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The Diffusion of Process Innovations in Industrialized and Developing Countries - A Case Study of the World Textile and Steel Industries

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Abstract

This paper tests the hypothesis that industrial process innovations diffuse more slowly in developing countries than in industrialized countries. The focus of the analysis is on four innovations in the textile and steel industries, selected according to data availability. The analysis uses a variable coefficient regression model, based on an S-shaped diffusion curve. It is found that, overall, the level of economic development had only a modest impact on the adoption of innovations. At a more disaggregated level of analysis, its (limited) impact was related to both the characteristics of the technology, and to the firm structure of the respective industry.

Zusammenfassung

In diesem Arbeitspapier wird die Hypothese empirisch getestet, daß industrielle Prozeßinnovationen sich in Entwicklungsländern langsamer verbreiten als in Industrieländern. Es wird eine ökonometrische Analyse der Diffusionsverläufe von vier Innovationen in der Textil- und Stahlindustrie vorgenommen, die nach der Verfügbarkeit entsprechender Daten ausgewählt wurden. Grundlage ist ein Regressionsmodel mit variablen Koeffizienten auf der Basis einer S-förmigen Diffusionskurve. Insgesamt gesehen blieb der Einfluß des wirtschaftlichen Entwicklungsstandes auf die Verbreitung von Innovationen begrenzt. Bei stärker disaggregierter Betrachtungsweise zeigt sich, daß dieser (begrenzte) Einfluß sowohl von der jeweiligen Technologie als auch von der Industriestruktur abhing.

1. INTRODUCTION*

It has frequently been argued that world-wide technical progress, especially in the form of microelectronics-related process innovations, may harm the prospects for industrialization in developing countries (e.g. Kaplinsky, 1984, p. 157 ff.; de Meyer, 1985; Castells, 1985, p. 304 ff.; UNCTAD, 1986; UN/ECLAC, 1988, p. 15 f.; Henke, 1990, p. 8 ff.). Apart from a possible labor-saving bias of technical change, it was hypothesized that developing countries find themselves at a relative disadvantage regarding the adoption of new technologies (lack of technological competence), or are excluded from the use of new technologies by "technological protectionism" on the part of firms in industrialized countries (Ernst, O'Connor, 1989, p. 124f.). In either case, assuming a steady stream of productivity-raising process innovations, developing country producers would face a widening productivity gap and, hence, an increasing competitive disadvantage vis-a-vis firms based in industrialized countries.

Technological competence involves, in particular, the ability to identify and adopt those new technologies that provide a significant productivity increase (and cost reduction) compared with existing practice. This assumes special importance in developing countries since process innovations developed in industrialized countries frequently imply a substitution of capital (human or physical) for labor, and may thus reduce per-unit production costs substantially in high-wage, but not necessarily in low-wage economies. Such innovations probably occur mainly in peripheral

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activities. By contrast, modifications in core processes are more likely to result in efficiency gains across a wide range of relative factor prices (Pack, 1979, p. 60; Rosenberg, 1988, pp. 29ff.; Bhalla, James, 1991).[1] Innovations of this latter type therefore tend to undermine the competitiveness of producers failing to adopt them.

This paper studies the diffusion patterns of four innovations affecting core processes of the textile and steel industries. These have been selected on the ground that sufficient data are available for both industrialized and developing countries. In the recent past, all four new techniques have been used in countries at rather different stages of economic development, suggesting that they provide significant efficiency gains across a wide range of relative factor prices. Hence, early and fast adoption of these innovations by developing country producers could be taken as a sign that no major barriers to international technology transfer exist. By contrast, retarded adoption would imply the possibility of an increasing productivity gap.

This paper is organized as follows: Section 2 provides a brief overview over existing diffusion models and introduces the econometric model used in the present analysis. Section 3 presents the data as well as some relevant technical characteristics of the innovations. Section 4 summarizes the econometric estimates. Section 5 discusses the extent to which the present findings can be generalized, and suggests directions for further research.

2. DIFFUSION MODELS

The first step of the present analysis consists in describing, for each country, the salient features of the diffusion patterns of the selected process innovations. Subsequently, it is determined whether certain relevant parameters of the diffusion process vary systematically across countries as a function of the level of economic development. While the two steps may later be combined into one estimating equation, they represent analytically separate stages of the analysis.

A crucial question for the first step is the choice of the model to represent the diffusion patterns of the selected process innovations. Since the 1960s three broad types of diffusion models have appeared in the literature (cf. Silverberg, Dosi, Orsenigo, 1988, pp. 1034f.). The first assumes an "epidemic" diffusion of the innovation depending on its expected profitability and the increasing availability of information on the new technology (e.g. Mansfield, 1968). Over time, the share of actual in potential users of the innovation follows an S-shaped diffusion path, rising rapidly initially and leveling off when the saturation point is approached.

The other types of diffusion models relax some of the restrictive assumptions of the "epidemic" approach. One class of models (e.g. Davies, 1979, pp. 60 ff.) describes the diffusion process as a sequence of equilibria determined by the characteristics of the innovation as well as the economic environment in which diffusion takes place. However, such analyses tend to focus on the existence and properties of the equilibria, without considering the adjustment process itself (Silverberg, Dosi, Orsenigo, 1988, p. 1035). By contrast, the third group of models look upon the diffusion of an innovation as an evolutionary process under the conditions of uncertainty, bounded rationality, and endogenous market structures (e.g. Silverberg, Dosi, Orsenigo, 1988).

Simulation experiments have shown, however, that even in the more sophisticated models the diffusion path over time typically follows an S-shaped curve. This functional form can therefore be used to describe diffusion processes under a wide variety of assumptions about their determinants. This property makes it a suitable device for the first stage of the present analysis (cf. Sahal, 1981, p. 86).

The diffusion of a process innovation in a particular country may be characterized by the date of first adoption, the speed of diffusion, and the point of saturation. These features are directly represented in the general form of the logistic function:

$$[1]\ P_{t,k} = a_k/(1 + \exp(b_k - c_k t))$$

where P_t is the share of output produced with the "new" technique in total output at time t, a is the point of saturation, b reflects the date of first adoption, and c represents the speed of diffusion, and k is the country index.

In its general form this function is non-linear in variables and parameters. The point of saturation, however, can frequently be assumed to be 100 per cent (a=1), i.e. the new equipment completely replaces traditional technology. In that case [1] can be transformed into

$$[2]\ \ln (P_{t,k}/(1-P_{t,k})) = \text{LOGIT}\ (P_{t,k}) = -b_k + c_k t,$$

which is linear in transformed variables and parameters. Equation [2] is used as the basis of the first step of the present econometric analysis, as it has been shown elsewhere that alternative functional forms offer no significant advantages (Lücke, 1992, Section D.I.2.a).

