

Donges, Juergen Bernhard

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THE WEST GERMAN ECONOMY TOWARDS THE YEAR 2000

- An Analysis of Structural Change -

by

Juergen B. Donges
Henning Klodt
Klaus-Dieter Schmidt

Institut für Weltwirtschaft an der Universität Kiel

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Kiel Institute of World Economics
Department I
Düsternbrooker Weg 120, D-2300 Kiel-1

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THE WEST GERMAN ECONOMY TOWARDS THE YEAR 2000

- An Analysis of Structural Change -*

I. Introduction

The West German economy, once praised for its exceptionally successful postwar development, has been struggling with deep-seated problems over the past 15 years. Since the early seventies, the growth of potential output slowed down markedly (from about 4-5 percent a year during the sixties to less than 2 percent in the early eighties), an extended period of full employment came to an end (unemployment increased sharply, affecting more than 2 million workers or 9 percent of the labour force), and the industry lost ground in certain high-technology areas (such as micro-chips, computing, robots). The problems are structural rather than cyclical, their main roots are on the supply side and not on the demand side. As it happened in most Western European countries, also the West German economy has unduly delayed needed adjustment to rapidly changing global economic conditions, energy saving being the notable exception to this rule (Fels, Schmidt, 1980; Schmidt et al., 1984; Wolter, 1984).

The pressure to adjust is likely to remain strong in years to come, if only for such reasons as major changes in demographic trends, sudden increases and decreases in energy prices, continued fluctuations of real interest rates and exchange rates, rising costs of environmental control, new waves of revolutionary technologies, and further growing intensity in international competition. The West German economy has to pass with success the test of its capacity to adjust, should there be a chance for achieving sustained growth and for improv-

* Paper prepared for the final conference of the Bonn-IIASA Research Project on Economic Growth and Structural Change, to be held in Laxenburg (near Vienna) on November 24-25, 1986.

employment opportunities over the long term. The ongoing cyclical upswing, which is quite modest by the country's own historical standards, must not be interpreted as if the far-reaching structural adjustments were already made. In spite of some recent progress (in particular with regard to the modernization of industrial equipment), the economy has still a long way to go to get out of sunset activities and into modern growth-oriented ones (Schmidt, Gundlach, Klodt, 1986).

It is against this background that the present paper purposes to explore how the structure of production and employment of the West German economy will have changed by the year 2000, under alternative assumptions about the rate of long-term growth. The analysis is carried out following the familiar Clark-Fourastié-Kuznets-Chenery "three-sector hypothesis" and it constitutes a re-appraisal of comprehensive projections of structural patterns for West Germany up to 1980 which were undertaken at the Kiel Institute in the early seventies (Fels, Schatz, Wolter, 1971, called hereafter FSW-study). Before attempting to make the new projections, it may be useful to recapitulate the major structural changes in the past, which can be expected to operate also in the future; this is done in Section II of the paper. Section III deals with the projections, explaining the methodology applied and presenting the results obtained. Section IV provides a summary of the findings and draws policy conclusions of them.

II. Structural Change in Retrospect

One message of the FSW-study (1971, pp. 262-64) was, as it may be recalled, that West Germany became over-industrialized during the fifties and sixties. The share of industry in gross domestic product (more than 40 percent on average)

was permanently higher than what would be expected of a "representative" country with similar per-capita income and population; moreover, this share increased over time, whereas it declined in other advanced European countries, such as France and the United Kingdom. In anticipation of the profound exchange-rate adjustments, which were to occur during the seventies after the collapse of the Bretton-Woods system, and by expecting major shifts in the international division of labour, which were to be induced by the emergence of new competitors on the world market, the FSW-study predicted that West Germany's industry would begin to see its relative weight in the sectoral composition of production decreasing from the mid-seventies onwards (FSW, 1971, pp. 265-69).

As Table 1 shows, this prediction has been confirmed by actual developments, at least as far as the reversal of the industry's trend is concerned, to which, however, several additional factors to those mentioned in the FSW-study (e.g. wage explosion, profit squeeze, sluggish investment) contributed to a significant extent (Schmidt et al., 1984). Since 1970, the share of industry in both the gross value added and the labour force fell sharply. The pattern of resource allocation shifted from industry (and manufacturing) to services (whereas the primary sector continued the trend previously observed). But the shift was not accomplished at full employment. On the contrary, while the industry lost 2.3 million jobs in the period 1970-85 (manufacturing 1.9 million), the tertiary sector absorbed only a part of the displaced workers and this in spite of the extraordinary expansion of employment in public administration (by more than 1 million).¹

¹See Schatz, Wolter (1982) and Schmidt (1984) for empirical analyses of the various factors which determined West Germany's employment patterns.

