EUROPEAN COMMISSION
ENTERPRISE DIRECTORATE-GENERAL

Enterprise policy
Enterprise policy: competitiveness and SMEs

ENTERPRISE DG
WORKING PAPER

SPEED OF CHANGE

BACKGROUND REPORT FOR
"THE EUROPEAN COMPETITIVENESS REPORT 2000"

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September 2000

Speed of change

by

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The author is grateful for discussions with members of the DG Enterprise (George Lemonidis, Annalisa Ferrando, Anestis Filopoulos, Isabel Grilo, Gerald Petit, Pierre Vigier, Renate Weissenhorn, David White), with participants at two workshops at WIFO (Paul Baker, Lionel Fontagne, Wolfgang Gerstenberger, Isabel Grilo, Bruce Lyons, Nora Plaisir, Gunther Tichy, Wilhelm Kohler, Michael Landesmann, Klaus Gugler, Rudolf Winter-Ebmer), and to his colleagues at WIFO, specifically Peter Egger, Michael Peneder, Michael Pfaffermayr, and Yvonne Wolfmayr-Schnitzer. The work could not have been performed without the programming of Marianne Schöberl and Wolfgang Klameth, the project management by Dagmar Guttmann, and the research assistance of Traude Novak and Eva Sokoll.

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Introduction

Competitiveness depends crucially on the speed at which production reacts to changes in demand or to changes in the comparative advantages of a country. We measure the ability of countries to adapt to new opportunities by measuring the speed of change of production structure. As simplest indicator for the speed of change, we calculate the sum of all absolute differences between a starting year and the latest available period, thus adding up increases and decreases in industry or sector shares. For the activity variable, we use the nominal value added, since this is available for broad macro sectors in agriculture, industry and services and also for industry types and individual industries. We calculate specific indicators which stress the importance of shifts to technology driven industries, to high skill sectors and to industries with high content of knowledge intensive services to build a link to policy indicators, as we stress that entry, venture capital, firm growth are aspects of adaptability which are important complementary to changing structures.

Box: Measuring speed of change

Most economists agree that it is crucial for the competitiveness of an economy to adapt quickly to changes in demand and supply. The Competitiveness Report 1999 has demonstrated that the adaptability and the speed of change may be more important for growth than the degree of specialisation and its change over time. As usual for complex processes it is difficult to measure this adaptability by simple indicators.

We use as indicator of the speed of change, the sum of all the differences between the shares in an aggregate between a starting year (t-n) and a final year (t). Each change contributes to this indicator, independently of its direction (plus or minus) and independently of whether it originates from mature or dynamic industries. The variable used is nominal value added, the shares are calculated as part of the total economy (macro speed of change) or of total manufacturing (all other indicators).
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 = $\Sigma \mid a_t - a_{t-n} \mid$, where a_t , a_{t-n} shares in final year, starting year

Statistical caveats:

- Adding up absolute changes in shares disregards the size of the sectors and the degree of disaggregation. A one percentage share is larger for a small sector than for a large sector. A sector subdivided into a few industries will yield a higher measured speed of change indicator than an industry. This recommends to compare countries only for identically classified sectors and limits the comparison if they have very different structure in the beginning (e.g. highly concentrated versus highly dispersed structure). It recommends not to focus too much on the contribution of a large vs. a small industry towards total change. We normalise the speed of change in Figure 1.2-3. to prevent the influence of different numbers of sectors between the indicators.
- Stochastic elements and errors in the variable further contribute to a potential bias. Large countries will exhibit a lower value for this indicator than smaller countries, since a stochastic influence like the entry or exit of a firm of given size will change shares less for larger countries. Growing countries will tend to have stochastically somewhat larger changes than stagnating countries.

Economic caveats

- Changes of the shares of an industry can originate from different reasons and are of different importance for long run competitiveness. Changes coming from firms losing competitiveness in a mature industry will have a different impact, as compared to changes coming from firms switching into dynamic, innovative industries. We abstract from directly distinguishing between positive and destructive changes, but we hint at the direction of change and its importance for long run competitiveness by stressing changes according to factor inputs, skills and service content.
- Adaptability is a complex process, where the speed of change of shares can highlight only one aspect. A more comprehensive picture needs an investigation of the entry and exit process, and on 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 hints that speed of change and competitiveness or growth are interrelated – be it suggested by graphs or be it econometrically by correlations and regressions – involve many problems. The main problem is that of causality, since we expect that growth needs adaptability but also measured speed of change is higher if growth accelerates (two way causality). With all this reservations in mind, we can use this indicator to inform about an important characteristic of economies.