The second step involves testing the hypotheses that the timing of the start of diffusion, or the speed of diffusion within each country depend on the level of economic development. The latter is approximated by per-capita gross domestic product, rendered internationally comparable through the use of purchasing power parities (RGDP1 according to Heston, Summers, 1988). The hypotheses will be accepted if, in the following equations, the coefficients β_1 and β_2, respectively, turn out significantly different from 0 (cf. Mansfield, 1968, pp. 179ff.):

$$[3]\quad -b_k = \alpha_1 + \beta_1 \, RGDP1_k$$

$$[4]\quad c_k = \alpha_2 + \beta_2 \, RGDP1_k$$

Instead of estimating [2], [3], and [4] separately, the three equations may be combined into a variable coefficient model:

$$[5]\quad LOGIT\ (P_t) = \alpha_1 + \beta_1 \, RGDP1 + \alpha_2 \, T + \beta_2 \, RGDP1 \; T.$$

If the variance-covariance matrices of the disturbance terms of [2], [3] and [4] were known, GLS estimates of β_1 and β_2 based on [2], [3] and [4], on the one hand, or [5] on the other hand, would yield identical coefficients (Amemiya, 1978). Levels of significance, however, would differ due to the larger number of observations in [5] (Balassa, Bauwens, 1988, pp. 27ff.). Furthermore, it has been shown that under certain restrictive assumptions about the disturbance terms, particularly uncorrelated residuals in [2], Weighted Least Squares will give consistent estimates (Amemiya, 1978, p. 795f.).

The assumption of independent residuals in [2] may not, however, be warranted in the present context. The S-shaped diffusion curve may not fully account for the complexity of the diffusion process, in which case autocorrelation may arise in the disturbances (cf. the examples in Sahal, 1981, pp. 94f.). Since the specification of the present model cannot be improved due to lack of data on expected profitability etc., two procedures will be used alternatively for estimation. First, [5] is estimated by simple OLS in order to gain an impression of the explanatory power of the approach as a whole, and in order to assess the significance of β_1 and β_2 on the basis of a relatively large number of observations. Secondly, [2] is estimated separately for each country correcting for autocorrelated residuals by the Maximum Likelihood method proposed by Beach and MacKinnon (1978; the Cochrane-Orcutt method is used when the data for individual countries are discontinuous). Equations [3] and [4] are then estimated by OLS, correcting the standard errors of the coefficients for heteroskedasticity of unknown form as suggested by White (1980).[2]

3. DATA

The innovations studied in this paper are open-end rotor spinning and shuttleless looms in the textile industry, as well as basic oxygen furnaces and continuous casting in the steel industry. No other innovations have been found for which data on adoption are available for a sufficiently large number of industrialized and developing countries, and for a long enough period of time. The data sources are listed in the Appendix and the data are reproduced in Tables A1 through A4.[3]

The four innovations have in common that they lead to substantial reductions in per unit production costs under a wide range of relative factor prices. Adoption of the new textile machinery predominantly increases labor productivity, affecting both unskilled and skilled labor. Simultaneously, fixed capital requirements per unit of output tend to rise (cf. Lücke, 1990, p. 142). Nevertheless, open-end rotors and shuttleless looms account for a large proportion of newly installed capacity in industrialized as well as developing countries (ITMF).

The basic oxygen furnace in steelmaking leads to savings mainly of raw materials and energy. Continuous casting technology decreases fixed capital requirements per unit of output and reduces wastage. Since inputs and machinery are both traded internationally, reduced input or fixed capital requirements per unit of output can be expected to lower per-unit production costs to a similar extent in industrialized and developing countries. Hence, if firms in developing countries failed to adopt these new types of machinery, their competitive position in the world market would probably deteriorate.

The data on the adoption of open-end-rotors and shuttleless looms relate to installed (rather than utilized) capacity. The output of basic oxygen furnaces is expressed as a proportion of "non-electric" steel production, since the technological characteristics of the electric "mini-mills" are rather different from those of the large-scale plants where basic oxygen furnaces are typically used. Steel output by the continuous casting method is measured as "crude steel equivalent" to account for reduced wastage compared with the traditional ingot method.

4. ESTIMATES

The regression results are summarized in Table 1. Overall, the S-shaped diffusion model fits the data reasonably well, with $\bar{R}^2$ for the estimates of equation [5] in the range from .38 to .51. The impact of the level of economic development on the diffusion of innovations, however, was limited. With $\bar{R}^2$ not exceeding .21, the cross-country regressions [3] and [4] explain at most a modest proportion of intercountry differences in the beginning and the speed of diffusion.

The results also suggest that the diffusion of innovations in the textile industry was more strongly affected by the level of economic development than in the steel industry. Independently of which method of estimation is used (equation [5] vs. [3] and [4]), β_1 is found to be significantly positive in the case of open-end rotors. This finding implies that the diffusion of open-end spinning technology started earlier, on average, in more developed countries. The speed of diffusion, however, did not increase as a function of the level of economic development (insignificant estimates of β_2). By contrast, estimates of β_2 are significantly positive in the case of shuttleless looms. This innovation apparently diffused faster, the more developed a country. The estimates of β_1, relating to the beginning of diffusion, are highly sensitive to the choice of the estimation method and should therefore be looked at with caution.

In the steel industry, the level of economic development did apparently not exert a similarly well-defined influence on the diffusion of innovations. Estimates of β_2 are weakly positive for

Table 1: The International Diffusion of Selected Process Innovations - Regression Results

Dependent variable/ estimation method	Coefficient estimates β_1	β_2	α_2	Test statistics F	$\bar{R}^2$	N
Open-end rotors						
"one pass" [5]	.201E-03***	-.126E-05	.155***	215.7***	.46	747
	(6.62)	(-.56)	(10.4)			
"two step" [3]	.262E-03***			13.7***	.21	49
	(3.32)					
[4]		.435-05		1.78	.02	49
		(-1.31)				
Shuttleless looms						
"one pass" [5]	.103E-03***	.840E-05***	.137***	239.8***	.51	676
	(2.84)	(3.17)	(8.43)			
"two step" [3]	.332E-04			.26	-.02	50
	(.82)					
[4]		.147E-04**		7.43***	.12	50
		(2.40)				
Basic oxygen furnaces						
"one pass" [5]	.373E-04	.662E-05**	.150***	138.3***	.38	670
	(.44)	(2.12)	(6.10)			
"two step" [3]	-.278E-02			.41	-.02	31
	(-1.20)					
[4]		.453E-04**		3.00*	.06	31
		(2.56)				
Continuous casting						
"one pass" [5]	.528E-04	.295E-05	.205***	153.3***	.41	661
	(.69)	(.83)	(7.18)			
"two step" [3]	.522E-04			.05	.03	35
	(.21)					
[4]		.579E-05		.29	-.02	35
		(.49)				

t-values in parentheses. - ***(**;*) Significantly different from 0 at the 1 per cent (5; 10 per cent) confidence level (2-tailed test).

Source: Data cf. Tables A1 through A4; own calculations with Time Series Processor Version 4.2A.

the basic oxygen furnace technology, suggesting that this new type of equipment diffused faster, on average, the higher a country's level of economic development. The explanatory power of equation [4] remains rather low, however ($\bar{R}^2$ = .06). Apparently the impact of the level of economic development was fairly limited. The diffusion of continuous casting technology did not differ significantly across countries as a function of the level of economic development.