Table 1

Structure of production and employment (percent)

Sectors	1960	1970	1980	1985 ^a
	Gross Value Added ^b			
Primary sector ^c	8.6	4.6	3.1	2.8
Secondary sector ^d	50.4	50.4	43.5	41.4
of which: Manufacturing	40.3	40.2	33.9	33.4
Tertiary sector ^e	49.0	45.0	53.4	55.8
	Active Labour Force			
Primary sector ^c	15.9	9.7	6.4	6.3
Secondary sector ^d	45.8	47.7	43.2	40.1
of which: Manufacturing	36.9	38.1	34.2	32.0
Tertiary sector ^e	38.3	42.6	50.4	53.6

^aPreliminary. - ^bAt current market prices. - ^cAgriculture, forestry, and fishing; mining and quarrying. - ^dManufacturing; electricity, gas, and water; construction. - ^eTrade, transport and communications; banking, insurance, and real estate; public administration; other services.

Source: Statistisches Bundesamt, Volkswirtschaftliche Gesamtrechnungen, Fachserie 18, Reihe S.8: Revidierte Ergebnisse 1960-84. Stuttgart 1985. - Idem, Volkswirtschaftliche Gesamtrechnungen, Fachserie 18, Reihe 1: Konten und Standardtabellen 1985. Vorbericht. Stuttgart 1986. - Own calculations.

As is well known, structural changes are caused by an interaction of demand and supply factors, whose relative weight may vary over time. In the following we consider changes in the composition of final demand, changes in the international division of labour, changes in technology, and changes in the supply of labour as major driving forces of the structural changes noted (and of those to be expected in the future).

Changes in Final Demand

Changes in the composition of final demand are an important factor for the performance of any economy. In the long run, a country's capability to achieve sustained economic growth and to bring about the necessary structural changes is determined by its propensity to invest. Table 2 provides

Table 2

Distribution of gross domestic product at current market prices 1960-1985 (percent)

Demand component	1960	1970	1980	1985
Private consumption	52.0	54.4	56.3	55.7
Government consumption	18.6	18.4	19.6	19.9
Gross fixed capital formation	24.2	24.2	21.5	19.6
Change in stocks	2.2	2.1	1.2	0.8
Exports of goods and non-factor services	17.0	22.6	29.5	35.2
Less: imports of goods and non-factor services	14.0	21.6	28.1	31.3
Gross domestic product	100	100	100	100

Source: As Table 1.

information about the trends in aggregate expenditures during the period 1960-85. While the shares of private and public consumption increases and that of foreign trade (exports minus imports) remained almost constant, the share of gross fixed capital formation decreased. This shift from investment to consumption is a most remarkable aspect indeed. It helps to explain why the West German economy has been lagging in modernizing productive capacities and in creating new jobs (Schmidt et al., 1984).

Shifts in the demand structure have not been confined to aggregate expenditures. It is well known, for instance, that there are long-term changes in the pattern of private consumption on account of Engel's law: The steady improvement in standards of living have altered the style of life of the West Germans and shifted preferences of private households away from food and other basic needs towards durable consumer goods and services. This unquestionably has clouded the development prospects of the producers facing an income-elasticity of demand of less than unity. Table 3 shows how deeply the pattern of private household demand changed. In a sense, these shifts are consistent with the changing structure of production

Table 3
Structure of private household consumption
(percent of total expenditure)

	1960	1970	1980	1984
Agricultural products	33.3	27.2	22.3	21.7
Manufactured goods	36.9	40.7	43.1	41.7
Marketed services ^s	29.8	32.1	34.6	36.6
¹ Housing included.				

Source: As Table 1.

and employment mentioned above: The increase in purchases of foodstuffs has been slower and that of services has been sharper than that of consumption in general, in particular since 1970.

Having said this, it should be noted that the shifts on the demand side cannot completely explain the gains and losses of sectors in terms of production and employment. Above all, the relative decline of manufacturing since the early seventies is not in line with the stable shares of manufactured goods in total consumption during the past 15 years. An explanation for this apparent contradiction is that German manufacturers lost shares in world trade, and this mainly with regard to investment goods rather than consumer goods and particularly in the domestic markets rather than in third markets.

Changes in the International Division of Labour

The difficulties encountered by West German producers of manufactured goods during the seventies reflect, broadly, a weakening of the competitive strength and the emergence of new competitors such as Japan and a number of newly industrializing countries (Donges, 1984). The share in world exports, which had risen from 3.6 percent in 1950 to 9.7 percent in 1960 and to 11.9 percent in 1970, has slightly decreased over the past 15 years. A loss of share in international trade is a normal phenomenon for a mature industrial country. In the case of the West German economy one can even argue that the previously excessive weight, by international standards, of the tradables sector in comparison to the non-tradables sector was corrected to some extent (Fels, Schmidt, 1980, ch. 4).