Push and pull by agriculture and services

National accounts offer production data for 25 broad sectors, including agriculture, industry (manufacturing, construction, energy) and services. The Macro Speed of Change – as we call the dynamics of change at this rather aggregated level – was considerable between 1980 and 1997.

Approximately one half of the change occurred in the service sector, while the lion's share of the other half took place in industry. The change in agriculture - a decline in all countries – averaged to less than one tenth of total change, but with very large differences across countries. In Greece the agricultural shares contracted by 9%, in Ireland and Portugal by 6% respectively, although these three countries nevertheless continue to hold the largest shares of agriculture. In the Netherlands and Ireland, the structural change in industry is larger than that in services. In Austria, Portugal, Finland and Sweden, the structural change in services is double that in industry. All these are small countries, with high growth, geographically situated at the periphery of the European Union; they were not yet members at the beginning of the period analysed.

Table 1.2-1: Macro speed of change 1980-1997

Country	Macro speed of change 1997/1980				Shares of GDP						Growth p.a. 1997/1980	
	Macro speed of change	Agriculture	Industry	Services	Agriculture		Industry		Services		Total economy	
		Contributions to macro speed of change			1980	1997	1980	1997	1980	1997	Nominal terms	Real terms
Belgium	22,6	1,0	8,2	13,3	2,2	1,2	35,3	28,8	62,5	70,0	5,5	1,9
Denmark	16,9	2,2	6,8	7,8	5,5	3,2	28,7	27,2	65,8	69,6	6,7	2,1
Germany	27,1	1,1	10,8	15,2	2,1	1,0	42,7	31,8	55,2	67,2	6,2	1,9
Greece	39,5	9,3	11,0	19,2	17,3	8,1	30,4	23,0	52,3	68,9	6,7	1,6
Spain	24,3	3,6	9,3	11,4	6,9	3,3	38,0	31,1	55,1	65,6	6,8	2,5
France	22,7	2,1	8,0	12,6	4,5	2,4	35,5	27,5	60,0	70,1	5,7	1,9
Italy	28,5	3,2	12,1	13,3	5,8	2,7	39,6	31,1	54,5	66,3	6,9	1,8
Ireland	37,8	7,2	16,4	14,1	11,7	4,5	38,8	40,9	49,5	54,6	10,0	4,5
Luxembourg	46,5	1,6	17,9	27,0	2,4	0,8	37,6	21,1	60,0	78,1	9,0	4,8
The Netherlands	20,4	0,7	12,5	7,3	3,7	3,0	34,0	28,5	62,3	68,5	5,8	2,3
Austria	25,3	3,1	6,9	15,3	4,6	1,4	37,7	32,3	57,7	66,3	7,2	2,1
Portugal	34,3	5,9	10,3	18,1	10,0	4,1	37,8	33,6	52,2	62,3	9,3	2,6
Finland	29,4	5,6	8,5	15,3	9,7	4,1	37,8	31,6	52,5	64,2	6,0	2,2
Sweden	21,8	1,7	6,5	13,7	3,5	1,8	31,7	28,9	64,8	69,3	4,8	1,6
United Kingdom	29,5	0,2	11,5	17,7	1,7	1,5	42,1	31,6	56,2	66,9	6,5	2,4
EU	21,4	1,9	8,4	11,1	4,0	2,1	38,7	30,4	57,3	67,5	6,3	2,0

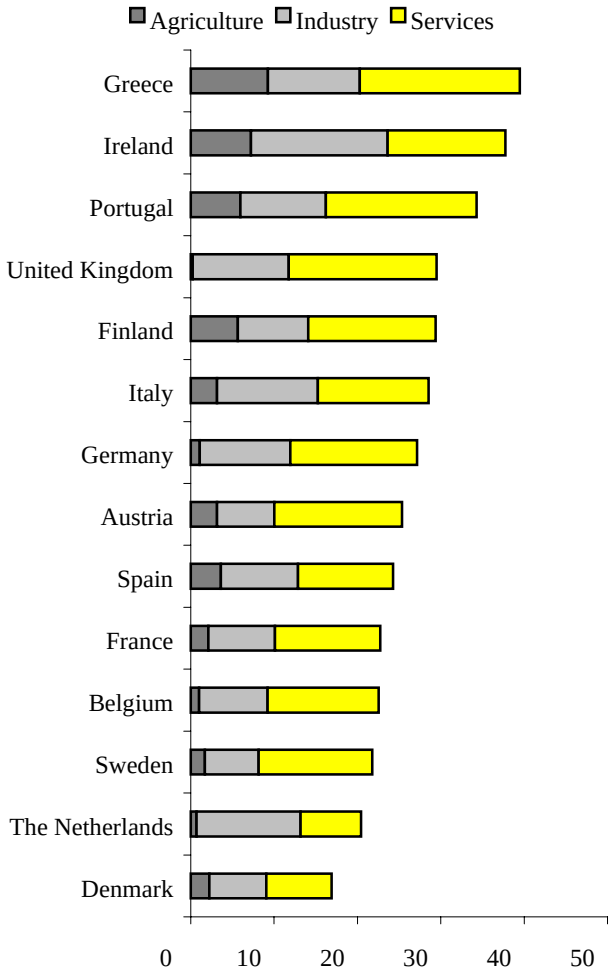
Remark: Macro speed of change: absolute difference in shares 1997/1980 in 25 broad sectors; the term "Industry" includes sectors of manufacturing, construction and energy.

