(10.32)	(7.25)	(7.98)
SOS $_{(t-1)}$		–0.0005***		
		(–4.64)		
Δ XSR_tdi $_{(t-1)}$			0.0586 **	
			(2.52)	
Δ2 XSR_tdi			0.0332 ***	
			(4.37)	
MSR_tdi $_{(t-1)}$			0.0108 ***	
			(2.83)	
Δ XSR_hs $_{(t-1)}$				0.0467**
				(2.18)
Δ2 XSR_hs				0.0472***
				(4.64)
MSR_hs $_{(t-1)}$				0.0091***
				(3.17)
year dummies (η_t)	yes	yes	Yes	Yes
No. Observations	201	174	173	173
No. Countries	27	26	27	27
A-B test (1)	0.0600	0.2117	0.1411	0.3609
A-B test (2)	0.0950	0.4703	0.3555	0.3280

Note: Δ var = variable in first differences; Δvar_{t-1} =.. lagged differences; Δ2var = .. second differences; XSR = shares in total exports relative to OECD; tdi = technology driven industries; hs =high skill industries.

Source: OECD, UNO, WIFO calculations.

5.5 Summary and conclusions

The paper attempts to provide an empirical validation of the linkages between meso-structure and macro-performance. Within the context of the present study, its specific purpose is to validate the general relevance of the Austrian paradox, i.e. the ambivalent observation of an economy, which on the one hand is performing reasonably well in terms of macroeconomic growth, employment and income levels, but on the other hand is generally perceived as relying on comparatively old industrial structures. Within the broader academic discourse, the intention is to substantiate by empirical facts whether evolutionary economics correctly emphasises the fundamental importance of structural change to an understanding of economic growth and development.

The analysis is developed in three consecutive steps. In the beginning, Harberger´s (1998) visualisations of the growth process are reproduced for the member countries of the European Union plus Japan and the USA. An inspection of the so-called "sunrise-diagrams" reveals that (i) differential growth in industries is an undeniable empirical fact; and (ii) structural change itself is not a uniform process, but rather appears in clusters; it is more pronounced in some periods and less in others. Consistent with Schumpeter´s notion of creative destruction, the graphs additionally suggest that (iii) the scope of structural change tends to be larger in times of lower aggregate growth.

In the second step, the direct contribution of structural change to the aggregate growth of labour productivity is measured by conventional shift-share analysis. Consistent with most of the literature, the structural components appear to be largely dominated by the within effects of productivity growth. A critical discussion of detailed results illustrates why the mechanical aggregation of shift-share analysis hides the more interesting sectoral dynamics beneath the level of average effects. The general conclusions are threefold: (i) structural change generates positive as well as negative contributions to aggregate productivity growth; (ii) since many of these effects net out, structural change on average appears to have only a weak impact; (iii) since certain types of industries systematically achieve higher rates of productivity growth than others, structural change in favour of specific industries might still be conducive to aggregate growth.

This last point is taken up in the final step, which forms the centre piece of the study. Dynamic panel econometrics is applied to test for the impact of specific structural variables

on aggregate income and growth. The data panel is comprised of 28 OECD countries; the time frame is 1990 to 1998; the data indicates the levels and first differences of GDP per capita at PPPs. The set of regressors includes demography, employment rates, capital investment, and average years of education. These are complemented by the value added share of the services sector and relative shares in the exports and imports of technology driven and high skill industries. For the general macro-economic variables, the standard results of cross-country regressions are mostly reproduced. But the additional inclusion of several structural variables generates the following stylised facts:

(i) Although the share of the services sector is positively correlated with income levels, its lagged levels have a negative impact on GDP per capita and annual growth rates after inclusion of the standard variables of cross-country growth regressions. The effect is small, but significant and robust. It is generally consistent with Baumol´s hypothesis of a *structural burden* through unbalanced growth in those branches of the services sector, where productivity gains are hard to achieve.

(ii) Turning to the manufacturing sector, for both technology driven and high skill industries, the lagged levels and first differences for the shares of total exports relative to the OECD have a pronounced positive and consistently significant impact on the level and growth of GDP per capita. This observation might be explained by two distinct links between meso-structure and macro-performance: From a *capability based* perspective, a higher share of "entrepreneurial" types of industry also implies a higher capacity for aggregate growth in the economy. This explanation offers a *direct* link to aggregate developments via differential growth rates favouring industries with a greater capacity to expand the consumers' willingness to pay. An *indirect* link is provided by positive externalities between industries. In the case of *producer related spillovers*, proximity (either spatial or institutional) allows for a better diffusion of relevant knowledge within common territorial boundaries.

(iii) It is not only an increase in exports but also in imports and hence the application of technologically advanced products, which contributes positively to aggregate growth. Coefficients are smaller and less robust. But the significant impact of the lagged levels of shares in total imports relative to the OECD confirms that user related *rent spillovers* (intrinsic to certain goods but independent of proximity in

production) are also relevant. Positive externalities between industries arise when the economic value of embodied knowledge is not entirely captured in the prices for intermediate goods.

The essential message of this chapter is quite obvious. Structural change with respect to specific types of industry is a highly significant determinant of aggregate income levels and growth. The empirical evidence thus substantiates the evolutionary concern for Schumpeterian economic development, which comprises growth and structural change as two inseparable elements. Finally, this study has also confirmed our specific concern for the Austrian paradox. Industrial structure does matter, and over the long term, the lack of structural change in favour of technologically progressive industries implies the danger of a "growth penalty". The immediate consequences appear to be small, and therefore easily escape public attention. But industrial structures are quite persistent; in the long run, seemingly small variations in growth rates can accumulate into considerable differences in income levels.

Appendix: Decomposition Analysis of labour productivity growth

Table A.5.1: Decompositions of labour productivity growth

Austria					
	Total		static shift	dynamic shift	within-growth
1995-1999 constant prices					
Total	*+1.992*	=	*+0.083*	*–0.121*	*+2.031*
			=	=	=
Agriculture	(+8.95)		–0.074	–0.012	+0.102
Industry	(+4.52)		–0.601	–0.125	+1.595
Services	(+0.53)		+0.758	+0.015	+0.334
1995-1999 current prices					
Total	+1.744	=	+0.083	–0.097	+1.758
			=	=	=
Agriculture	(+1.38)		–0.074	–0.002	+0.016
Industry	(+3.99)		–0.601	–0.110	+1.409
Services	(+0.53)		+0.758	+0.015	+0.334
1985-1998 current prices					
Manufacturing	*+10.481*	=	*+0.008*	*–0.088*	*+10.561*
Taxonomy 1	*+10.481*	=	*–0.123*	*–0.084*	*+10.689*
			=	=	=
1. MM	(+9.87)		+0.176	+0.260	+2.698
2. LI	(+8.27)		+0.037	+0.047	+2.057
3. CI	(+12.54)		–0.469	–0.614	+2.087
4. MDI	(+11.56)		+0.042	+0.053	+2.292
5. TDI	(+13.73)		+0.091	+0.170	+1.553
Taxonomy 2	*+10.481*	=	*–0.080*	*–0.046*	*+10.607*
			=	=	=
1. LS	(+8.27)		–0.395	–0.430	+3.382
2. MBC	(+9.74)		+0.354	+0.501	+2.180
3. MWC	(+15.61)		–0.194	–0.340	+3.829
4. HS	(+9.97)		+0.155	+0.222	+1.217
Taxonomy 3	*+10.481*	=	*+0.055*	*–0.228*	*+10.654*
			=	=	=
1. IKBS	(+15.09)		–0.085	–0.188	+1.619
2. IR&A	(+7.13)		+0.439	+0.373	+1.793
3. ITR	(+13.58)		–0.071	–0.125	+3.975
4. Other	(+9.38)		–0.228	–0.287	+3.267

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.2: Decompositions of labour productivity growth (continued)