However, this process of adjustment becomes evident more on the import side than in exports. As Table 4 shows, the share

Table 4
Structure of foreign trade by major product categories
(percent)

Product categories	1960	1970	1980	1985
	E x p o r t s			
Foodstuffs	3.5	3.5	5.3	5.2
Raw materials	4.5	2.6	1.9	1.6
Semi-manufactures	10.3	7.7	8.8	7.6
Final products	81.7	86.2	84.0	85.6
of which: Consumer goods	9.3	10.6	11.5	11.7
Investment goods	52.1	54.7	51.4	54.0
	I m p o r t s			
Foodstuffs	26.6	19.4	12.8	12.5
Raw materials	21.9	13.7	17.5	12.4
Semi-manufactures	19.0	16.3	17.8	18.7
Final products	32.5	50.6	51.9	56.4
of which: Consumer goods	10.2	22.5	22.9	14.1
Investment goods	11.0	13.2	15.4	27.1

Source: Statistisches Bundesamt, Aussenhandel, Fachserie 7, Reihe 1, various issues. - Idem, Jahrbuch für die Bundesrepublik Deutschland, various issues. - Own calculations.

of final manufactured goods in exports has remained, more or less constantly, on a high level (predominantly investment goods); in contrast, final manufactures have increased sharply their weight in imports, which is a consequence of the rising market penetration by developing countries, in particularly the newly industrializing ones (textiles, clothing, electronic consumer goods and the like).

The ongoing changes in the international division of labour have three fundamental implications for the West German economy:

- Firstly: As Germany has achieved a prominent position in technological development, it cannot benefit as much as before from importing and applying technology developed in other countries. Having come closely to the technology frontier, competitive strength can only be maintained, or restored, if the country's own technological base is deepened adequately.
- Secondly: In the course of their catching-up, the newly industrializing countries have intensified competition in high-tech markets. Hence, pressure to accelerate the pace of scientific inventions and of product and process innovations as well is likely to increase further.
- Thirdly: The developing countries embarking upon industrialization will continue to exploit, to the largest extent possible, their comparative advantage deriving from the almost unlimited supply of low-skilled labour. Thus, traditional labour-intensive industries in West Germany will be subjected to marked import competition also in the future.

Changes in the Global Technological Environment

Typically, a country's ability to invent and innovate, and to effectively use technologies developed abroad, is a key factor in the patterns of specialization in foreign trade. (West) Germany has a long tradition as a technologically leading country. Indicative of this strength is the robust competitive position which human-capital and research-intensive branches, such as chemicals, pharmaceuticals, medical technology, engineering goods and motor cars, have been displaying even during the seventies, when the world economy was struck with many turbulences.

And yet, the West German economy (as other European countries) has found it hard to keep abreast with the microelectronics and other revolutionary technologies, even allowing for the fact that a notable competitive strength could be achieved early in some important segments (such as videotex or sensors and systems for robots) and that there was considerable success in nuclear power, aircraft industries, military equipment, and rocket launching (backed by massive government support). As can be seen in Table 5, West Germany lagged behind the United States and Japan regarding the robotization of the economy or the extent of use of microelectronics. Even in NC machine tools, in which German companies have been strong leaders for long, Japan has caught up. Moreover, new technologies were often applied with the main purpose of reducing labour costs, i.e., process innovations were attached priority over product innovations by many German firms. The consequences have been both losses in foreign sales and increased import competition in several high-tech fields (Härtel, Langer, 1984; Klodt, 1984).

In recent years, much of the technological gap seems to have been made up. Intensified R&D efforts by the firms, in conjunction with more aggressive marketing strategies, were

Table 5

Selected indicators of technological change in West Germany, the United States and Japan

Technology	Year	West Germany	United States	Japan
<u>Integrated circuits</u>				
Consumption per-capita (value in U.S.-\$)	1977	5	13	8
	1980	13	21	19
	1985	19	53	39
Share in world consumption (percent)	1982	6.5	48.9	25.9
	1985	5.0	56.0	21.0
Share in world production (percent)	1982	2.0	69.5	23.4
	1985	1.9	66.8	26.7
<u>Electronic goods</u>				
Share in world production (percent)	1980	9.1	40.0	15.7
	1986	7.2	41.8	16.3
<u>Industrial robots</u>				
Installed units (thousand)	1974	0.1	1.2	1.5
	1980	1.2	4.5	6.0
	1985	7.5	20.0	25.0
Units per million employees	1974	5	15	30
	1980	50	50	100
	1985	300	200	400
<u>NC machine tools</u>				
Installed units (thousand)	1975	8	40	14
	1980	25	80	28
	1985	40	100	120
Units per million employees	1975	300	400	250
	1980	950	800	500
	1985	1,600	1,000	1,000

Source: OECD (1985). - Verband Deutscher Maschinen- und Anlagenbau, Fachgemeinschaft Montage, Handhabung, Industrieroboter im VDMA (unpublished data). - Idem, Fachgemeinschaft Werkzeugmaschinen im VDMA (unpublished data). - Franzmeyer et al. (1986). - Own calculations and estimates.

indispensable for this catching-up process to happen, but it should also be noted that the West German high-tech industry benefitted a great deal from the strong U.S. dollar (until early 1985). However it may be, the technology challenge will not vanish away in years to come. On the contrary, the new technologies carry an enormous potential for developing new markets for entirely new goods and services facing a high income-elasticity of demand, for locational decentralization of economic activities, for inducing fresh investment, and for improving job opportunities in branches which are not themselves high-tech (Giersch, 1982; Pérez, 1985). To put it another way: New technologies such as robotics, computers, and telecommunications will rapidly alter the production and employment structures as well as the organization of work life both in factories and offices of the West German economy. If one is to characterize future structural change in terms of new technologies, this might be sketched as follows:

- more small scale and less large scale production;
- more automation and less mechanization;
- more production-factor saving and less factor consuming;
- more engineering-skills ("brainpower") and less routine ("manpower");
- more product-orientation and less processing-orientation;
- more services and less manufacturing.