Source: WIFO calculations using National accounts ESA, EUROSTAT.

The macro speed of change is highest in Greece, Ireland and Portugal partly because of the large decrease in the agricultural share. However, these countries are also among the top 4 in the speed of change in services. Ireland exhibits the highest speed of change within the industrial sector, while the slowest change occurred in France, Italy and the United Kingdom. Germany is a big country with a rather large amount of change in broad sectors, with services making a strong contribution, while the speed of change in industry (and specifically manufacturing) has been lower.

Among the 25 sectors, the greatest change is the increase in "market services", the share of which increased about one quarter of total value added for the EU total. In the industrial sector, the largest changes are the drop in the value added share of construction, within manufacturing that of the textile industry.

Figure 1.2-1: Contributions to macro speed of change 1980 to 1997



Source: WIFO calculations using National Accounts ESA, EUROSTAT.

Macro growth is significantly related to the macro speed of change, and to a certain extent, the share of agriculture is a driving force in this correlation. The relation is a two way causality: high agricultural shares supply workers potentially able to promote growth and changes in structures; higher rates of growth in industry and services in turn accelerate the number of workers leaving agriculture[1]. Growth is higher in countries where the industry

[1] There is also a stochastic component which contributes to concurrence of speed of change and growth.

share is larger and the service share is smaller, although this relation is not significant. Furthermore, the result is a corollary of the catching-up process. Growth is significantly related to the speed of change within industry, not to the speed of change within services[2].

Industry speed of change less than in the USA and Japan

Within manufacturing, the speed of change is measured at the level of 93 industries, for the period 1985–1998. The absolute difference of value added shares between these years is summarised as the "industry speed of change"[3].

The industry speed of change is largest in Greece, followed by Ireland and Portugal. Finland again is very close to the top 3. Germany, France and Italy exhibit the slowest speed of change. The correlation between "macro speed of change" and "industry speed of change" is rather close, the greatest differences are the slower speed of change for Germany and the higher ranks for Denmark and Austria at the industry level.

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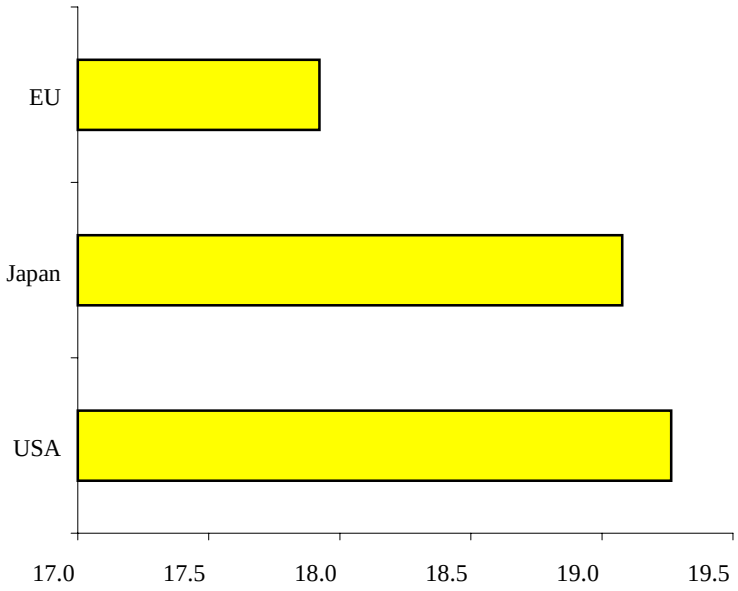
[2] Correlation can reveal relations but cannot detect causalities. The correlation between the macro speed of change and the growth of value added for all sectors is 0.64. Growth is correlated closely with changes in agriculture (R= 0.60) and industry (R=0.59), less with changes in the service sectors (R=0.29). The first two relations are statistically significant by usual statistical standards, but the result should be interpreted with caution due to the complex relation between growth and statistical indicators of structural change.