Belgium					
	Total		static shift	dynamic shift	within-growth
1986-1999 constant prices					
Total	*+1.17*	=	*+0.24*	*–0.25*	*+1.17*
			=	=	=
Agriculture	(–7.78)		+0.10	–0.03	–0.03
Industry	(+2.96)		–0.51	–0.24	+1.06
Services	(+0.22)		+0.65	+0.02	+0.14
1986-1999 current prices					
Total	*+5.09*	=	*+0.23*	*–0.13*	*+5.00*
			=	=	=
Agriculture	(–22.24)		+0.16	–0.07	–0.09
Industry	(+5.44)		–0.55	–0.44	+1.95
Services	(+4.93)		+0.62	+0.38	+3.14
1985-1998 current prices					
Manufacturing	*+7.399*	=	*+1.032*	*–1.299*	*+7.666*
Taxonomy 1	*+7.399*	=	*–0.039*	*–0.302*	*+7.740*
			=	=	=
1. MM	(+5.80)		+0.018	+0.015	+1.528
2. LI	(+5.98)		–0.008	–0.009	+1.223
3. CI	(+13.03)		–0.458	–0.619	+2.508
4. MDI	(+5.64)		+0.293	+0.178	+0.965
5. TDI	(+8.99)		+0.117	+0.132	+1.515
Taxonomy 2	*+7.399*	=	*–0.014*	*+0.039*	*+7.374*
			=	=	=
1. LS	(+6.70)		–0.183	–0.160	+2.731
2. MBC	(+7.64)		+0.113	+0.140	+1.679
3. MWC	(+8.60)		+0.100	+0.096	+2.170
4. HS	(+6.60)		–0.044	–0.037	+0.794
Taxonomy 3	*+7.399*	=	*+0.063*	*–0.009*	*+7.345*
			=	=	=
1. IKBS	(+7.54)		+0.313	+0.229	+0.871
2. IR&A	(+6.14)		–0.101	–0.073	+1.571
3. ITR	(+8.80)		–0.159	–0.176	+2.581
4. Other	(+6.92)		+0.010	+0.011	+2.321

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.3: Decompositions of labour productivity growth (continued)

Germany					
	Total		static shift	dynamic shift	within-growth
1991-1999 constant prices					
Total	*+2.239*	=	*+0.339*	*–0.039*	*+1.939*
			=	=	=
Agriculture	(+4.65)		–0.043	–0.030	+0.110
Industry	(+2.04)		–0.723	–0.143	+0.866
Services	(+1.75)		+1.105	+0.134	+0.962
1991-1999 current prices					
Total	*+5.317*	=	*+0.280*	*+0.085*	*+4.952*
			=	=	=
Agriculture	(+4.88)		–0.048	–0.032	+0.116
Industry	(+4.30)		–0.751	–0.301	+1.829
Services	(+5.46)		+1.079	+0.418	+3.008
1985-1998 current prices					
Manufacturing	*+7.084*	=	*+0.000*	*–0.196*	*+7.280*
Taxonomy 1	*+7.084*	=	*–0.019*	*–0.041*	*+7.144*
			=	=	=
1. MM	(+7.15)		+0.017	+0.017	+2.129
2. LI	(+6.19)		–0.113	–0.114	+1.164
3. CI	(+7.63)		–0.112	–0.087	+1.015
4. MDI	(+5.49)		+0.210	+0.163	+0.865
5. TDI	(+8.81)		–0.021	–0.020	+1.972
Taxonomy 2	*+7.084*	=	*+0.027*	*–0.016*	*+7.073*
			=	=	=
1. LS	(+6.93)		–0.210	–0.218	+1.982
2. MBC	(+6.54)		+0.278	+0.237	+1.560
3. MWC	(+7.20)		–0.035	–0.030	+2.134
4. HS	(+7.80)		–0.006	–0.005	+1.398
Taxonomy 3	*+7.084*	=	*+0.007*	*–0.003*	*+7.080*
			=	=	=
1. IKBS	(+6.63)		+0.091	+0.074	+1.117
2. IR&A	(+7.47)		+0.024	+0.023	+2.184
3. ITR	(+7.04)		–0.033	–0.031	+1.591
4. Other	(+6.99)		–0.074	–0.069	+2.187

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.4: Decompositions of labour productivity growth (continued)

Denmark					
	Total		static shift	dynamic shift	within-growth
1986-1999 constant prices					
Total	*+1.007*	=	*+0.016*	*–0.023*	*+1.013*
			=	=	=
Agriculture	(+6.69)		–0.057	–0.040	+0.168
Industry	(+0.57)		–0.177	–0.014	+0.169
Services	(+1.00)		+0.249	+0.031	+0.676
1986-1999 current prices					
Total	*+5.915*	=	*–0.025*	*+0.041*	*+5.899*
			=	=	=
Agriculture	(+2.98)		–0.091	–0.018	+0.075
Industry	(+5.39)		–0.176	–0.137	+1.602
Services	(+6.23)		+0.243	+0.195	+4.221
1985-1998 current prices					
Manufacturing	*+5.685*	=	*+0.086*	*–0.040*	*+5.640*
Taxonomy 1	*+5.685*	=	*–0.063*	*–0.025*	*+5.774*
			=	=	=
1. MM	(+5.09)		+0.199	+0.140	+1.674
2. LI	(+4.58)		–0.000	–0.000	+0.859
3. CI	(+4.31)		–0.197	–0.081	+0.265
4. MDI	(+5.94)		+0.009	+0.006	+1.702
5. TDI	(+9.35)		–0.074	–0.090	+1.273
Taxonomy 2	*+5.685*	=	*–0.039*	*–0.058*	*+5.782*
			=	=	=
1. LS	(+6.16)		–0.205	–0.154	+2.178
2. MBC	(+4.17)		+0.196	+0.121	+0.845
3. MWC	(+6.10)		–0.011	–0.008	+1.447
4. HS	(+6.35)		–0.019	–0.017	+1.312
Taxonomy 3	*+5.685*	=	*+0.024*	*+0.054*	*+5.607*
			=	=	=
1. IKBS	(+4.94)		–0.234	–0.146	+0.918
2. IR&A	(+7.46)		+0.166	+0.169	+2.059
3. ITR	(+4.84)		+0.347	+0.199	+0.881
4. Other	(+4.91)		–0.255	–0.168	+1.748

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.5: Decompositions of labour productivity growth (continued)

Spain					
	Total		static shift	dynamic shift	within-growth
1995-1999 constant prices					
Total	*–1.493*	=	*+0.010*	*–0.020*	*–1.483*
			=	=	=
Agriculture	(+2.09)		–0.098	–0.008	+0.085
Industry	(–0.56)		–0.061	+0.002	–0.188
Services	(–2.21)		+0.168	–0.014	–1.380
1995-1999 current prices					
Total	*+0.401*	=	*+0.010*	*+0.008*	*+0.383*
			=	=	=
Agriculture	(–1.41)		–0.098	+0.005	–0.058
Industry	(+0.29)		–0.061	–0.001	+0.098
Services	(+0.55)		+0.168	+0.003	+0.343
1985-1998 current prices					
Manufacturing	*+5.722*	=	*–0.091*	*–0.794*	*+6.607*
Taxonomy 1	*+5.722*	=	*–0.189*	*–0.177*	*+6.088*
			=	=	=
1. MM	(+5.45)		+0.080	+0.058	+1.192
2. LI	(+3.87)		+0.076	+0.056	+1.158
3. CI	(+9.61)		–0.369	–0.276	+1.105
4. MDI	(+5.23)		+0.067	+0.044	+1.372
5. TDI	(+12.03)		–0.043	–0.059	+1.261
Taxonomy 2	*+5.722*	=	*–0.018*	*+0.036*	*+5.704*
			=	=	=
1. LS	(+5.26)		–0.369	–0.259	+2.430
2. MBC	(+5.64)		+0.192	+0.188	+1.549
3. MWC	(+5.92)		+0.105	+0.061	+1.109
4. HS	(+8.11)		+0.054	+0.046	+0.616
Taxonomy 3	*+5.722*	=	*+0.043*	*–0.029*	*+5.707*
			=	=	=
1. IKBS	(+4.76)		+0.215	+0.116	+0.580
2. IR&A	(+5.57)		+0.013	+0.009	+1.445
3. ITR	(+6.20)		–0.065	–0.050	+1.640
4. Other	(+5.77)		–0.120	–0.104	+2.042

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.6: Decompositions of labour productivity growth (continued)