5. INTERPRETATION

The main finding of the foregoing empirical analysis is that the level of economic development has exerted, at most, a modest influence on the diffusion of the selected innovations. This applies to both the speed and the beginning of diffusion. It is therefore unlikely that the international competitiveness of developing countries as exporters of manufactures will be undermined on a large scale by world-wide technical progress. Similarly, the data show no evidence of technological protectionism, directed specifically against developing countries, by equipment suppliers in industrialized countries.

At a more disaggregated level, the (limited) impact of the level of economic development on the adoption of innovations apparently depended on the characteristics of the technology in question. Open-end rotors and shuttleless looms raise labor productivity, but also increase fixed capital requirements per unit of output.[4] In developing countries with relatively low labor costs, the cost advantage of these types of machinery over traditional equipment is therefore probably smaller than in high-wage countries.[5] By contrast, unit cost reductions due to the introduction of basic oxygen furnaces or continuous casters are apparently distributed more evenly across countries. This would explain the small impact of the level of economic development on the diffusion of innovations in the steel industry, compared with its somewhat larger role in the textile industry.

The difference between the diffusion patterns in the textile and steel industries may also be related to the firm structure of the two industries. Operating novel types of machinery requires relatively large amounts of highly skilled labor, a scarce resource in developing countries. Besides, it may be feasible only in close cooperation with equipment producers who can quickly be called upon if teething problems arise. In addition, information about the profitability of the new machinery may come largely from experience and from personal networks, rather than through formal channels. All this will retard the adoption of innovations in industries with a high proportion of small, traditional firms, such as textiles, and especially so in developing countries. By contrast, relatively large, modern firms as in the steel industry are more likely to have the technological competence required for fast, and successful adoption of innovations. This should apply even to those steel producers that are small by the standards of the industry, such as electric "mini" mills.

The present, largely optimistic assessment of the impact of technical progress on the competitiveness of manufactured exports from developing countries requires two qualifications. First, some developing countries maintain a highly restrictive import regime for machinery in order to protect domestic suppliers. Investment credit is also sometimes allocated to enterprises and branches of industry on a discriminatory basis (for the case of traditional, labor-intensive industries in Brazil cf. Lücke, 1990, pp. 59ff. and 102ff.). Such policies tend to raise the cost of fixed capital, and may therefore impede the adoption of innovations in particular countries or industries. In addition, real interest rates may be high, by international standards, in countries that have lost access to the international capital market.

Secondly, the innovations studied in this paper represent technical progress that is largely embodied in capital equipment that has already attained a high degree of technological maturity. With regard to the future impact of technical progress on developing countries, this raises the question of whether the present findings also apply to new technologies such as microelectronics, bio-technologies and new materials. Their application might require, for some time to come, a substantial input of human capital which is relatively scarce in developing countries (Vickery, Campbell, 1991, p. 66; Brainard and Fullgrabe, 1986). In the meantime, however, significant productivity gains might be realized by firms in industrialized countries that have already adopted the innovations. Unfortunately, the available data on the diffusion of these new technologies in developing countries are rather scarce. A recent survey of the literature on microelectronics-related process innovations has found evidence that such technologies are beginning to be adopted in some more advanced developing countries (Lücke, 1992, pp. 64ff.). As more data become available, more systematic research efforts should be directed at the determinants of the international diffusion of these new technologies.

1 The idea that a distinct new technique may be optimal under a variety of relative factor prices, has been conceptualized under the heading of 'localized technical progress' by Lapan (1975).

2 In this context, equation [2] is not looked upon as a binary choice model, which would necessitate Weighted Least Squares estimation due to heteroskedastic residuals (cf. Judge et al., 1988, p. 785). Rather [2] is viewed as representing a functional form that can be used to describe diffusion curves under varying assumptions about their determinants. Besides, when [2], on a purely experimental basis, was estimated by Weighted Least Squares as well as correcting for first-order autocorrelation, the results were frequently implausible (e.g. negative coefficients attached to T).

3 Values of .0 and 100.0 per cent in the original data have been replaced by .1 and 99.9 per cent, respectively, in order not to lose these observations in the calculation of the logit terms. The data frequently do not cover the whole length of the diffusion process in individual countries. Therefore, no more than one observation each of .1 or 99.9 per cent has been included in the data set. Inclusion of a larger, necessarily arbitrary number of such observations, representing periods of either no adoption at all or complete adoption of an innovation, would have distorted the regression results.

4 I avoid using the terms of "factor-saving" vs. 'neutral' technical progress, which are normally employed to characterize a shift in a neoclassical, substitutional production function. The present discussion, by contrast, relates to the choice between several distinct techniques.

5 Anecdotal evidence exists on the technological behaviour of the Korean textile industry (Amsden, 1989, pp. 247ff.). In spite of rising wages, Korean manufacturers apparently remained fairly competitive until the late 1970s, using equipment that was then largely obsolete by international standards.

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Appendix: Data Sources

Open-end rotors, shuttleless looms:
International Textile Manufacturers' Federation (ITMF), International Cotton Industry Statistics, various issues.

Basic oxygen furnaces, continuous casting:
International Iron and Steel Institute (IISI), Steel Statistical Yearbook, various issues.

Wirtschaftsvereinigung Eisen- und Stahlindustrie, Statistisches Jahrbuch der Eisen- und Stahlindustrie, various issues.

United Nations, Economic Commission for Europe (UN/ECE), Quarterly Bulletin of Steel Statistics for Europe, various issues.

Instituto Latinoamericano del Fierro y el Acero, Statistical Yearbook of Steelmaking and Iron Ore Mining in Latin America, various issues.

Real per capita GDP: Heston, Summers (1988).