[3] This is calculated for manufacturing industries (NACE 15-36) excluding construction, energy.

Figure 1.2-2: Speed of change in manufacturing, 1988-1998



Source: WIFO calculations using SBS (EUROSTAT); Japan, USA 1988-1997.

The industry speed of change is lower in Europe as compared to Japan and the USA. The indicator is 17.9 for Europe, 19.1 for Japan and 19.3 for the USA (in both countries data end in 1997). This underlines the fact that the speed of change is insufficient in Europe, as has been analysed with regard to specialisation and concentration patterns in past reports[4]. Specifically, there is a large difference in the speed of change in industries in which national procurement policies and specific regulations (food, etc) played significant roles before the Single Market Program took effect[5].

[4] Aiginger (1999A) and Aiginger et al. (1999B), European Commission (1998 and 1999), Peneder (2000). For a review of theoretical forces see Wolfmayr-Schnitzer (1999).

[5] These sensitive sectors contributed to the speed of change in Europe (4.1 points relative to 6.9 in the USA). These numbers indicate that the shares of each sensitive sector changed nearly half as quickly as in the USA (see Buiges and Ilzkovitz (1990)).

Relating change to structure and policy

There are some limitations to assess the speed of change by one single indicator. Changing structure can be the result of firms' strategies actively to restructure into dynamic and promising industries or can be the result of losing competitiveness of existing firms. Secondly, adaptability of supply to demand needs more comprehensive evaluation of economic activity and a link to policy factors. We try to follow these demand first by investigating the structural change according to the main input factor used (speed of change according to factor inputs), secondly to skill classes and thirdly to the type of services used. These additional indicators on the speed of change give indicators as to the source and direction of change. We finally add information on entry, venture capital and the use of information technology to include other aspects important for the adaptability of the economies.

In Figure 1.2-3 the countries are ranked according to macro speed of change. The second column shows the speed of change in manufacturing. The third column shows the speed of change according to factor inputs, specifically how labour intensive industries lose shares and technology driven industries win. The next column concentrate on change in skill classes, specifically how structure changes from low skill to high skill industries. The final bar for each country shows how structure changes in the direction of knowledge intensive service inputs.[6]

Among the countries undergoing quick change, Greece and Portugal still have a high share of labour intensive industries. Speed of change according to input factors and to service types is lower than macro speed of change. Ireland is far ahead in the speed of change in industry types, since it has been shifting resources from labour intensive into research intensive industries. Portugal and Greece did change their share in broad sectors, but were not able to achieve a large increase in technology oriented industries. Sweden and Finland outperformed all other countries in their ability to increase their shares of technological industries, hinting at the importance of technology policy and successful firm clusters in the field of information technologies. Finland, Sweden and Ireland, but also the Netherlands shifted its industry structure towards knowledge based services.

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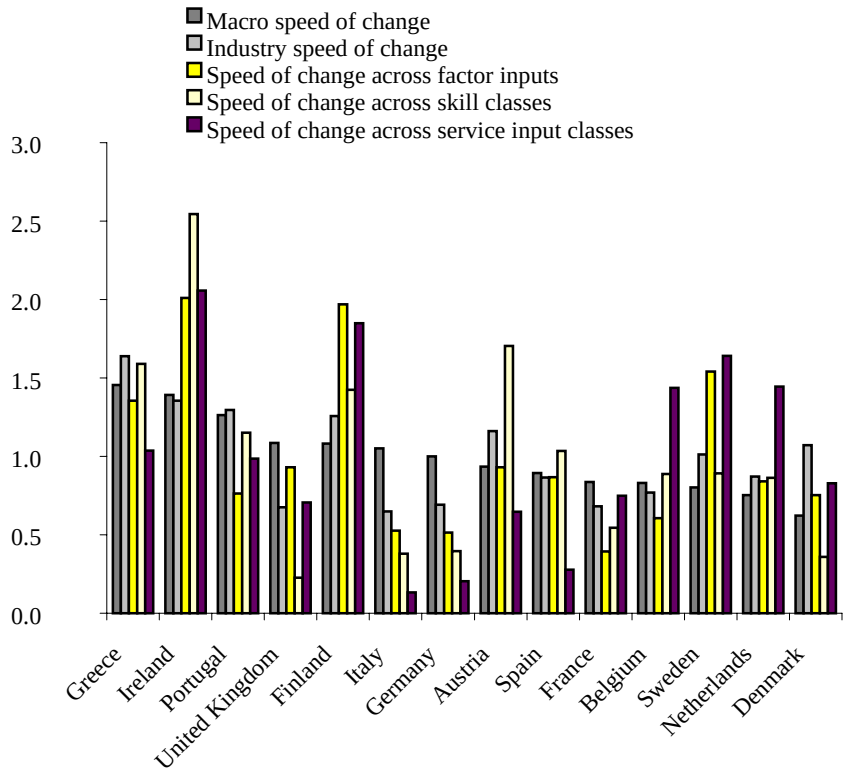
[6] As mentioned in the box, the indicator depends on the degree of disaggregation and would always be higher for more disaggregated classifications. Therefore the data are normalised by dividing into the mean across countries, to become comparable. Secondly the indicators are still theoretically neutral between losses and gains in the specific sectors, but in the examples mentioned the share of technology driven industries, the share of high skill industries and the share of knowledge intensive services dominate the picture, allowing to some extent to measure the speed of change most favourable for long term competitiveness.