Finland					
	Total		static shift	dynamic shift	within-growth
1995-1999 constant prices					
Total	*+0.732*	=	*+0.203*	*–0.107*	*+0.636*
			=	=	=
Agriculture	(–22.61)		+0.314	–0.100	–0.373
Industry	(+3.22)		–0.056	–0.007	+0.947
Services	(+0.09)		–0.055	–0.000	+0.062
1995-1999 current prices					
Total	*+0.676*	=	*+0.203*	*–0.122*	*+0.595*
			=	=	=
Agriculture	(–26.54)		+0.314	–0.118	–0.438
Industry	(+0.92)		–0.056	–0.002	+0.270
Services	(+1.11)		–0.055	–0.003	+0.763
1985-1998 current prices					
Manufacturing	*+5.939*	=	*+0.539*	*+0.583*	*+4.817*
Taxonomy 1	*+5.939*	=	*+0.301*	*+0.294*	*+5.344*
			=	=	=
1. MM	(+4.70)		+0.055	+0.035	+1.200
2. LI	(+4.88)		–0.373	–0.344	+1.362
3. CI	(+9.84)		+0.235	+0.203	+1.438
4. MDI	(+3.05)		–0.163	–0.060	+0.717
5. TDI	(+7.40)		+0.547	+0.460	+0.626
Taxonomy 2	*+5.939*	=	*+0.257*	*+0.214*	*+5.468*
			=	=	=
1. LS	(+4.54)		–0.574	–0.366	+1.571
2. MBC	(+4.85)		–0.112	–0.095	+1.097
3. MWC	(+7.28)		+0.761	+0.555	+2.133
4. HS	(+4.97)		+0.182	+0.120	+0.667
Taxonomy 3	*+5.939*	=	*+0.119*	*+0.133*	*+5.686*
			=	=	=
1. IKBS	(+7.85)		+0.479	+0.459	+1.136
2. IR&A	(+3.44)		+0.123	+0.055	+0.840
3. ITR	(+6.86)		+0.013	+0.010	+2.261
4. Other	(+5.15)		–0.495	–0.391	+1.450

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.7: Decompositions of labour productivity growth (continued)

France	Total		static shift	dynamic shift	within-growth
1986-1999 constant prices					
Total	*+1.202*	=	*+0.163*	*–0.111*	*+1.150*
			=	=	=
Agriculture	(+1.36)		+0.010	+0.001	+0.019
Industry	(+2.18)		–0.426	–0.153	+0.744
Services	(+0.60)		+0.579	+0.042	+0.387
1986-1999 current prices					
Total	*+4.326*	=	*+0.076*	*+0.035*	*+4.215*
			=	=	=
Agriculture	(+1.86)		+0.012	+0.001	+0.026
Industry	(+3.91)		–0.481	–0.275	+1.334
Services	(+4.43)		+0.545	+0.309	+2.855
1985-1998 current prices					
Manufacturing	*+4.814*	=	*–0.020*	*–0.045*	*+4.879*
Taxonomy 1	*+4.814*	=	*–0.078*	*–0.078*	*+4.970*
			=	=	=
1. MM	(+4.42)		+0.098	+0.063	+1.058
2. LI	(+3.58)		–0.017	–0.011	+0.722
3. CI	(+7.07)		–0.254	–0.179	+0.872
4. MDI	(+4.46)		+0.172	+0.101	+0.900
5. TDI	(+6.07)		–0.077	–0.051	+1.418
Taxonomy 2	*+4.814*	=	*+0.049*	*+0.020*	*+4.745*
			=	=	=
1. LS	(+4.15)		–0.107	–0.066	+1.501
2. MBC	(+4.88)		–0.008	–0.007	+1.209
3. MWC	(+5.50)		+0.132	+0.077	+1.408
4. HS	(+4.66)		+0.032	+0.015	+0.628
Taxonomy 3	*+4.814*	=	*+0.068*	*+0.056*	*+4.691*
			=	=	=
1. IKBS	(+5.25)		+0.071	+0.041	+0.974
2. IR&A	(+5.38)		+0.216	+0.134	+1.137
3. ITR	(+5.00)		+0.038	+0.026	+1.150
4. Other	(+3.83)		–0.257	–0.146	+1.430

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.8: Decompositions of labour productivity growth (continued)

Greece					
	Total		static shift	dynamic shift	within-growth
1995-1998 constant prices					
Total	*–0.087*	=	*–0.771*	*–0.381*	*+1.066*
			=	=	=
Agriculture	(+59.55)		–1.046	–0.359	+1.129
Industry	(+1.23)		–0.251	–0.012	+0.363
Services	(–0.62)		+0.525	–0.010	–0.426
1995-1998 current prices					
Total	*+3.059*	=	*–0.771*	*–0.316*	*+4.146*
			=	=	=
Agriculture	(+55.36)		–1.046	–0.334	+1.049
Industry	(+3.24)		–0.251	–0.032	+0.958
Services	(+3.12)		+0.525	+0.050	+2.139
1985-1998 current prices					
Manufacturing	*+5.857*	=	*+0.270*	*–0.159*	*+5.745*
Taxonomy 1	*+5.857*	=	*–0.019*	*+0.130*	*+5.746*
			=	=	=
1. MM	(+5.92)		–0.128	–0.111	+1.303
2. LI	(+3.55)		–0.084	–0.048	+0.929
3. CI	(+5.37)		–0.244	–0.124	+0.957
4. MDI	(+7.97)		+0.354	+0.342	+2.170
5. TDI	(+5.70)		+0.083	+0.073	+0.387
Taxonomy 2	*+5.857*	=	*+0.189*	*–0.133*	*+5.801*
			=	=	=
1. LS	(+7.87)		–0.151	–0.205	+4.876
2. MBC	(+1.84)		–0.170	–0.030	+0.281
3. MWC	(+2.21)		+0.490	+0.085	+0.364
4. HS	(+4.46)		+0.021	+0.016	+0.280
Taxonomy 3	*+5.857*	=	*–0.022*	*+0.300*	*+5.578*
			=	=	=
1. IKBS	(+3.32)		+0.008	+0.003	+0.490
2. IR&A	(+10.25)		+0.317	+0.434	+1.800
3. ITR	(+7.93)		–0.007	–0.009	+2.001
4. Other	(+3.03)		–0.340	–0.128	+1.287

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.9: Decompositions of labour productivity growth (continued)

Ireland					
	Total		static shift	dynamic shift	within-growth
1990-1998 constant prices					
Total	–		–	–	–
Agriculture	–		–	–	–
Industry	–		–	–	–
Services	–		–	–	–
1990-1998 current prices					
Total	*+5.994*	=	*–0.261*	*–0.124*	*+6.385*
			=	=	=
Agriculture	(+0.90)		–0.281	–0.006	+0.025
Industry	(+9.85)		–0.380	–0.289	+3.396
Services	(+4.73)		+0.399	+0.171	+2.964
1985-1998 current prices					
Manufacturing	*+7.850*	=	*+0.488*	*–0.221*	*+7.583*
Taxonomy 1	*+7.850*	=	*+0.455*	*+0.329*	*+7.066*
			=	=	=
1. MM	(+3.39)		+0.013	+0.010	+0.776
2. LI	(+2.98)		–0.188	–0.157	+0.630
3. CI	(+27.83)		–0.082	–0.106	+1.716
4. MDI	(+7.41)		–0.328	–0.291	+2.717
5. TDI	(+9.38)		+1.040	+0.874	+1.226
Taxonomy 2	*+7.850*	=	*+0.540*	*+0.645*	*+6.665*
			=	=	=
1. LS	(+5.08)		–0.884	–0.699	+2.683
2. MBC	(+2.49)		+0.051	+0.025	+0.320
3. MWC	(+11.40)		+0.800	+0.884	+2.850
4. HS	(+8.70)		+0.573	+0.435	+0.813
Taxonomy 3	*+7.850*	=	*+0.710*	*+0.546*	*+6.594*
			=	=	=
1. IKBS	(+12.78)		+0.846	+0.707	+1.468
2. IR&A	(+8.63)		+0.122	+0.091	+2.396
3. ITR	(+5.95)		–0.033	–0.034	+1.354
4. Other	(+3.62)		–0.226	–0.218	+1.377

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.10: Decompositions of labour productivity growth (continued)

Italy					
	Total		static shift	dynamic shift	within-growth
1986-1999 constant prices					
Total	*+1.994*	=	*+0.226*	*–0.162*	*+1.930*
			=	=	=
Agriculture	(+6.28)		–0.133	–0.166	+0.345
Industry	(+2.18)		–0.219	–0.080	+0.850
Services	(+1.32)		+0.578	+0.083	+0.735
1986-1999 current prices					
Total	*+5.259*	=	*+0.140*	*+0.025*	*+5.094*
			=	=	=
Agriculture	(+7.42)		–0.161	–0.196	+0.408
Industry	(+3.85)		–0.242	–0.141	+1.496
Services	(+5.74)		+0.543	+0.362	+3.190
1985-1998 current prices					
Manufacturing	*+5.462*	=	*+0.013*	*–0.481*	*+5.930*
Taxonomy 1	*+5.462*	=	*–0.069*	*–0.054*	*+5.585*
			=	=	=
1. MM	(+5.39)		+0.203	+0.145	+1.475
2. LI	(+4.62)		+0.055	+0.042	+1.127
3. CI	(+7.12)		–0.240	–0.181	+0.989
4. MDI	(+5.17)		–0.052	–0.035	+0.987
5. TDI	(+6.60)		–0.034	–0.025	+1.008
Taxonomy 2	*+5.462*	=	*+0.036*	*–0.015*	*+5.441*
			=	=	=
1. LS	(+5.47)		–0.248	–0.195	+2.270
2. MBC	(+5.30)		+0.112	+0.092	+1.128
3. MWC	(+5.88)		–0.016	–0.011	+1.310
4. HS	(+4.91)		+0.188	+0.099	+0.733
Taxonomy 3	*+5.462*	=	*+0.022*	*–0.052*	*+5.492*
			=	=	=
1. IKBS	(+7.37)		+0.008	+0.007	+1.031
2. IR&A	(+4.73)		+0.186	+0.104	+1.170
3. ITR	(+6.99)		–0.180	–0.167	+1.593
4. Other	(+4.42)		+0.007	+0.004	+1.698