Changes in the Labour Force

Although for an open economy, as the West German one, the patterns of structural change are largely shaped by general worldwide trends, there are also key factors which are specific to individual countries or groups of countries. Demographic

trends are a case in point, i.e. long-term changes in the size and structure of the population and especially of the labour force. West Germany's demographic development since World War II has been characterized by a sequence of swings: The sharp increase in population in the fifties and sixties, which was accompanied by a decrease in the labour force, was followed by a slight decrease in population and a sharp increase in the labour force since the mid-seventies (Table 6). As a consequence of the dramatic fall in the birth rates a marked reduction in the supply of labour has to be expected for the nineties and afterwards.

Table 6
Population and labour force 1960-1985
(average annual change in thousand)

	1960-1970	1970-1980	1980-1985 ^a
Total population	+ 522	+ 92	- 62
Total potential labour force	+ 25	+ 100	+ 226
Natives	- 126	+ 54	+ 255
Foreigners	+ 151	+ 46	- 29
Males	+ 48	+ 1	+ 85
Females	- 23	+ 99	+ 141
Total active labour force	+ 50	- 28	- 161
^a Preliminary.			

Source: Mitteilungen aus der Arbeitsmarkt- und Berufsforschung, Vol. 18, 1985: 4, p. 24. - Own calculations.

Demographic swings affect not only the size and structure of labour markets but also those in final demand. The rapid increase in population in the post-war period, for example, raised the demand for the building sector. And while more dwellings meant increasing demand for furniture, home textiles or household appliances, a number of consumer goods industries were favoured too. By the same token, the future pattern of total households' expenditures cannot safely be expected to be consistent with the main trends observed earlier. On the contrary, the decline of the West German population and labour force may have more lasting effects on the domestic demand of food and manufactures than on modern services on the grounds that the move into the "information society" is an irreversible process.

III. Prospects For Structural Change

Model and Data

Structural change and economic growth are interrelated: The redeployment of production factors away from shrinking activities into expanding sectors promotes the growth of the whole economy, and a rapid pace of economic development facilitates structural adjustments. Since the paper is concerned with future structural trends in West Germany, it states one specific direction of causality, namely that the level of per-capita income determinates those trends. Thus, the sectoral structure of the West German economy will be regarded as an endogenous variable, whereas the explanatory variable is assumed to incorporate the relevant, and often interacting, basic supply and demand factors underlying economic growth.

Beyond all doubt, there is a variety of factors determining shifts of the sectoral structure of an economy. Economic growth is only one among others. In West Germany, e.g., reconstruction after World War II, the integration into the European Common Market, the realignment of exchange rates in the early seventies, the two oil-price shocks in 1973-74 and 1979-80, and the rise and decline of the U.S. dollar in the early eighties, they all might have had a significant impact on the performance of different industries. Analyses of past trends of structural change should obviously take account of those effects, as happened indeed (Fels, Schmidt, 1980; Schmidt et al., 1984). However, as such singular events are difficult to predict (if they are predictable at all), an assessment of future trends must concentrate on more permanent factors. A long list of econometric studies of structural change, which were pioneered by Chenery (1960) and include also the Kiel FSW-study (1971), has revealed that the level of per-capita income satisfies this requirement for long-term projections.

As is usual in this type of analyses, we derive the projections from "normal patterns" of structural change that occur in the process of economic growth. Such patterns only provide relevant information on future trends, however, if they are rather stable across countries and over time. Therefore, the "normal patterns" are identified for a sample of countries that show some similarities to the West German economy, i.e. the OECD-countries. An additional advantage of choosing this sample is the ease of access to, and the comparability of, data for particular industries.

The "normal patterns" of structural change are measured by OLS regression analyses. The functional form of the equations should have three properties:

- Firstly: As a linear regression approach would call for linear relationships between the variables and therefore preclude the utilization of percentages of sectoral shares as the dependent variable, we choose an alternative specification of sectoral shares, namely through a logit-transformation of percentages (Intriligator, 1978, pp. 174-76). After this transformation the possible range of the dependent variable reaches from minus infinite to plus infinite. Moreover, thanks to this transformation retransformed values of estimated shares cannot become negative.
- Secondly: Since non-monotonical sectoral shifts seem to be important, the regression function should allow for increasing and decreasing elasticities as well as for maxima and minima. One way of taking this condition into consideration is the inclusion of the independent variable (per-capita income) in two different forms. Here, a logarithmic form is chosen in addition to a linear form.
- Thirdly: The estimated shares of all sectors should add up to 100 percent. Therefore, the same type of equation is applied to all sectors. Fitted values will add up to 100 percent if observed values fulfill this condition.