Growth in manufacturing is higher in countries with a large share of advertising intensive industries. It is stronger in countries in which the share of low skill industries decreased and higher where the share of high skill industries increased. This could hint that part of the growth potential, as well as part of broad structural change, represents the catching up process of countries with a formerly large share in the agricultural sector and reliance on less qualified labour.

Figure 1.2-3: Speed of change according to the level of aggregation

(normalised)



Source: WIFO calculations using EUROSTAT, ESA for macro speed of change, SBS for industry speed, WIFO typology for industry types. Normalised means that the indicators were made comparable in size (dividing them by the means to correct for differences in the average "speed of change" in the individual measures).

Growth is related to changes in the skills of workers in manufacturing. Growth expands as the share of high skilled employees increases and the share of untrained workers decreases. A faster speed of change in skill classes is seen in Ireland, followed by Austria. Both countries

have experienced high rates of growth, indicating the close relationship between the quality of factor inputs and growth.

Table 1.2-2: Speed of change in manufacturing according to industries and industry types, 1985-1998

	Industry speed of change (93 industries)	Speed of change across factor inputs	Speed of change across skill classes	Speed of change across service input classes	Growth of manufacturing
Belgium	26.3	7.2	11.9	15.2	4.2
Denmark	36.7	8.9	4.8	8.8	4.8
Germany	23.7	6.1	5.3	2.2	3.9
Greece	56.0	16.0	21.3	11.0	3.3
Spain	29.6	10.3	13.8	2.9	4.7
France	23.3	4.7	7.3	7.9	3.0
Italy	22.2	6.2	5.1	1.4	3.8
Ireland	46.3	23.8	34.1	21.8	7.9
Netherlands	29.8	10.0	11.6	15.3	4.9
Austria	39.7	11.0	22.8	6.8	5.7
Portugal	44.3	9.0	15.4	10.4	8.2
Finland	43.0	23.3	19.1	19.5	3.1
Sweden	34.6	18.2	11.9	17.3	0.9
United Kingdom	23.1	11.0	3.0	7.5	3.1
EU15	34.2	11.8	13.4	3.6	3.8

Remark: speed of change = absolute difference in shares 1998/1985.

Source: WIFO calculations using SBS, EUROSTAT

Speed of change matters

The economic environment affecting firms changed dramatically over the past two decades. Growth is related to the speed of change, both at the macro-level and at the level of

manufacturing. Growth is further stimulated if research intensity, skills and the use of knowledge intensive services are high and rising. The speed of adjustment to a changing economic environment as well as the use of inputs specifically important for growth, are therefore crucial for competitiveness.

Comparisons of Europe and the USA and Japan have shown that the speed of change in European manufacturing may not have been fast enough in relation to changes in demand and technology. The lower speed of transition is one factor explaining the deterioration of the European competitive position relative to the USA.

Emphasising the speed of change directs policy to factors promoting change: mobilising financial resources for new, fast growing firms; fostering innovation in new technologies, intensifying training, retraining and education; upgrading quality and promoting knowledge-based services. A prerequisite for the success of such measures is, however, an economic framework for business conducive to innovation, change and growth. This implies especially open markets for goods and services, flexible labour and capital markets, a regulatory framework enhancing innovation and a system of taxes and social security contributions encouraging entrepreneurship.

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