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.11: Decompositions of labour productivity growth (continued)

Japan					
	Total		static shift	dynamic shift	within-growth
1990-1999 constant prices					
Total	–	=	–	–	–
			=	=	=
Agriculture	–		–	–	–
Industry	–		–	–	–
Services	–		–	–	–
1990-1999 current prices					
Total	*+0.741*	=	*+0.141*	*+0.035*	*+0.566*
			=	=	=
Agriculture	(–0.30)		–0.066	+0.007	–0.026
Industry	(+0.45)		–0.463	–0.017	+0.151
Services	(+0.76)		+0.670	+0.045	+0.441
1985-1997 current prices					
Manufacturing	*+6.483*	=	*+0.014*	*+0.055*	*+6.413*
Taxonomy 1	*+6.483*	=	*–0.019*	*–0.021*	*+6.523*
			=	=	=
1. MM	(+5.91)		+0.078	+0.057	+1.523
2. LI	(+4.83)		–0.098	–0.079	+1.134
3. CI	(+8.88)		–0.111	–0.083	+1.073
4. MDI	(+6.12)		+0.173	+0.136	+1.233
5. TDI	(+8.43)		–0.062	–0.053	+1.560
Taxonomy 2	*+6.483*	=	*+0.022*	*+0.019*	*+6.441*
			=	=	=
1. LS	(+5.26)		–0.062	–0.046	+1.889
2. MBC	(+6.29)		+0.006	+0.005	+1.422
3. MWC	(+7.47)		+0.043	+0.034	+2.175
4. HS	(+7.72)		+0.036	+0.027	+0.955
Taxonomy 3	*+6.483*	=	*+0.045*	*+0.041*	*+6.397*
			=	=	=
1. IKBS	(+8.53)		+0.053	+0.049	+1.275
2. IR&A	(+6.67)		+0.156	+0.115	+1.713
3. ITR	(+6.05)		+0.057	+0.041	+1.476
4. Other	(+5.53)		–0.220	–0.165	+1.934

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.12: Decompositions of labour productivity growth (continued)

Netherlands					
	Total		static shift	dynamic shift	within-growth
1995-1999 constant prices					
Total	*+0.896*	=	*–0.114*	*–0.001*	*+1.011*
			=	=	=
Agriculture	(+3.30)		–0.082	–0.005	+0.057
Industry	(+0.82)		–0.397	–0.012	+0.203
Services	(+1.02)		+0.364	+0.016	+0.751
1995-1999 current prices					
Total	*+1.097*	=	*–0.114*	*+0.020*	*+1.191*
			=	=	=
Agriculture	(–5.94)		–0.082	+0.009	–0.102
Industry	(+0.87)		–0.397	–0.012	+0.213
Services	(+1.47)		+0.364	+0.023	+1.080
1985-1998 current prices					
Manufacturing	*+5.654*	=	*–0.213*	*–1.168*	*+7.035*
Taxonomy 1	*+5.654*	=	*–0.195*	*–0.126*	*+5.975*
			=	=	=
1. MM	(+5.12)		+0.097	+0.075	+1.178
2. LI	(+2.90)		+0.091	+0.049	+0.498
3. CI	(+7.81)		–0.334	–0.192	+1.040
4. MDI	(+6.80)		+0.109	+0.100	+1.868
5. TDI	(+7.29)		–0.158	–0.157	+1.391
Taxonomy 2	*+5.654*	=	*–0.105*	*–0.072*	*+5.831*
			=	=	=
1. LS	(+7.56)		–0.208	–0.210	+2.455
2. MBC	(+4.41)		+0.158	+0.128	+0.822
3. MWC	(+5.00)		–0.176	–0.094	+1.830
4. HS	(+5.89)		+0.120	+0.104	+0.724
Taxonomy 3	*+5.654*	=	*–0.042*	*+0.058*	*+5.638*
			=	=	=
1. IKBS	(+6.05)		–0.246	–0.167	+1.362
2. IR&A	(+7.03)		+0.283	+0.272	+1.575
3. ITR	(+5.91)		–0.004	–0.003	+1.381
4. Other	(+4.16)		–0.076	–0.044	+1.321

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.13: Decompositions of labour productivity growth (continued)

Portugal					
	Total		static shift	dynamic shift	within-growth
1995-1999 constant prices					
Total	*+2.011*	=	*–0.162*	*–0.203*	*+2.376*
			=	=	=
Agriculture	(–7.18)		+0.196	–0.025	–0.162
Industry	(–0.13)		+0.739	–0.005	–0.048
Services	(+4.25)		–1.098	–0.173	+2.586
1995-1999 current prices					
Total	*+4.077*	=	*–0.162*	*–0.321*	*+4.560*
			=	=	=
Agriculture	(–14.10)		+0.196	–0.049	–0.318
Industry	(+0.87)		+0.739	+0.033	+0.322
Services	(+7.48)		–1.098	–0.305	+4.556
1985-1998 current prices					
Manufacturing	*+12.806*	=	*+3.395*	*–5.186*	*+14.597*
Taxonomy 1	*+12.806*	=	*–0.223*	*–0.706*	*+13.735*
			=	=	=
1. MM	(+16.29)		–0.156	–0.376	+3.557
2. LI	(+6.56)		+0.078	+0.116	+2.732
3. CI	(+32.73)		–0.332	–0.501	+2.486
4. MDI	(+12.55)		+0.275	+0.370	+2.928
5. TDI	(+36.09)		–0.086	–0.315	+2.032
Taxonomy 2	*+12.806*	=	*+0.069*	*+0.043*	*+12.694*
			=	=	=
1. LS	(+10.99)		–0.047	–0.074	+6.295
2. MBC	(+14.10)		–0.015	–0.041	+3.535
3. MWC	(+14.08)		+0.110	+0.095	+1.777
4. HS	(+21.66)		+0.021	+0.063	+1.086
Taxonomy 3	*+12.806*	=	*+0.082*	*–0.528*	*+13.253*
			=	=	=
1. IKBS	(+15.26)		–0.246	–0.571	+1.991
2. IR&A	(+15.72)		+0.231	+0.436	+3.225
3. ITR	(+18.41)		–0.365	–0.903	+4.302
4. Other	(+8.67)		+0.462	+0.509	+3.735

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.14: Decompositions of labour productivity growth (continued)

Sweden					
	Total		static shift	dynamic shift	within-growth
1995-1998 constant prices					
Total	*+4.262*	=	*–0.065*	*–0.021*	*+4.348*
			=	=	=
Agriculture	(+16.07)		–0.143	–0.033	+0.194
Industry	(+5.46)		+0.085	+0.012	+1.440
Services	(+3.75)		–0.007	–0.001	+2.715
1995-1998 current prices					
Total	+6.849	=	–0.065	–0.008	+6.923
			=	=	=
Agriculture	(+9.17)		–0.143	–0.019	+0.111
Industry	(+5.27)		+0.085	+0.012	+1.389
Services	(+7.49)		–0.007	–0.002	+5.423
1985-1998 current prices					
Manufacturing	*+2.380*	=	*+0.073*	*+0.070*	*+2.237*
Taxonomy 1	*+2.380*	=	*+0.013*	*+0.002*	*+2.365*
			=	=	=
1. MM	(+1.93)		–0.143	–0.038	+0.533
2. LI	(+2.28)		–0.255	–0.091	+0.405
3. CI	(+3.84)		–0.213	–0.086	+0.634
4. MDI	(+0.99)		+0.098	+0.012	+0.167
5. TDI	(+2.93)		+0.526	+0.205	+0.627
Taxonomy 2	*+2.380*	=	*+0.020*	*–0.003*	*+2.363*
			=	=	=
1. LS	(+2.34)		–0.508	–0.162	+0.623
2. MBC	(+1.88)		+0.216	+0.060	+0.514
3. MWC	(+2.50)		+0.211	+0.061	+0.747
4. HS	(+2.96)		+0.102	+0.037	+0.479
Taxonomy 3	*+2.380*	=	*–0.003*	*–0.046*	*+2.430*
			=	=	=
1. IKBS	(+1.98)		+0.552	+0.135	+0.326
2. IR&A	(+2.78)		–0.131	–0.046	+0.654
3. ITR	(+2.63)		–0.428	–0.136	+0.775
4. Other	(+2.21)		+0.005	+0.002	+0.674