Table A1: Share of Open-End Rotors in Spinning Capacity[a], Selected Countries, 1974-1990 (per cent)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	RGDPI[b] (1985)
Egypt	NA	0.1	0.3	0.3	2.1	4.1	4.1	4.3	4.3	4.2	4.3	4.0	NA	NA	NA	NA	4.0	1188
Ivory Coast	NA	NA	NA	NA	0.2	0.2	0.2	0.7	0.7	1.2	1.2	1.7	2.2	2.2	3.4	7.0	7.0	920
Madagascar	2.9	3.6	3.2	2.8	3.6	4.5	4.1	4.2	4.2	4.1	4.1	4.1	4.1	7.9	11.4	11.4	11.4	497
Morocco	NA	NA	NA	9.6	12.5	16.0	16.1	16.2	17.3	15.5	15.7	20.5	20.5	20.5	20.5	20.8	21.6	1221
Nigeria	NA	NA	NA	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.9	2.2	5.7	6.4	7.3	7.5	7.9	581
South Africa	0.2	0.6	0.7	0.8	1.9	2.2	1.8	1.8	2.0	2.0	2.4	5.0	4.7	7.3	6	6.0	NA	3885
Canada	NA	1.2	1.2	1.5	1.6	1.7	3.9	4.2	4.5	4.7	5.7	9.3	10.2	10.7	13	13.0	13.0	12196
El Salvador	NA	0.8	2.9	2.4	2.5	2.5	2.5	3.2	2.8	3.2	3.2	3.2	3.8	3.8	3.8	4.3	6.0	1198
Guatemala	0.5	0.5	0.5	0.5	0.5	0.7	0.7	1.9	3.0	3.1	4.9	7.9	12.4	17.6	19.1	19.1	21.1	1608
Mexico	1.3	1.5	1.7	1.8	1.8	1.9	1.9	3.4	3.4	3.4	3.5	2.8	3.3	3.2	4.1	3.8	3.7	3985
U.S.A.	NA	2.6	2.9	3.1	3.3	3.6	4.0	4.5	3.8	4.8	5.9	7.2	8.7	11.0	13.6	15.9	17.4	12532
Argentina	0.1	0.4	2.3	[illegible]	3.8	4.1	4.6	6.0	6.0	6.7	7.4	7.7	7.0	7.0	7	7.0	7.0	3486
Brazil	NA	1.5	2.0	1.7	1.7	1.9	3.0	3.0	4.1	4.2	4.2	4.2	4.0	4.0	4	4.0	NA	3282
Columbia	NA	0.9	0.9	1.0	1.1	1.7	2.0	3.5	3.9	2.5	2.6	3.7	4.4	4.9	5.6	6.1	5.3	2599
Ecuador	NA	NA	NA	NA	1.0	2.1	2.1	2.5	2.5	2.3	3.2	4.6	7.0	8.9	8.9	9.5	9.5	2387
Peru	NA	0.2	0.4	0.5	0.9	2.2	2.7	3.3	3.8	3.8	4.1	4.1	5.7	5.7	6.1	6.1	6.0	2114
Uruguay	NA	0.4	0.6	0.3	0.4	0.4	0.4	1.8	1.8	1.8	1.8	3.3	4.0	4.4	7	8.6	8.6	3462
Venezuela	NA	NA	NA	1.7	2.8	2.8	4.3	4.7	4.7	4.4	4.4	5.7	6.3	7.4	12.3	12.2	12.2	3548
Australia	NA	6.2	6.2	6.3	7.9	13.1	13.1	15.8	17.6	18.3	19.7	20.6	26.8	28.0	34.7	39.5	44.8	8850
Hong Kong	9.1	13.8	16.5	17.6	22.4	22.9	22.9	23.5	22.5	30.4	31.6	34.6	42.0	45.0	43.4	44.7	46.7	9093
India	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	0.2	0.2	0.5	0.5	0.7	750
Iran	NA	1.6	2.7	3.3	4.0	4.0	4.0	4.1	4.1	4.2	4.8	4.8	9.4	9.4	9.4	9.4	9.4	3922
Israel	NA	1.3	0.9	0.9	1.4	1.6	1.6	3.1	3.1	5.2	5.8	9.8	15.3	17.9	19.7	29.3	37.5	6270
Japan	4.9	5.2	5.4	5.4	5.9	6.5	6.6	7.6	6.3	6.2	6.7	6.3	6.4	5.8	5.9	5.9	6.4	9447
Korea, Rep.	NA	0.2	0.6	1.3	1.3	1.7	1.7	2.0	2.1	2.1	2.5	2.8	2.9	2.9	3.1	3.2	3.1	3056
Pakistan	NA	NA	0.1	1.0	1.0	1.3	1.2	1.5	1.6	1.9	2.2	2.3	2.6	3.5	3.6	4.0	3.8	1153
Philippines	NA	NA	NA	NA	1.1	2.6	2.8	2.9	2.8	2.7	2.7	2.5	2.5	3.1	5.7	8.1	8.2	1361
Singapore	NA	11.2	NA	12.6	12.9	17.1	16.0	16.9	16.9	11.4	11.4	15.3	18.4	20.8	36.0	38.2	38.2	9834
Taiwan, R.O.C.	0.3	1.2	2.4	2.9	3.9	4.6	5.8	5.7	7.6	8.4	7.9	7.0	7.6	8.4	8.4	8.4	11.0	3581
Thailand	0.4	0.3	0.3	0.3	0.3	0.3	0.8	0.8	0.7	0.8	1.1	1.2	1.8	2.9	3.4	3.6	4.3	1900
Belgium	NA	5.8	6.9	8.1	7.2	7.8	9.5	11.1	13.7	17.4	20.9	23.1	26.6	29.8	31.8	35.1	40.5	9717
France	NA	2.4	5.7	7.2	8.5	9.8	11.5	14.3	16.8	19.6	21.9	22.9	23.2	24.2	26.1	28.8	29.2	9918
Germany, F.R.	NA	3.9	3.9	4.9	4.9	5.7	7.3	7.9	9.9	11.8	13.6	15.9	16.7	17.5	16.8	20.4	18.0	10708
Italy	NA	2.8	4.1	4.3	5.5	6.8	7.0	7.2	8.2	7.7	7.4	8.9	9.4	10.1	10.4	11.5	11.3	7425
Netherlands	NA	8.5	9.7	14.5	15.0	18.4	18.9	18.4	20.8	NA	NA	27.5	24.8	24.8	24.8	25.3	37.5	9092
Portugal	NA	1.4	1.4	1.6	1.5	1.5	1.9	2.1	2.1	3.8	3.8	3.8	4.8	4.8	5.7	4.6	5.4	3729
Spain	NA	NA	9.7	NA	5.5	5.9	6.1	7.2	8.4	9.5	9.8	9.8	9.8	10.8	11.4	10.4	11.1	6437
U.K.	NA	3.4	3.9	4.5	5.0	5.6	6.6	9.8	11.2	12.2	13.2	13.9	13.7	14.9	17	NA	NA	8665
Austria	NA	0.3	0.3	0.4	0.4	0.4	0.5	0.6	1.5	3.2	4.7	5.5	7.7	8.5	8.9	9.3	10.1	9713
Finland	NA	5.4	5.5	5.5	5.7	7.5	7.8	10.9	11.0	13.7	17.4	39.7	34.3	34.3	30	30.0	56.9	9323
Sweden	NA	7.6	7.9	8.0	NA	19.8	19.5	22.4	24.0	24.0	45.2	45.2	45.2	45.2	55.6	55.6	55.6	9904
Switzerland	NA	1.7	2.4	2.5	2.4	2.7	2.7	2.7	3.1	3.4	2.9	3.2	4.2	4.2	4.2	3.5	4.3	10640
Czechoslovakia	NA	NA	19.6	22.0	25.6	25.6	29.9	29.6	30.2	33.5	31.0	29.4	32.8	33.7	34.6	35.6	37.5	7424[c]
Germany, D.R.	NA	NA	7.7	8.3	7.8	8.3	8.3	8.6	9.1	15.9	16.2	20.0	23.1	23.1	23.1	29.6	28.6	8740[c]
Hungary	11.8	12.5	14.6	15.8	17.0	17.1	17.4	18.3	18.7	20.2	20.6	18.4	18.7	19.6	20.3	20.3	19.4	5765[c]
Poland	NA	NA	4.1	4.2	5.1	6.6	8.9	9.3	10.4	12.2	16.6	18.7	22.9	24.1	25.8	28.7	38.6	4913[c]
Romania	NA	NA	3.2	4.2	4.2	5.3	8.2	9.1	9.1	14.3	22.6	22.6	22.6	25.0	26.7	NA	NA	4273[c]
U.S.S.R.	NA	NA	10.1	11.0	14.6	21.5	25.8	29.6	34.2	41.2	46.2	46.2	46.2	54.5	54.5	54.5	57.1	6266[c]
Turkey	0.5	NA	0.6	1.0	1.2	1.1	1.2	1.5	1.6	1.6	1.9	2.3	6.2	7.0	7.1	7.2	9.0	2533