Thus, the following equation is used for the regressions:

$$\ln \left(\frac{A_{ij}}{100 - a_{ji}} \right) = a + b Y_j + c \ln Y_j + D$$

where A_{ij} = percentage share of industry i in total output (or total employment) of country j ;

Y_j = per-capita income of country j ;

D = raw material dummy, in order to take account of the impact on the industrial structure of a

rich endowment with natural resources in some sample countries. The "dummy" takes the value of one for Canada, Australia, the Netherlands, and Norway, in addition to the United Kingdom since 1979; for all other countries the dummy-variable is zero.

In this equation, one minimum or maximum is possible. When the fitted values are retransformed back to A_{ji} , two turning points can occur.

The data on sectoral structure were taken from OECD-statistics on national accounts. We used the information regarding 24 different industries in 20 countries.¹ For an analysis of the production structure the sectoral contributions to gross domestic product seem to be appropriate. The structure of labour input is measured by the sectoral shares in total employment. The annual data of the sectoral structure have been pooled for the period 1970-82. As compared to simple cross-section analyses, this combination of cross-section and time-series data has two main advantages: Firstly, distortions of estimates due to singular events in particular years are reduced. Secondly, an overestimation of sectoral shifts is avoided, which could occur if pure cross-section parameters are used for projections over time because cross-section elasticities are higher than time-series elasticities (Kuznets, 1966).

The data for 20 countries and 13 years yield a maximum number of 260 observations for each industry's share in total output and in total employment. Since some data on specific years or specific industries are not available, however, the actual number of observations remains below this maximum level.

The per-capita incomes as indicator of the sample countries' level of economic development are converted to U.S. dol-

¹Luxembourg has been excluded due to insufficient sectoral disaggregation of data.

lars at 1975 prices. In order to avoid distortions from short-term fluctuations of exchange rates, the international comparisons are calculated at purchasing power parities, which are taken from Summers and Heston (1984). This source provides information on the period up to 1980. For more recent years, the data on per-capita income were derived from IMF-statistics (current issues).¹

International "Normal Patterns" at a Sectoral Level

For the three major sectors of the economy the estimated coefficients are given in Table 7. The regression results for 20 branches are presented in the appendix (Tables A1 and A2).

Each of the regressions for the three major sectors is statistically significant, as indicated by the F-values; according to t-statistics, most of the coefficients are significant too. This lends support to the fundamental hypothesis, that there is a close statistical relationship between structural change and economic development. The estimated equations, therefore, could be regarded as the description of a kind of "normal" changes in the economic structure of the OECD countries, as per-capita income rises.

A graphic illustration of this pattern could help interpreting the coefficients. The lines in Figure 1 represent the regression results for the production structure, which are retransformed to the original shares of the sectors in gross domestic product. According to these results an economy faces a permanent decline of its primary sector during the process of economic growth (Engel's law effects), whereas the secondary sector expands its share as per-capita income rises. Beyond a 4,500 U.S. dollars income level, also the sec-

¹For a more general discussion of international comparisons of data on output and labour input, see Kravis (1976) and Kravis, Heston, Summers (1978).