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.15: Decompositions of labour productivity growth (continued)

United Kingdom					
	Total		static shift	dynamic shift	within-growth
1989-1999 constant prices					
Total	*+1.708*	=	*–0.031*	*–0.124*	*+1.863*
			=	=	=
Agriculture	(+6.84)		–0.061	–0.027	+0.085
Industry	(+2.84)		–0.664	–0.188	+0.919
Services	(+1.29)		+0.694	+0.091	+0.858
1989-1999 current prices					
Total	*+6.512*	=	*–0.105*	*–0.023*	*+6.640*
			=	=	=
Agriculture	(+6.86)		–0.060	–0.027	+0.086
Industry	(+6.86)		–0.714	–0.454	+2.220
Services	(+6.53)		+0.668	+0.458	+4.334
1985-1998 current prices					
Manufacturing	*+6.471*	=	*+0.056*	*–0.107*	*+6.521*
Taxonomy 1	*+6.471*	=	*–0.006*	*+0.055*	*+6.423*
			=	=	=
1. MM	(+5.25)		–0.013	–0.010	+1.442
2. LI	(+4.08)		–0.055	–0.039	+0.851
3. CI	(+7.07)		–0.125	–0.077	+0.729
4. MDI	(+7.41)		+0.110	+0.101	+1.707
5. TDI	(+9.24)		+0.076	+0.080	+1.693
Taxonomy 2	*+6.471*	=	*+0.026*	*–0.033*	*+6.478*
			=	=	=
1. LS	(+6.07)		–0.104	–0.090	+2.191
2. MBC	(+5.74)		+0.068	+0.056	+1.197
3. MWC	(+6.23)		+0.152	+0.104	+1.702
4. HS	(+8.83)		–0.090	–0.103	+1.388
Taxonomy 3	*+6.471*	=	*+0.035*	*+0.035*	*+6.401*
			=	=	=
1. IKBS	(+7.65)		+0.033	+0.030	+1.527
2. IR&A	(+7.46)		+0.110	+0.101	+1.793
3. ITR	(+5.50)		+0.114	+0.081	+1.268
4. Other	(+5.50)		–0.222	–0.177	+1.813

Source: EUROSTAT, OECD, WIFO calculations

Table A.5.16: Decompositions of labour productivity growth (continued)

USA					
	Total		static shift	dynamic shift	within-growth
1987-1997 constant prices					
Total	*+1.449*	=	*+0.042*	*–0.049*	*+1.456*
			=	=	=
Agriculture	(+1.31)		–0.012	–0.002	+0.037
Industry	(+2.58)		–0.304	–0.084	+0.641
Services	(+1.08)		+0.359	+0.037	+0.779
1987-1997 current prices					
Total	*+5.095*	=	*+0.003*	*–0.000*	*+5.093*
			=	=	=
Agriculture	(+2.35)		–0.013	–0.004	+0.066
Industry	(+5.30)		–0.333	–0.173	+1.318
Services	(+5.13)		+0.348	+0.177	+3.708
1985-1997 current prices					
Manufacturing	*+5.335*	=	*–0.109*	*–0.289*	*+5.733*
Taxonomy 1	*+5.335*	=	*–0.058*	*–0.249*	*+5.643*
			=	=	=
1. MM	(+3.06)		+0.186	+0.076	+0.775
2. LI	(+2.52)		–0.025	–0.013	+0.566
3. CI	(+7.47)		–0.056	–0.034	+0.711
4. MDI	(+4.95)		+0.139	+0.074	+1.027
5. TDI	(+11.65)		–0.301	–0.352	+2.564
Taxonomy 2	*+5.335*	=	*–0.044*	*–0.072*	*+5.451*
			=	=	=
1. LS	(+4.33)		–0.023	–0.014	+1.312
2. MBC	(+3.12)		+0.150	+0.067	+0.672
3. MWC	(+7.54)		–0.045	–0.035	+2.330
4. HS	(+6.60)		–0.125	–0.090	+1.137
Taxonomy 3	*+5.335*	=	*–0.008*	*–0.083*	*+5.426*
			=	=	=
1. IKBS	(+8.67)		–0.201	–0.193	+2.160
2. IR&A	(+6.53)		+0.086	+0.059	+1.466
3. ITR	(+3.58)		+0.197	+0.091	+0.870
4. Other	(+3.28)		–0.090	–0.040	+0.929

Source: EUROSTAT, OECD, WIFO calculations

6. THE POLICY DIMENSION

MICHAEL PENEDER

6.1 Summary of the empirical findings

In light of the persistent structural deficits in the sectoral composition of Austria's production, a far sighted concept of economic policy requires a better understanding of the link between meso-structures and macro-performance. In contrast to most contemporary analyses, which treat both aspects as separate fields of investigation, this study is aimed at bridging the gap between empirical findings at the meso- and macro-levels by bringing together various experts from macroeconomics, industrial economics and innovation research. What ties their divergent approaches together is the common concern for the Austrian *paradox of old structures* but *high performance*, which arises from the apparent contradiction between the rather traditional, `low-´ to `medium-tech´ structures prevalent in Austrian industry and the general perception of satisfactory aggregate performance in terms of labour productivity and growth.

The introductory chapter presented characteristic empirical findings confirming the persistence of structural deficits in Austrian manufacturing. Applying three distinct taxonomies, two observations are particularly striking. First, relative to the EU, the shares in manufacturing value added for each taxonomy are always lowest for the one group, which generally relies on the most sophisticated processes of production. This structural gap vis-à-vis the EU is strongest for the groups of technology driven industries and industries characterised by particularly large inputs from knowledge based services. Regarding the human resources dimension, particularly high skilled industries are the only group for which the value added shares in Austria are smaller than in the European Union, although the gap is much smaller. Secondly, and even more discomforting, no indications of a reduction in the structural gaps could be detected for the period between 1988 and 1998. From 1992 onwards, the structural changes in favour of technology driven industries even appear to have slowed down relative to various other countries in the EU.

The study continued with a brief theoretical survey in Chapter 2, explaining the role of capital accumulation and technological change as major determinants of economic growth. Reflecting the specific Austrian situation of a small open economy, particular emphasis is put upon the absorptive capacity of a country characterised as technological follower, where the process of catching-up is predominantly driven by effective diffusion of productive knowledge. However, the forces of catching-up are necessarily self-defeating in the long run. Belonging to the leading countries in GDP per head, Austria now needs a paradigmatic shift towards innovation and knowledge-based sources of economic growth.

Chapter 3 presented an empirical assessment of Austria´s macroeconomic performance from the 1970s onwards. The message is that the Austrian economy in general performed well during the last decades. GDP and employment growth were slightly above average; the unemployment rate, inflation and budget deficits were below those of the OECD or the European Union. However, the analysis also reveals that over the decades, the positive growth margin relative to other industrialised countries vanished. The reduced potential for technological catching-up offers a first explanation for the loss of the positive growth margin. But it is also argued that this process corresponds to a degeneration of what once constituted a specifically Austrian concept of macroeconomic policy, characterised by anticyclical effects, the stabilisation of expectations and high capital investment.

Chapter 4 opened with a brief review of theories of structural change. Emphasis on institutional rigidities as potential impediments to growth led to the empirical focus on the relationship between the speed of change (measured by the absolute amount of sectoral adjustment) and growth. The major findings are twofold: (i) European countries with high growth rates also experience rapid structural change. Prospects for growth appear to be highest during periods which follow severe restructuring, when past strongholds are, to a certain extent, abandoned in favour of fast growing industries; (ii) for a long period of time, Austria's speed of structural change was slow, specifically in relation to its good growth performance. Consistent with developments in other countries of the European Union, the overall speed of change did however increase in the 1990s.

Chapter 5 then gradually shifted attention from the speed to the direction of structural change. Panel regressions confirmed that structural change with respect to specific types of industry is a significant determinant of aggregate income levels and growth. The empirical evidence thus substantiates our concern for the Austrian paradox. Industrial structure does

matter, and over the long term, the lack of structural change in favour of technologically progressive industries implies the danger of a "growth penalty". The immediate consequences appear to be small, and therefore easily escape public attention. But industrial structures are quite persistent. In the long run, small variations in growth rates can therefore accumulate into considerable differences in the achieved standards of living.