[a] One rotor is assumed to correspond to three ring spindles (cf. Toyne et al., 1984, Table 5.18). - [b] In US-$ at 1980 international prices. - [c] RGNP.

Source: Cf. Appendix; own calculations.

Table A2: Share of Shuttleless Looms - Weaving Capacity, Selected Countries, 1974-1990 (per cent)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	RGDP1[a] (1985)
Algeria	NA	NA	NA	NA	4.9	7.1	12.2	13.1	13.1	13.4	14.8	18.4	19.0	20.0	20.0	20.0	20.0	2142
Cameroon	NA	NA	NA	NA	2.9	2.7	2.3	13.2	13.0	13.0	13.0	13.0	14.5	16.7	16.7	16.7	16.7	1095
Egypt	0.4	0.4	0.7	0.8	0.9	0.9	1.4	2.4	2.9	4.2	6.7	6.9	8.7	8.9	9.3	10.3	10.3	1188
Ivory Coast	NA	NA	NA	5.2	6.8	7.4	5.5	20.0	20.0	20.0	20.6	20.9	22.5	24.0	24.0	24.0	24.0	920
Kenya	NA	NA	NA	NA	5.3	5.3	8.2	8.0	10.2	10.2	10.2	11.2	12.3	12.3	11.2	11.2	11.2	598
Madagascar	NA	NA	NA	NA	4.5	4.4	3.8	11.0	11.0	11.0	10.2	10.2	11.5	14.0	14.0	14.0	14.0	497
Morokko	NA	NA	3.7	3.9	4.9	5.5	8.3	11.6	13.8	12.5	12.5	15.0	16.6	18.5	20.7	22.8	25.4	1221
South Africa	NA	15.9	15.5	16.5	22.9	26.7	26.4	25.9	34.1	NA	36.2	49.1	53.3	58.9	NA	NA	NA	3885
Tunisia	NA	14.1	14.1	14.8	15.0	16.4	16.4	20.2	22.1	27.6	29.1	29.9	24.3	21.3	22.6	25.5	27.1	2050
Canada	NA	NA	NA	8.1	8.6	8.8	NA	NA	NA	17.2	17.8	20.1	20.7	20.8	24.9	28.2	31.8	12196
Costa Rica	NA	NA	NA	NA	NA	NA	1.9	1.9	1.6	1.6	1.6	1.6	1.6	3.1	6.5	6.5	7.4	2650
Guatemala	NA	NA	NA	NA	1.1	1.8	1.8	1.8	1.9	1.9	2.5	3.6	6.7	7.3	9.1	10.2	11.8	1608
U.S.A.	NA	6.9	7.0	9.8	14.7	15.8	19.6	23.1	21.3	26.2	31.6	39.4	43.5	46.7	49.5	54.0	61.8	12532
Argentinia	NA	13.6	14.4	15.0	14.3	14.9	14.7	14.7	16.1	14.7	15.8	15.8	16.3	16.3	18.3	19.0	19.0	3486
Brazil	NA	NA	NA	1.7	1.7	2.0	3.4	4.0	4.2	4.1	4.7	4.7	4.9	5.3	6.4	6.4	10.0	3282
Chile	NA	NA	NA	1.7	3.0	3.1	3.5	3.6	3.7	3.7	4.1	4.5	5.7	6.6	6.9	9.1	9.3	3486
Columbia	NA	NA	2.0	2.9	4.6	5.6	7.9	8.9	8.8	9.5	14.5	16.5	17.2	18.1	18.1	17.8	25.1	2599
Ecuador	3.5	3.5	4.2	6.8	9.4	10.4	10.4	12.9	14.8	15.0	15.5	16.7	17.6	17.8	18.3	18.9	19.6	2387
Peru	NA	1.7	2.6	2.8	2.7	3.5	4.4	6.3	5.3	6.0	8.0	8.2	10.6	12.5	14.3	16.7	16.7	2114
Uruguay	NA	NA	NA	NA	5.6	6.7	9.9	11.1	11.3	11.7	12.6	18.9	20.2	20.2	21.9	23.1	NA	3462
Venezuela	NA	NA	NA	NA	NA	NA	1.5	2.5	2.8	3.9	12.7	16.7	21.3	25.0	26.8	27.1	27.1	3548
Australia	NA	NA	NA	12.0	14.8	15.7	15.7	19.2	21.5	27.3	31.3	39.4	83.9	84.9	90.9	99.9	NA	8850
Hong Kong	NA	NA	1.0	1.3	1.4	2.8	9.0	15.6	15.7	18.1	24.2	26.7	32.2	41.2	50.7	58.2	72.0	9093
India	NA	NA	0.4	0.4	0.6	0.8	1.0	0.9	1.0	1.4	2.8	3.3	2.7	3.1	3.8	4.8	NA	750
Indonesia	NA	NA	1.1	1.6	1.9	2.3	6.2	6.7	6.4	6.3	6.7	6.6	NA	NA	NA	NA	NA	1255
Iran	NA	NA	NA	NA	5.6	5.9	5.9	6.0	6.0	7.0	7.3	10.8	13.6	14.4	15.6	15.9	16.0	3922
Israel	NA	NA	NA	8.4	10.3	13.0	13.3	15.4	15.4	15.3	15.6	19.8	24.2	26.3	26.8	27.7	28.6	6270
Japan	NA	NA	8.0	9.0	9.6	10.1	12.2	12.6	14.2	17.2	19.7	24.0	28.1	33.4	36.5	NA	NA	9447
Pakistan	NA	NA	0.2	0.3	1.6	1.6	1.8	1.9	1.9	12.6	12.6	13.0	15.2	17.9	22.1	25.0	33.3	1153
Syria	NA	NA	NA	6.0	8.6	8.5	8.4	41.6	41.8	43.9	43.5	43.7	69.9	59.3	60.0	60.9	62.0	2900
Taiwan, R.O.	NA	NA	NA	3.5	6.0	13.2	17.9	17.6	15.3	16.7	20.9	24.9	30.6	36.2	36.5	36.5	NA	3581
Thailand	NA	0.4	0.4	0.4	0.4	0.4	0.5	0.6	0.9	0.9	1.0	1.0	1.2	2.3	3.2	5.5	6.3	1900
Belgium	NA	NA	NA	NA	NA	NA	8.4	12.0	17.2	39.6	38.9	46.2	54.9	57.8	59.2	59.8	61.3	9717
France	NA	NA	NA	NA	13.7	17.5	22.9	33.6	41.4	44.7	51.5	58.3	61.8	67.8	79.5	79.4	83.2	9918
Germany, F.R	NA	NA	NA	NA	4.8	9.5	13.6	20.2	32.9	37.6	42.1	50.6	55.2	63.8	73.4	80.6	86.6	10708
Italy	NA	5.9	7.1	8.2	9.9	12.5	16.4	19.3	21.7	36.6	45.1	48.0	51.9	61.3	73.8	82.2	83.9	7425
Netherlands	NA	NA	NA	18.9	24.2	29.9	39.2	53.7	54.9	57.9	58.7	60.0	62.2	63.2	74.2	77.7	NA	9092
Spain	NA	NA	NA	NA	10.8	16.1	13.8	14.6	17.4	21.3	23.6	33.5	33.5	40.7	40.7	40.7	64.1	6437
U.K.	NA	18.3	20.4	22.1	25.3	27.9	29.0	29.7	30.5	33.7	37.4	38.9	41.5	41.6	48.2	49.2	51.0	8665
Austria	NA	8.9	8.9	11.9	14.5	15.1	19.1	20.1	27.4	35.6	47.9	46.0	58.1	69.4	73.0	79.3	85.7	9713
Finland	NA	5.3	6.6	6.8	9.6	13.7	15.8	46.4	36.3	92.9	93.2	99.9	NA	NA	NA	NA	NA	9323
Switzerland	NA	5.5	6.0	6.5	7.1	10.5	13.4	16.1	17.4	18.6	22.0	26.6	34.0	34.0	NA	50.6	55.3	10640
Czechoslovakia	NA	NA	NA	NA	NA	NA	NA	7.1	7.6	17.4	18.4	19.1	19.6	19.9	20.8	29.2	33.3	7002[b]
Germany, D.R	NA	NA	NA	NA	7.2	8.0	8.4	9.5	10.2	9.6	11.4	13.3	14.9	16.5	NA	NA	NA	8740[b]
Hungary	13.3	16.0	19.9	23.5	26.4	28.6	30.8	31.2	31.7	33.7	34.7	36.0	37.9	41.1	44.2	45.2	53.8	5765[b]
Poland	NA	NA	NA	13.0	15.0	14.9	34.7	37.1	42.5	39.3	40.3	42.3	43.0	NA	NA	NA	NA	4913[b]
Romania	NA	NA	NA	NA	9.1	8.8	8.8	8.8	9.3	9.3	12.4	12.1	13.2	14.4	15.8	20.0	23.1	4273[b]
U.S.S.R.	NA	NA	NA	27.3	28.7	29.6	29.5	30.8	30.8	32.0	37.5	43.5	47.8	61.5	65.4	67.3	71.2	6266[b]
Yugoslavia	NA	NA	NA	NA	8.4	8.4	9.3	11.3	11.3	11.8	14.3	15.8	13.1	13.4	NA	NA	NA	5063[b]
Turkey	4.4	4.6	5.0	2.5	2.9	2.9	4.2	4.2	5.4	8.0	9.4	11.4	9.6	NA	NA	NA	NA	2533