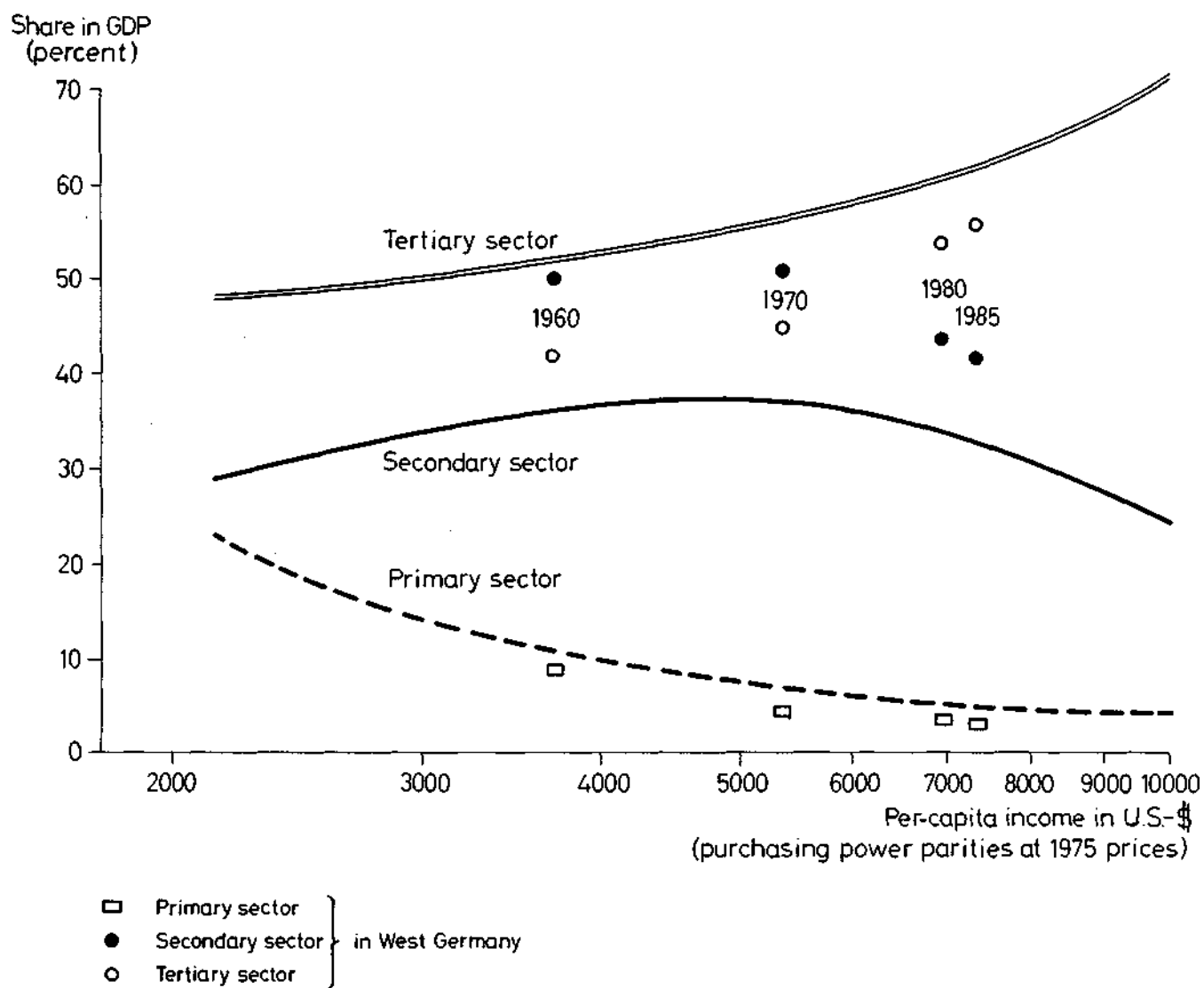
Table 7

Estimated coefficients for the relationship between the sectoral structure and the level of per-capita income (OECD sample)^a

$\ln \left(\frac{A_{ij}}{100-A_{ij}} \right) = a + b 10^{-3} Y_j + c \ln Y_j + D$ (t-values)					\bar{R}^2 F	n
	Contribution to gross domestic product					
Primary sector	15.48 (6.72)	0.18 (2.35)	- 2.22 (- 7.05)	0.55 (8.32)	0.65 138.4	225
Secondary sector	-12.36 (-11.11)	- 0.34 (- 9.47)	1.59 (10.49)	-0.25 (-7.60)	0.41 56.7	243
Tertiary sector	- 0.37 (- 0.43)	- 0.10 (3.49)	0.01 (0.06)	0.07 (2.84)	0.55 93.3	232
	Share in total employment					
Primary sector	69.67 (6.03)	1.02 (3.75)	- 8.98 (- 5.92)	-0.14 (-1.56)	0.65 88.8	142
Secondary sector	-27.22 (- 8.85)	- 0.74 (- 9.47)	3.57 (8.76)	-0.15 (-3.75)	0.43 36.8	141
Tertiary sector	7.58 (2.29)	0.44 (5.20)	- 1.15 (- 2.62)	0.23 (6.66)	0.67 92.7	137
^a The coefficient of determination \bar{R}^2 has been adjusted for the degrees of freedom; F gives the F-value for the whole regression; the figures in brackets refer to t-values; n is the number of observations.						

Source: As Table A1.

Figure 1
Per-capita income and sector shares in gross domestic product
(OECD sample)



Source: As Table A 1.

ondary sector shrinks.¹ Such a level of income has been achieved in West Germany in the late sixties; nowadays the per-capita income in Italy has reached this point. The tertiary sector shows a continuous increasing share in gross domestic product. These results obviously fit the three-sector hypothesis described above.

Furthermore, Figure 1 shows the deviations of the West German economy from "normal patterns" for selected years. As in other OECD countries, the relative importance of the primary sector has diminished, the tertiary sector was constantly growing and the secondary sector has passed a maximum. It should be noted, however, that the level of the secondary sector's share is still substantially above the "normal" levels, whereas the primary and tertiary sector are of a comparatively small size. This deviation from the international average, already emphasized in the FSW study, was reduced during the seventies, when structural adjustment in the West German industry consisted, to a large extent, in scaling down the level of activity. In the eighties, the pace of shrinkage slackened and the gap between the sectoral structure of West Germany and the international average has not further been narrowed.

Projected Structural Changes in West Germany

The production and employment structures, of which one can conceive for the West German economy in the year 2000, are sensitive, according to the model used, to the rate of growth of per-capita income. Three alternative scenarios have been chosen:

¹The first derivation of the output equation of the secondary sector is zero at an income-level of 4,676 U.S. dollars.