Let us briefly recapitulate, what these findings can tell us about the Austrian paradox of old structures/high-performance:

- First of all, we have found strong evidence of persistent deficits in the industrial structure of Austrian manufacturing. This finding bears weight because it was revealed in the econometric analysis that high shares of technology driven and skill intensive industries have a significantly positive impact on growth, which suggests that these types of industry tend to generate positive spillovers to the rest of the economy.

- Secondly, the assessment of Austria's macroeconomic performance has narrowed down the scope of the Austrian paradox. Over the decades, Austria´s positive growth margin of the 1970s diminished, and low official unemployment rates were increasingly contrasted by hidden unemployment due to early retirement schemes.

- Thirdly, we have learned about three principle mechanisms, which jointly explain the disappearance of Austria´s growth advantage: (i) the loss of growth enhancing effects from general convergence mechanisms, following the successful completion of the *technological catching up* process; (ii) the growing burden of public deficits, combined with the forces of European integration, which have largely eliminated room for traditional demand-oriented macroeconomic policies; and finally, (iii) the lack of industrial restructuring and innovation, which might already have had a negative impact on aggregate performance.

Although the disappearance of the positive growth margin reduced the scope of the paradox, the latter is far from being resolved. The question remains, why – despite its persistent deficits in industrial structure – is the Austrian economy still capable of at least average macroeconomic performance in terms of GDP growth. For the last decade of the 1990s, we might correctly rename this phenomenon the *old structures/average-performance paradox*.

6.2 Some pieces of the Austrian growth puzzle

The essential message of the above empirical findings is that the Austrian technology gap must be taken seriously as an indication of a potential *growth penalty,* resulting from persistent deficits in industrial structure. The observation of at least average growth performance during the past cannot eliminate its relevance, but can only suggest the importance of other determinants of economic growth, which so far have been able to compensate for Austria's deficits in industrial structure. Two critical questions therefore arise: what are these factors and can we expect them to be sustained?

The issue is, of course, too broad and complex for any definite answers. Therefore, in the following brief excursion we intend only to touch upon a few central aspects of the Austrian growth puzzle. Four interrelated dimensions of economic performance are reviewed in the schematic representation in Figure 6.1: (i) economic geography, as it determines the potential for market and supplier access; (ii) macroeconomic policy, comprising fiscal and monetary policies; (iii) industrial relations, shaped by the institution of social partnership; and (iv) a particular aspect of entrepreneurial capabilities, summarised under the heading of `adaptive specialisation´. Interactions among these factors are of course manifold. Spatial proximity together with economic integration reduces transaction costs and thus enables faster catching up to state-of-the-art technology. Fiscal and monetary policies have an impact on the formation of expectations about the business environment, again affecting investment and productivity growth. The nature of industrial relations which, for example, determine the wage bargaining process obviously influence real wage flexibility and cost competitiveness. The combined impact of these and other elements can either be more enabling or obstructing to firm level productivity performance.

Economic geography

It is a well documented empirical fact, that economic interactions fall off very rapidly as distance increases (Venables, 2001, p. 6). The New Economic Geography (Fujita, Krugman, and Venables, 1999) takes this matter seriously by allowing the costs of transaction (costs of searching, quality control, transport, the synchronisation of processes, the passage of time, etc.) to decrease with spatial proximity. As a consequence, locational choices are not only explained by relative factor prices, but depend also on the costs of market access and the costs of intermediate products, which both increase with distance.

Additional complications arise through the presence of positive externalities, e.g. through pooled markets for skilled labour or the easier diffusion of relevant knowledge, which can trigger typical dynamics of cluster formation. Otherwise, given equal technology and primary factor prices, central locations which benefit from the cost advantages of spatial proximity can afford to pay higher wages, whereas peripheral regions can only compete with lower labour costs.

The fast pace of theoretical developments in this field has recently come to bear fruit in a series of new empirical studies. According to these, the forces of economic geography appear to favour the Austrian economy very strongly. Midelfart-Knarvik et al (2000, p. 52) report data for *market potential*, which are based on incomes inversely related to distance, according to NUTS2 regional disaggregation. Together with Benelux, France, Germany and the United Kingdom, Austria is a member of the group of countries with the highest values - only 7.8 % below Belgium as the most centrally located European economy, and 37.6 % above the median. Redding and Venables (2001) use similar calculations for *market* and *supplier access*, defined as the distance weighted sum of the market/supplier capacities of all trading partners. In their econometric analysis, they demonstrate that the two measures of economic geography can explain a substantial part of the variations in per capita income. What warrants further attention is that in the scatterplots, Austria is always placed among the countries with high levels of access to markets and suppliers.

These results are also consistent with an earlier analysis by Aiginger and Peneder (1997), in which the top managers of national and international enterprises located in Austria placed especial emphasis on the benefits of *double-integration*, i.e. EU membership plus strong commercial ties to Central and Eastern European countries. This source of competitive advantage has not only sustained but considerably grown during the 1990s due to the dynamics of economic transition in our near neighborhoud. Accession of these countries to the European Union can only strengthen it further, making Austria an even more central location to do international businesses. But proximity is not only a geographic factor. It also depends on institutional boundaries, cultural values, attitudes, and, yes, sympathy. Austrian policy therefore has to play a positive role in the process of Eastern enlargement (Arndt – Handler – Salvatore, 2000). It would be a pity, if this opportunity is missed due to the false fear, that proximity is a danger instead of an opportunity to economic development.

Macroeconomic policy

Many authors attribute Austria´s exceptional growth performance in the 1970s to its strong concern for anticyclical stabilisation, which was reflected in a coherent concept of demand-oriented macroeconomic policy. Guger (1998, p. 45) summarised the core elements of this so-called Austro-Keynesianism: first, absolute priority for full employment and growth; secondly, anticyclical fiscal policy through built-in stabilisers in the generous system of social security, public investment, accelerated depreciation schemes, etc.; and thirdly, a strong currency which keeps inflation under control. Together with the fourth element of aggregate real wage flexibility (see next section), this specific policy combination stabilised expectations and thus created a favourable environment for private investment. In Chapter 3, Marterbauer also emphasised the importance of high capital investment as major factor in Austria´s aggregate growth performance. This is consistent with the general results of the panel regressions in Chapter 5, where high investments in physical capital appeared to be the single most important source of aggregate growth.

Over the decades, however, the lustre of Austria´s macroeconomic performance vanished. The positive growth margin disappeared and low unemployment rates were increasingly misleading due to the hidden unemployment which developed as a result of early retirement schemes. This degeneration of performance can be attributed to various aspects related to macroeconomic policy: (i) There is good reason to believe that demand pull strategies are most effective, the farther an economy is operating below its potential output, especially when catching-up through imported technology substitutes for more rigorous structural reforms on the supply side. (ii) Higher growth rates due to catching-up also ease the social tensions arising from distributional conflicts. Conversely, when aggregate growth slows down, the public willingness to pay for fiscal expansion decreases and political priorities change in accordance. (iii) Economic integration in general tends to narrow down the potential to pursue divergent national policies, but monetary and fiscal policies were particularly affected by the decision to join the Economic and Monetary Union (EMU). National discretion in monetary policy was formally abolished, although the effect of this may have been relatively subtle, since the exchange rate of the Schilling had previously been fixed to that of the German Mark. Discretion in fiscal policy was constrained by an obligation to comply to the convergence criteria (Breuss, 2000; Bayer et al 2000). In short, national, demand oriented macroeconomic policies do not anymore offer a sustainable source of high aggregate performance.

Industrial relations

Austria´s macroeconomic performance cannot be separated from the distinctive role of its corporatist system. The institution of social partnership allowed organised interests to participate in the process of policy formulation, thereby increasing internal consistency of and compliance to the decisions made. Theoretic rationales are found in the notion of `social capabilities´, emphasising the importance of ongoing relationships, consensus building and trust, in order to confine transaction costs, uncertainty, and conflict (Butschek, 1995). Low unemployment, high standards of social security, the much heralded apprenticeship training system, a high degree of aggregate real wage flexibility, and the maintenance of a competitive edge in labour cost per unit of output (Guger, 2000) – all these demonstrate how remarkably well the Austrian economy has performed with respect to the core competencies of the social partners. In their comparative study, Casey and Gold (2000, p. 29) attribute this to an exceptionally high degree of coherence in policy concepts, directed by the shared macroeconomic goals of securing growth and employment:

> In the case of Austria, critical actors were faced with the task of rebuilding a society that had been shattered politically and economically after the war. They therefore constructed a set of procedures and institutions that gave recognition to the interrelationships between taxation and expenditure policy, interest rate and exchange rate policy, industrial assistance and training policy, and social security and health and education policy. ... Moreover, the act of fitting the parts together, and subsequently of keeping them together, was made possible only because those who were responsible for any one part were simultaneously responsible for other parts too. This meant that they had the picture as a whole in their heads, the nature of their own contribution to it and the ability to recognise the parts that were contiguous and the way in which the matching should occur (Casey and Gold, 2000, p. 29).