[a] In US-$ at 1980 international prices. - [b] RGNP.

Source: Cf. Appendix; own calculations.

Table A3: Share of Basic Oxygen Steel in Non - Electric Crude Steel Production, Selected Countries, 1955-1990 (per cent)

	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970
Belgium	NA	NA	NA	NA	NA	NA	NA	0.1	1.9	7.7	16.5	23.7	28.7	40.0	46.5	54.6
France	NA	NA	NA	NA	0.1	0.5	2.6	4.2	8.3	12.2	14.4	16.2	18.5	20.2	24.7	32.6
Germany, F.R.	NA	0.1	0.2	1.6	2.3	2.7	3.9	5.6	8.5	15.2	20.9	17.2	34.4	40.8	50.6	61.9
Italy	NA	NA	NA	NA	NA	NA	NA	NA	0.1	4.2	35.1	42.8	43.2	46.2	47.3	52.9
Luxemburg	NA	NA	NA	NA	NA	NA	0.1	1.6	3.0	6.0	10.7	13.2	21.7	33.7	35.5	38.3
Netherlands	NA	NA	0.1	22.0	29.7	36.5	42.2	57.2	67.3	75.7	74.0	69.7	69.2	67.9	76.8	83.1
Spain	NA	NA	NA	NA	NA	NA	NA	0.1	5.2	14.4	16.8	21.9	30.2	38.9	50.2	59.3
U.K.	0.8	0.7	0.7	0.6	0.5	0.5	0.9	1.6	7.4	12.8	23.1	30.2	32.2	33.5	33.8	40.0
Austria	44.2	48.2	55.5	56.2	59.8	64.2	67.8	69.2	71.2	70.5	70.1	70.1	77.1	79.7	79.1	81.5
Finland	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	21.4	66.0	77.0	82.1
Sweden	0.1	1.6	5.0	5.7	6.7	7.6	10.7	21.3	24.4	27.7	35.2	46.7	51.8	54.1	55.7	59.5
Turkey	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	NA
Yugoslavia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	0.2	4.4	9.6	8.5
Canada	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	38.0	36.2	38.4	38.7
U.S.A.	NA	NA	NA	NA	2.2	3.7	4.4	6.2	8.7	13.5	19.4	28.5	37.0	42.0	48.8	55.8
Japan	NA	NA	NA	NA	NA	14.9	24.1	38.8	49.7	55.9	69.0	77.6	82.3	90.1	92.3	95.0
Australia	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	27.8	27.8	45.2	31.6
South Africa	NA	0.1	NA	NA	NA	NA	NA	27.0	32.7	34.3	37.2	37.8	42.1	40.7	34.3	51.2
Argentina	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Brazil	NA	NA	NA	NA	NA	13.3	NA	NA	17.2	27.2	30.9	43.7	43.5	47.0	46.9	45.9
Chile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mexico	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
India	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.1	13.5	11.4
Korea, Rep.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bulgaria	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	NA	NA	41.4	58.4	65.5	67.3
Germany, D.R.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hungary	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Poland	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	7.0	10.2	11.3	12.2	13.7
Romania	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	6.9	20.4	31.6
U.S.S.R.	NA	0.1	1.0	2.3	3.5	4.2	3.8	3.8	3.7	4.2	5.0	7.3	10.1	11.6	15.2	18.9
Egypt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table A3: (Cont.)