- In a "base scenario" we assume that gross domestic product per capita, in real terms, will increase at an annual rate of 3 percent. This assumption is, by and large, consistent with the growth trend recorded during the past 25 years and implies that the policy reforms initiated in recent years will be maintained.

- In a more "pessimistic scenario" the annual rate of growth is assumed to be 1 percentage point lower than in the "base scenario". The underlying premise is that inappropriate domestic macro- and microeconomic policies generate distortions, which held back economic growth.

- In a more "optimistic scenario" we expect significant policy improvements domestically and substantial trade liberalization resulting from the new GATT round of multilateral negotiations, which would stimulate a faster growth rate than in the "base scenario". The projected rate of growth is 4 percent.¹

The main tool for projecting structural trends are the regressions for "normal patterns" discussed above. Nevertheless, it surely would be inappropriate to base the forecasts only on those regression results. This would imply, for example, the prediction that West Germany's primary sector is going to increase its weight in the economy, since the estimated share of this sector in gross domestic product at high income levels is about 4 percent, whereas the actual share in West Germany is below 3 percent (Table 1). There is nothing in the foreseeable coal mining and agricultural policies, which can lead us to expect a reversal in the historical structural trend of this sector.

¹For the sake of comparison, it should be noted that the Basle-based Prognos AG predicted, in its recent report on West Germany (1986), an average annual rate of growth of real per-capita income of about 2.7 percent for the period 1984-2000. This lies in the range of World Bank's forecasts (1986) for the industrial countries as a whole, whose real per-capita income could increase by annual rates in the order of 2 to 3.8 percent between 1985 and 1995, depending on the economic policies pursued.

Therefore, the results of the regression analyses were adjusted according to information available from other Kiel research projects on structural change.¹ Tables 8 and 9 show the predicted sectoral shares in gross domestic product and in labour input for the three scenarios regarding overall economic growth as well as the actual shares in selected previous years. The following salient features emerge:

- At the three-sector level, the primary sector will continue to loose relative weight in the West German economy, both in terms of value added and employment. Moreover, there will be a fundamental shift in production and employment from the secondary to the tertiary sector, and this the more so, the faster the economy grows. This is consistent with the ongoing move towards an informations- and communications-based economy.
- At a more disaggregated level, manufacturing and construction emerged as the main losers. In the case of construction, the demographic trends referred to above in combination with a comparatively high degree of saturation in housing and road-building provide a reasonable explanation for the decline. In the case of manufacturing, a major impact might come from the unrelenting industrialization efforts in the Third World and the concomitant changes in the international division of labour; hence, consumer goods industries will face a faster relative shrinkage than the investment goods industries.
- The expanding sectors of the future are to be found among services industries. But not all of the service industries are expected to increase their share in gross domestic product or in employment. The predicted shares of "wholesale and retail trade, restaurants and hotel" and of "transport and storage" are below the level of 1985. The major winners

¹See, for example, Schmidt et al. (1986) for the most recent study.

Table 8

West Germany: Shares of sectors and branches in gross domestic product (percent)

Sectors/Branches	Actual		Predicted		
	1970	1985	2000 ^a		
			A	B	C
Primary sector ^b	4.6	2.8	2.5	2.3	2.3
Secondary sector ^b	50.4	41.4	33.0	30.2	28.8
Tertiary sector ^b	45.0	55.8	64.5	67.5	68.9
Agriculture, forestry and fishing	3.4	1.7	1.5	1.4	1.4
Mining and quarrying	1.3	1.1	1.0	0.9	0.9
Manufacturing	40.2	33.4	27.5	25.2	24.0
Intermediate goods	11.8	8.9	6.2	5.5	5.0
Investment goods	15.9	15.7	14.8	14.0	13.7
Consumer goods	12.5	8.8	6.5	5.7	5.3
Electricity, gas, and water	2.2	2.8	2.5	2.3	2.2
Construction	8.0	5.2	3.0	2.7	2.6
Wholesale and retail trade, restaurants and hotels	11.4	10.9	9.7	9.4	9.2
Transport, storage, and communications	5.9	5.8	6.6	7.4	7.7
Transport and storage	4.1	3.4	3.1	2.9	2.7
Communications	1.8	2.4	3.5	4.6	5.0
Finance, insurance, real estate, and business services	10.7	15.7	21.6	22.4	23.4
Financial institutions	2.6	4.6	5.2	5.5	5.7
Insurance	0.7	1.1	1.4	1.4	1.5
Real estate and business services	7.4	10.0	15.0	15.5	16.2
Personal services, other private producers	7.2	11.8	15.2	17.1	17.7
Government services	9.7	11.6	11.4	11.2	10.9

^a The predicted percentages of the year 2000 refer to three different assumptions on the expected annual growth rate of per capita income. A: 2 percent; B: 3 percent; C: 4 percent. For method of projection, see text. - ^b See Table 1 for definition.

Source: As Table 1.