In recent years, however, the system has increasingly come under strain. Any institution which is so intricately involved in the policy process is held equally responsible for the less favourable aspects of economic performance. The above authors, for example, argue that corporatist systems cope well with incremental changes, but perform badly when major changes in direction are needed. A related problem is an excess of concern for the established interests of insiders, which tends to harm the potential future interests of outsiders. Insiders are often unable to adequately organise their needs in a way that promotes policies oriented towards future innovation or entry conditions advantageous to new entrepreneurs. Corporatism is consequently accused of hindering structural change and the institution of social partnership is considered to bear responsibility for both sides of Austria´s old structures/high-performance paradox.

Adaptive specialisation

Economic geography, government policy, corporatist and other institutions shape the general business environment of locations, making them either more conducive or obstructive to entrepreneurial activity (Harberger, 1998). An important missing piece, which calls at least for a tentative explanation, is the particular nature of entrepreneurial capabilities which fits into the puzzle. Clearly, given the poor characteristics of industrial structure, pure innovativeness or technological leadership are not consistent explanations. Despite our awareness of the dangers of oversimplification, a strong case can still be made for the entrepreneurial capabilities of "adaptive specialisation" as a major source of firm level productivity performance. Several empirical observations support this conclusion:

Aiginger (2000) provides a first indication of successful quality competition for Austrian manufacturing. Export unit values are close to the European average and Austria is ranked sixth with regard to export shares in the segment of industries which characteristically have the highest unit values. At first sight, this might not seem to be a big achievement. But, given Austria´s structural deficits, and especially its low share of technology driven industries (i.e. the one group which usually surpasses other industries by far in terms of unit values), average aggregate unit values imply that Austrian manufacturing primarily serves the high quality segments within its more traditional patterns of specialisation.

This interpretation is further strengthened by data from the Community Innovation Survey. Leo (1999) reports that within most industries, innovative performance corresponds to EU averages or is even better. This implies that the desired increase in total R&D expenditures, currently the major preoccupation of Austria´s innovation policy, is primarily a problem of industrial structure. Two additional observations are of relevance here: (i) differentiation by firm size reveals that it is only the small enterprises, which surpass their EU counterparts in terms of innovative activities; (ii) customer relations are a much more important source of information for innovative activities in Austria than in the EU.

The Austrian Technology Delphi, which screens various markets with respect to their potential for Austrian leadership, is another source of supportive evidence. Tichy draws the following conclusion: "Austria´s high share of basic and mainstream industries rests on a solid long-maintained knowledge base in several fields, which is usually regarded as medium technology (e.g. advanced materials, vehicle components, machinery, bio-food).

The concentration on intermediate rather than consumer goods assigns prime importance of receiver competence towards commercial customers" (Tichy, 2000B, p. 10).

Finally, recent empirical research in the field of New Economic Geography reports that among small member states, the Austrian pattern of industrial specialisation is by far the most similar to that of the total European Union.[22] An intriguing explanation is that Austrian industry performs particularly well by fitting its industrial structure very neatly into the overall European patterns of production. This interpretation is on the one hand supported by the importance of small to medium sized enterprises (OECD 2000A), many of which have developed their specific competitive advantages as flexible and reliable suppliers to other industrial customers. On the other hand, the many affiliates of foreign multinational enterprises do not just increase the existing stock of capital investment, but additionally support the transfer of knowledge and firm specific assets, including the set of established customer relationships. In a recent study on Austrian manufacturing, Egger and Pfaffermayr (2001) use this as an explanation of their econometric finding that in addition to the effects of capital deepening, foreign direct investments also have a separate and significant impact on labour productivity. The international marketing of industrial locations (as, for example, by the Austrian Business Agency) is therefore a very effective tool in nurturing aggregate growth. In short, both characteristics – the importance of SMEs and large inward FDIs – enhance the overall capability to adapt to and participate in the industrial dynamics of foreign markets.

To conclude, the various findings support the view that flexible specialisation and adaptation to specific customer needs is a major strength, which explains a considerable part of Austria´s high productivity performance at the micro-level. These innovations may be largely incremental and therefore of comparatively modest size. But they are widely distributed across a large number of actors, fostering the overall capacity to benefit from proximity to some of Europe´s most dynamic economic areas.

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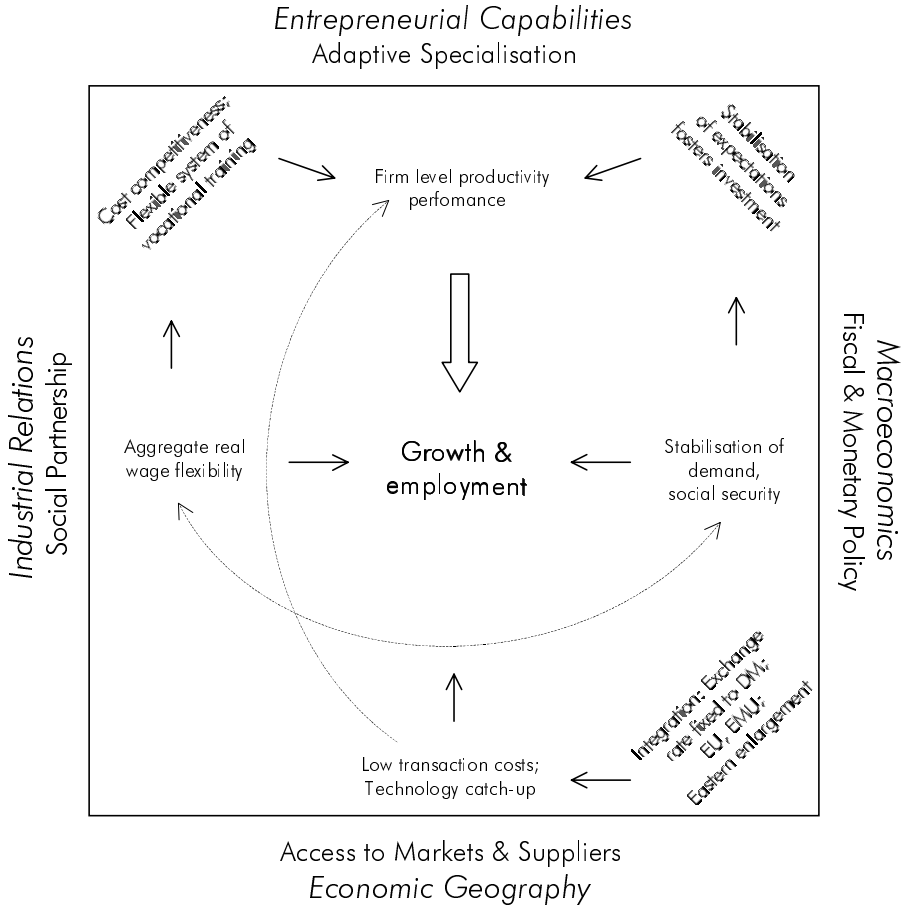
[22] See Midelfart-Knarvik et al (2000, p. 5f). Summing up the absolute differences to sector shares in the European Union, their `K – specialisation index´ is naturally bound to be higher for small countries and lower for large countries. This is indeed the case, except for Austria, where the index of dissimilarity is clearly below the average of the 14 EU countries and only slightly above those for the big economies of France, the UK, Germany and Spain.

Figure 6.1: Fitting together some pieces of the Austrian growth puzzle



6.3 Paradigm shift: towards a dynamic concept of industrial policy

An important aspect of the Austrian growth puzzle was the long-time coherence between macroeconomic policies and the other institutions, which bear responsibility for organised interests. This coherence was possible only because the goals of these institutions were united to those of the economy by a minimum number of concepts shared by both. Given the specific historic situation and Austria's geographic location, the resulting policy mix effectively fostered growth and employment, based upon economic integration, the import of advanced technology, demand stabilisation, high investment, the flexibility of aggregate real wages, and a system of apprenticeship training, which adapts quickly to the actual demand for labour skills. Due to these factors, the system performed well, even though political responsibilities for innovation and structural change were largely neglected.