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	RGDP1[a] (1985)
Belgium	62.1	75.4	80.5	83.3	91.0	97.0	99.6	99.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9717
France	41.5	51.3	58.1	66.0	73.9	79.7	85.8	92.0	94.1	97.4	99.5	99.8	99.9	NA	NA	NA	NA	NA	NA	NA	9918
Germany, F.R.	68.7	71.9	75.7	77.1	79.3	82.1	85.5	87.3	88.5	92.1	95.4	98.2	99.9	NA	NA	NA	NA	NA	NA	NA	10708
Italy	61.3	66.0	70.6	74.7	80.4	84.4	86.8	87.2	89.9	96.4	99.8	99.9	NA	NA	NA	NA	NA	NA	NA	NA	7425
Luxemburg	38.6	44.2	49.6	66.2	71.1	87.9	99.7	99.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	10540
Netherlands	84.9	95.5	98.3	98.4	99.1	99.7	99.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9092
Spain	67.6	78.8	78.0	81.4	84.7	86.0	86.0	90.8	90.2	90.1	90.9	93.3	95.6	99.9	NA	NA	NA	NA	NA	NA	6437
U.K.	47.4	53.0	58.4	62.7	69.3	73.9	76.6	86.4	91.6	99.8	99.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	8665
Austria	81.5	82.4	81.7	83.2	91.7	92.8	95.6	95.1	96.3	96.6	97.1	97.4	99.9	NA	NA	NA	NA	NA	NA	NA	9713
Finland	85.8	88.7	89.9	84.4	89.4	89.1	93.4	95.8	99.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9323
Sweden	61.4	63.1	64.9	66.6	73.4	77.1	81.7	86.1	89.8	91.2	94.7	99.9	NA	NA	NA	NA	NA	NA	NA	NA	9904
Turkey	NA	56.0	49.1	55.9	57.1	14.6	14.6	63.4	69.2	69.8	70.8	74.3	78.8	83.7	83.4	82.7	84.6	86.3	89.6	86.3	2533
Yugoslavia	13.0	12.7	14.7	15.4	15.2	14.0	31.5	41.3	42.1	44.0	48.6	48.0	52.8	53.3	54.2	54.1	56.9	62.3	63.8	68.3	5063[b]
Canada	38.7	51.9	61.8	68.3	70.4	72.8	73.3	73.6	73.4	69.1	81.3	81.6	90.2	99.9	NA	NA	NA	NA	NA	NA	12196
U.S.A.	63.1	66.3	67.4	68.0	74.3	75.4	76.9	79.7	81.4	83.9	84.5	88.2	89.8	86.4	89.0	93.5	95.2	91.9	93.0	94.3	12532
Japan	97.1	97.7	98.1	98.3	98.7	99.4	99.5	99.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	9447
Australia	31.7	50.5	50.5	71.7	71.7	71.7	71.7	77.4	76.4	77.9	78.0	87.1	99.9	NA	NA	NA	NA	NA	NA	NA	8850
South Africa	52.6	41.4	45.0	51.0	69.4	72.0	75.1	83.6	85.4	89.6	91.9	94.5	96.8	97.2	97.4	99.9	NA	NA	98.0	98.0	3885
Argentina	NA	0.1	30.3	34.9	31.7	29.4	17.2	33.3	46.3	56.4	63.7	49.4	45.1	46.9	68.9	80.6	80.2	77.3	90.5	98.6	3486
Brazil	47.1	50.4	52.6	54.2	58.3	63.0	74.2	82.3	84.2	87.7	89.8	89.9	92.7	94.1	95.2	96.8	97.9	98.7	96.6	97.1	3282
Chile	NA	NA	NA	NA	0.1	33.0	79.5	98.6	99.9	NA	NA	NA	98.9	NA	NA	95.2	95.3	NA	NA	NA	3486
Mexico	0.1	13.4	15.2	21.3	23.9	24.7	48.1	62.1	63.9	66.7	69.3	72.9	78.6	78.4	75.6	80.2	78.4	77.8	83.2	83.2	3985
India	10.5	15.9	15.9	17.0	18.8	24.7	25.8	25.7	30.2	30.5	30.0	32.3	35.0	41.5	44.6	48.1	51.5	53.6	56.2	57.0	750
Korea, Rep.	NA	NA	NA	84.6	93.5	97.8	96.2	94.4	98.1	98.4	99.3	99.9	NA	NA	NA	NA	NA	NA	NA	NA	3056
Bulgaria	67.9	70.0	73.1	71.2	71.0	74.2	75.2	73.2	74.0	76.0	77.3	78.7	80.3	83.0	83.7	83.4	83.6	83.5	83.4	83.3	5113[b]
Germany, D.R.	NA	NA	0.1	5.2	11.1	11.8	12.0	12.2	12.3	12.6	12.6	11.5	11.9	21.1	32.9	36.7	38.6	39.9	43.9	50.0	8740[b]
Hungary	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	15.4	36.3	37.1	39.1	41.3	44.2	51.2	57.5	52.2	54.7	5765[b]
Poland	18.8	22.3	24.3	25.2	25.2	25.1	34.5	42.6	45.4	45.7	44.5	49.8	49.7	49.9	49.7	51.5	51.4	51.5	57.2	64.5	4913[b]
Romania	32.9	36.8	39.6	40.6	42.7	47.9	42.8	51.8	53.8	54.3	55.4	58.0	57.3	61.7	61.7	61.9	63.4	63.2	68.0	71.3	4273[b]
U.S.S.R.	21.3	23.8	23.8	25.2	27.3	29.2	29.2	31.2	31.4	32.5	33.1	33.3	35.5	35.6	36.8	38.9	38.9	42.9	39.9	40.5	6266[b]
Egypt	NA	NA	NA	NA	NA	56.0	60.5	62.8	74.3	88.0	93.7	87.7	82.9	95.7	84.7	84.4	84.7	85.1	86.1	NA	1188

[a] In US-$ at 1980 international prices. - [b] RGNP.

Source: Cf. Appendix; own calculations.

Table A4: Share of Continously Cast Steel in Crude Steel Production, Selected Countries, 1969-1990 (per cent)

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	RGDP1[a]
Belgium	NA	NA	NA	NA	0.1	1.3	4.1	5.7	14.6	21.1	23.4	25.5	30.6	33.0	38.4	49.5	60.0	72.4	85.8	88.0	90.9	91.7	9717
Denmark	NA	NA	NA	NA	NA	0.1	13.1	43.2	50.6	55.7	58.8	73.3	95.8	96.8	97.4	99.5	99.9	NA	NA	NA	NA	NA	10884
France	0.6	0.8	1.9	3.4	7.3	10.2	12.9	18.1	23.7	27.5	29.7	41.3	51.4	58.5	63.8	66.9	80.6	90.1	93.1	94.0	93.9	94.3	9918
F.R.Germany	7.3	8.3	10.2	13.9	16.3	19.4	24.3	28.3	34.0	38.0	39.0	46.0	53.6	61.9	71.8	76.9	79.5	84.6	88.0	88.5	89.8	91.3	10708
Italy	3.1	4.2	6.2	12.7	16.1	21.7	27.0	32.2	38.5	41.5	46.4	49.9	50.8	58.5	68.2	73.3	78.6	84.1	89.9	93.9	94.1	94.8	7425
Luxembourg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	7.0	19.4	24.1	26.2	28.3	34.6	37.5	34.2	33.5	34.1	10540
Netherlands	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	5.9	21.2	31.0	36.0	38.7	39.1	42.7	65.0	75.6	87.1	93.5	9092
Portugal	NA	NA	0.1	4.2	6.1	7.8	8.4	15.0	36.7	40.1	37.7	42.6	37.2	47.1	43.4	39.6	43.7	44.9	46.0	46.9	48.8	51.2	3729
Spain	9.6	12.0	14.6	15.5	18.9	19.3	21.0	22.7	25.8	29.0	31.7	36.4	39.5	41.9	45.9	49.4	57.0	61.2	66.7	72.6	86.0	89.0	6437
U.K.	1.8	1.8	1.7	2.1	3.0	5.0	8.5	9.7	12.5	15.5	16.9	27.1	31.8	39.0	46.6	52.0	54.8	60.5	64.9	70.5	80.2	83.6	9665
Austria	6.0	8.0	9.1	10.3	11.9	16.3	21.3	27.8	37.5	39.7	47.5	51.2	62.4	77.3	87.6	89.0	93.4	94.6	95.7	95.5	95.7	95.9	9713
Finland	63.0	69.0	71.5	73.8	77.8	77.9	76.3	76.1	83.4	88.0	88.8	90.2	91.9	93.4	93.5	94.2	93.5	94.4	94.0	93.9	94.0	97.8	9323
Norway	NA	NA	0.1	3.2	12.5	15.7	15.7	16.0	16.6	15.8	14.8	12.9	16.0	29.3	36.1	51.4	55.6	56.0	53.9	53.4	60.3	92.2	12632
Sweden	12.2	14.1	14.6	16.0	15.7	19.3	24.8	28.2	30.6	36.1	38.5	49.0	66.8	76.0	79.7	79.6	80.6	81.8	83.6	83.0	82.3	85.8	9904
Turkey	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	7.2	13.4	55.7	63.6	72.0	65.7	77.8	79.2	79.9	82.3	82.2	2533
Yugoslavia	NA	NA	NA	NA	NA	0.1	11.3	14.5	25.9	34.3	36.4	36.6	43.2	47.6	51.6	51.8	53.5	53.4	55.8	61.8	63.9	70.2	5063[b]
Canada	11.8	11.3	11.5	11.7	11.6	13.7	13.3	11.9	15.9	20.2	19.9	25.6	32.2	32.8	37.4	38.4	43.6	45.8	49.0	68.9	76.1	76.7	12196
United States	2.8	3.7	4.7	5.6	6.8	8.1	9.1	10.5	12.5	15.2	16.9	20.3	20.3	29.0	32.1	39.6	44.4	55.2	59.8	61.3	64.8	67.1	12532
Japan	4.0	5.6	11.2	17.0	20.7	25.1	31.1	35.0	40.8	46.2	52.0	59.5	70.7	78.7	86.3	89.1	91.1	92.7	93.3	93.1	93.5	93.9	9447
Australia	2.0	2.8	2.9	NA	2.0	2.9	0.6	NA	0.1	0.4	5.4	10.3	13.0	17.5	24.6	27.0	27.1	27.0	44.5	71.5	80.0	81.5	8850
South Africa	11.3	12.9	12.4	14.7	16.0	18.9	20.4	26.2	37.5	43.4	49.3	51.9	55.2	61.2	60.1	61.5	64.7	63.9	64.6	69.6	73.4	73.7	3885
Argentina	NA	NA	NA	NA	0.1	24.4	25.6	27.6	27.5	40.6	48.7	53.3	49.2	51.8	48.6	47.4	62.4	64.9	65.7	66.8	73.6	76.1	3486
Brazil	1.4	0.8	0.8	2.2	3.2	5.0	5.7	12.1	17.4	24.7	27.6	33.4	36.4	41.1	44.3	41.3	43.7	46.1	45.5	49.0	53.9	58.5	3282
Chile	NA	1.5	1.5	1.3	1.3	1.4	1.4	2.3	2.0	1.5	1.5	2.1	1.4	0.8	1.3	1.6	1.9	2.7	1.7	1.7	2.0	2.2	3486
Mexico	6.0	9.9	11.9	12.8	12.1	12.7	13.2	12.9	28.8	29.5	29.5	29.3	32.2	37.9	55.6	54.6	54.3	60.9	67.1	66.9	58.1	61.0	3985
Venezuela	NA	NA	NA	NA	NA	NA	NA	NA	0.1	11.6	27.1	40.5	62.2	68.4	78.3	72.2	73.5	71.3	76.6	74.4	75.7	74.5	3548
Rep. of Korea	NA	NA	NA	NA	NA	0.1	19.7	21.9	31.7	36.8	30.6	32.4	44.3	51.1	56.6	60.6	63.3	71.1	83.5	88.3	94.1	96.1	3056
Taiwan(R.O.C.)	NA	NA	NA	NA	NA	NA	NA	0.1	24.6	39.1	59.9	56.5	58.5	80.9	84.7	82.8	83.6	88.3	89.6	96.3	93.1	96.1	3581
Bulgaria	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	7.0	10.0	9.3	13.6	12.4	15.5	15.9	16.2	5113[b]
Czechoslovakia	NA	NA	NA	NA	0.7	0.7	0.5	0.7	0.7	0.4	0.9	1.5	1.5	2.5	5.1	7.3	7.7	8.2	8.5	8.7	9.2	11.5	7424[b]
German Dem.Rep.	0.4	0.4	0.5	0.6	6.8	7.8	8.1	8.4	9.1	9.7	10.5	14.2	15.8	17.2	18.1	25.6	33.7	36.5	37.6	39.6	41.0	41.1	8740[b]
Hungary	NA	0.1	2.4	5.3	1.8	12.2	21.1	27.9	28.3	29.7	32.8	36.1	35.4	33.6	39.3	46.6	46.6	52.1	55.9	63.2	55.6	64.2	5765[b]
Poland	2.1	2.2	2.3	2.3	2.2	2.2	2.2	1.9	2.5	2.8	3.6	4.0	3.8	4.3	4.0	10.1	10.3	10.6	11.0	11.1	7.7	7.0	4913[b]
Romania	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1	18.1	20.7	22.4	26.0	30.2	29.9	31.9	32.4	33.7	34.2	36.2	4273[b]
U.S.S.R.	0.1	4.3	4.9	5.5	5.3	5.4	6.9	8.1	8.3	9.5	10.3	10.7	12.2	12.6	12.4	12.7	13.6	15.0	16.1	16.6	17.3	17.9	6266

[a] In US-$ at 1980 international prices. - [b] RGNP.

Source: Cf. Appendix: own calculations.