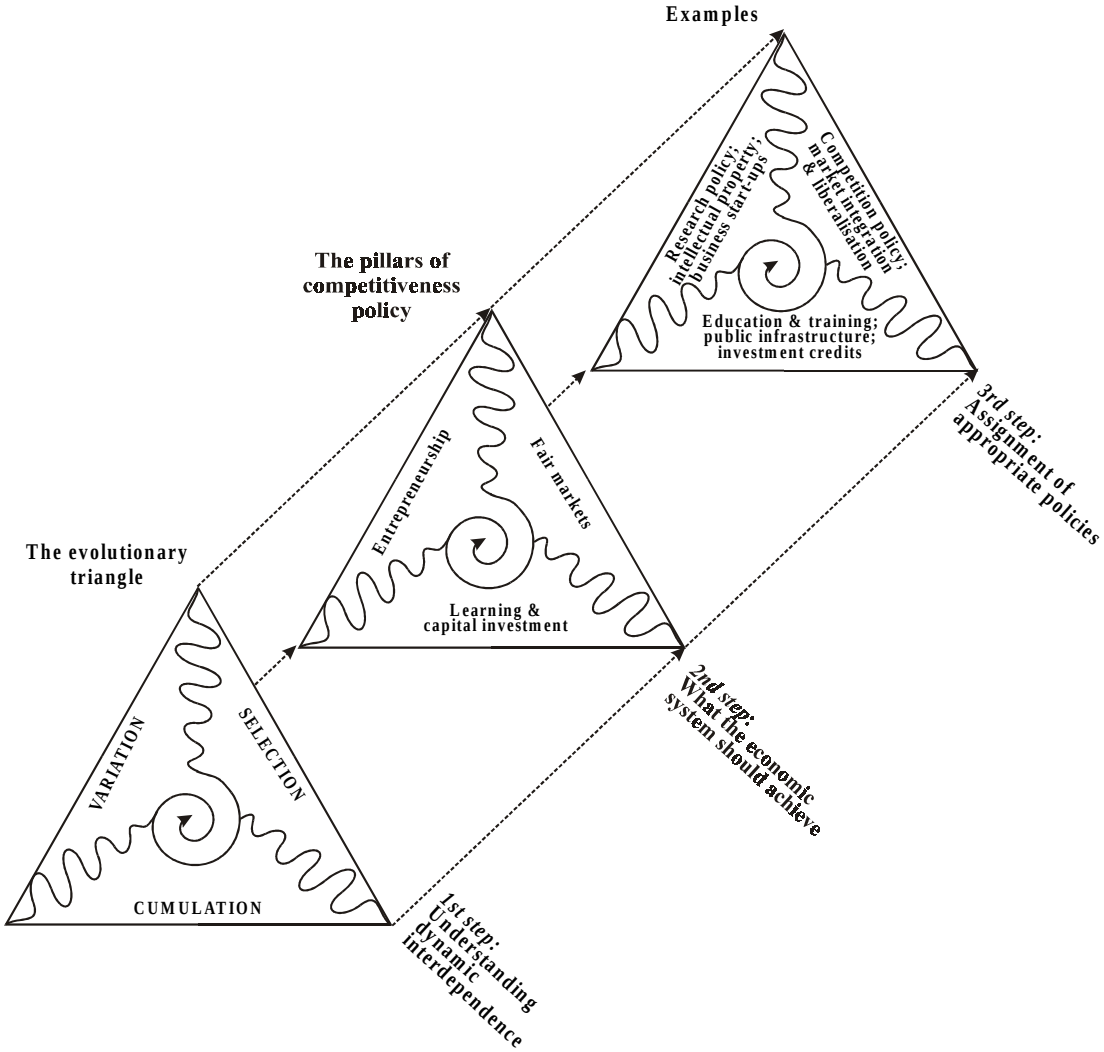
For the various reasons explained above, the traditional model has lost its lustre. Not all of the above elements in the Austrian growth puzzle could be sustained. The loss of Austria´s positive growth margin is an unmistakable empirical indication. The potential for additional growth through technological *catching up* already disappeared in the eighties. Membership in the Economic and Monetary Union marked another turning point, at which the concept of a national, demand-oriented macroeconomic policy lost its feasibility. The low share of dynamic industries additionally threatens to dampen the prospects for growth. Given this situation, the required *policy mix* will inevitably shift towards the supply side and industrial policy must therefore be prepared to generate additional impulses for long-term growth through structural reforms. Otherwise, the Austrian paradox might ultimately resolve into a situation of *old structures/low-performance* (Tichy, 2000B, p. 11).

Raising the share of R&D investment in GDP is currently one of the most important benchmarks of Austrian economic policy. But the empirical evidence has demonstrated that if any substantial increase in the overall innovative activity is desired, a considerable dynamics of structural change has to be achieved first. The Austrian technology gap is not just a problem of public support to R&D. It is deeply rooted in the lack of structural change towards those types of industries, where technological opportunities are relatively abounding and therefore the capabilities to undertake major innovations tend to be explored more systematically.

Trying to enable or even trigger the dynamics of structural change is however a highly complex matter. To begin with, economic policy must comprise a common vision, shared goals and a coherent concept for the different actors involved. As was the case with the model of demand-oriented macroeconomic policy, supply side microeconomic policies require an equally coherent framework in order to be effective. The conventional workhorse for such a framework is found in the static welfare analysis of so called market failures; an approach which must be acknowledged for its well defined target and clear policy prescriptions. The various rationales for policy intervention are well known and need not be repeated. A fundamental critique, however, has emerged from the field of Austrian economics, where the market failure approach is rejected for its reliance on the misleading benchmark of perfect competition. As the Austrian school of economics had pointed out, perfect competition is tantamount to the impossibility of entrepreneurial innovation and technological progress. Furthermore, since perfect competition is the mere theoretical

construct of an ideal state, untenable in the actual business world, shrewd intellectual exercise can always establish potential welfare gains through the interventions of a presumably omnipotent and benevolent government (Kirzner, 1997). In contrast to its free market rhetorics, the analytic benchmark of perfect competition distracts our attention away from the creative forces of self-organising processes towards the legitimation of welfare increasing public interventions.

Figure 6.2: The competitiveness policy prism



Source: Peneder (2001, p. 172)

An alternative to static welfare analysis is offered by the evolutionary perspective. Although methodologically much less elaborate, it offers the clear advantage of congruency with a dynamic vision of industrial development. Peneder (2001) offers a stylised projection of the fundamental rationales of evolutionary dynamics into a coherent set of economic policies. The so called competitiveness policy[23] prism in Figure 6.2 summarises its major intuition. The legitimation of policies is developed over three consecutive steps. To begin with, understanding the dynamic interdependence invokes the evolutionary trinity of the principles of (i) variation, (ii) cumulation and (iii) competitive selection. Any kind of evolutionary change, including technological innovation or structural adjustment, depends on the simultaneous interplay of these three forces. In the second step, these very abstract principles are projected into the realm of economics, defining what this system should achieve in terms of the three pillars of competitiveness policy: (i) entrepreneurship; (ii) learning and capital accumulation; and (iii) fair markets. In the third step, appropriate policies are assigned to these specific functions. Examples are R&D policies or start-up policies, each of them fostering the entrepreneurial function of generating novelty. Education and training, as well as investment policies, including the marketing of business locations to foreign investors, can be attributed to the second pillar of learning and capital accumulation. Finally, competition policy, market liberalisation and economic integration are prime examples of policies responsible for guarding fair principles of selection in the markets.

Such a general scheme is of course only a first, and indeed very modest step towards a better understanding of the dynamic rationales for structural policies and their mutual dependency. The intention is not to invent any new policies, but to present relevant fields of existing policies within a coherent framework. This framework should offer some flexibility, but nevertheless be derived from very fundamental theoretical considerations about industrial dynamics and structural change. What makes an important difference to the traditional arguments based upon static welfare analysis is the compelling need to legitimate and design the various policies interdependently, i.e. with regard to the overall

[23] Its definition is largely consistent with the established notion of "Standortpolitik": "Competitiveness policy is defined as the set of public activities that enable its entrepreneurs to strengthen their performance on competitive markets, and hence create income, employment and raise the overall standard of living" (Peneder, 2001, p. 158).

functions of the economic system they are meant to support. In contrast to the static welfare approach, it is no longer sufficient to justify any policies according to their own particular rationales (the presence of externalities, information asymmetries, public goods, subadditivity of cost, etc.) and execute them in isolation of one another. It is the systemic nature of the evolutionary perspective, which forces upon policy a shared vision of the overall goals and the specific tasks for which each of its disciplines is responsible.

Although the figure is only an exemplary exposition, it might serve well as an illustration for the required paradigmatic shift towards a coherent set of policies directed at the goal of enabling industrial dynamics as a self-organising process. Given the ample empirical evidence of the particular Austrian situation presented in this study, as a first step, the shared goal of such a strategy should be easy to communicate: to enable *structural change* and return to a trajectory of *high performance*.

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