Table 9

West Germany: Employment by sector and branches (percent)

Sectors/Branches	Actual		Predicted		
	1970	1985	2000 ^a		
			A	B	C
Primary sector ^b	9.7	6.3	4.3	3.7	3.6
Secondary sector ^b	47.7	40.1	32.1	29.8	28.5
Tertiary sector ^b	42.6	53.6	63.6	66.5	67.9
Agriculture, forestry and fishing	8.5	5.4	3.5	3.0	2.9
Mining and quarrying	1.2	0.9	0.8	0.7	0.7
Manufacturing	38.1	32.0	27.2	25.1	23.9
Intermediate goods	8.4	6.5	4.7	4.2	3.8
Investment goods	16.3	15.9	15.1	14.3	14.0
Consumer goods	13.3	9.6	7.4	6.6	6.1
Electricity, gas, and water	0.9	1.1	0.9	0.9	0.9
Construction	8.7	7.0	4.0	3.8	3.7
Wholesale and retail trade, restaurants and hotels	15.1	16.2	15.9	15.7	15.5
Transport, storage, and communications	5.3	5.6	6.4	7.1	7.4
Transport and storage	3.6	3.6	3.3	3.0	2.8
Communications	1.7	2.0	3.1	4.1	4.6
Finance, insurance, real estate, and business services	4.3	6.2	12.2	13.2	14.1
Financial institutions	1.5	2.3	3.0	3.3	3.5
Insurance	0.7	0.8	1.2	1.2	1.3
Real estate and business services	2.1	3.1	8.0	8.7	9.3
Personal services, other private producers	6.7	9.6	13.3	14.8	15.4
Government services	11.2	16.0	15.8	15.7	15.5

^a The predicted percentages of the year 2000 refer to three different assumptions on the expected annual growth rate of per capita income. A: 2 percent; B: 3 percent; C: 4 percent. For method of projection, see text. - ^b See Table 1 for definition.

Source: As Table 1.

are "communications", "business services"¹ and "personal services". It should be noted that the share of these activities in employment increases, which should help to dissipate apprehensions about the job-killing effects of the new revolutionary technologies.

IV. Summary and Policy Conclusions

The thrust of this paper rests on the factual observation about the interaction of economic growth and structural change. The main factors generating shifts in the composition of output and employment have been discussed, if only briefly, with a view to appraising their role in West Germany's future economic development. There is a strong presumption that the economy will face considerable adjustment pressures also during the next 15 years mainly due to intensifying international competition on both domestic and world markets, and to the fast rate of technological innovation as well.

The projections of structural change up to the year 2000 show that the West German economy will undergo deep transformations, as per-capita income rises. Services activities shall expand at a rate above average, whilst manufacturing and building industries are going to shrink in relative terms. We expect labour displacement in industry to continue, whereas the labour absorption capacity of the services sector might grow steadily. As industrial employment in West Germany has been found to be still higher than what one would derive from "normal patterns", the projected decline of the industry's share in labour input implies that, by the year 2000, the overall employment structure should be closer to the country's level of development than it is nowadays.

¹Employment data on business services refer to unpublished data from the Federal Statistical Office, Wiesbaden.

Whether or not structural change will be adequate for accomplishing stated growth and employment objectives, depends on the course of domestic policies to a large extent. In West Germany, as in other European countries, governments have been tempted, time and again, to use sector-specific measures, mainly non-tariff barriers and public subsidies, to ease the adjustment pressure in shrinking industries, such as agriculture, coal mining, textiles or shipbuilding. Moreover, there is a myriad of administrative interventions in goods and factor markets. Only less than half of the economy (in terms of value added and employment) operates under true competition (Donges, Schatz, 1986; Soltwedel et al., 1986). Under these circumstances, dynamic activities are discriminated against, the growth and employment potential of the services sector remains underutilized, and structural change is hampered.

In view of the challenges ahead, it would be desirable that governments resist demands of interest-groups for tailor-made assistance and gear their policies to establishing an overall economic environment which is predictable by the economic agents and attractive for new investment and technological innovations to flourish over the long run. To this end, a strategy would be helpful which (i) keeps monetary stability, arrests selective protectionism and subsidization, and strengthens domestic and foreign competition; (ii) reforms the tax system with a view of shifting some of the burden from factor input and efficiency incomes towards consumption and leisure; (iii) makes the domestic capital markets more efficient in providing equity financing and risk capital to innovative firms; and (iv) deregulates the economy, including the removal of unusually restrictive market entry regulations for new firms, especially in transportation, insurance services, and telecommunications.

The way in which structural change will take place in detail, will be determined by the entrepreneurs themselves. As the future is uncertain (it always has been), it is not possible to specify the activities for which prospects are best, especially in a country like West Germany which is close to the frontier of knowledge available in the world economy at any point of time. Governments and bureaucrats cannot solve this problem of uncertainty since they have no superior wisdom (not to be confused with wishful thinking). The way of embarking upon promising activities will have to be found out in a trial-and-error process, in the course of which many firms will fail, whereas others will succeed - a proof that growth-promoting and job-creating structural change is making headways.

Table A1

Estimated coefficients for the "normal pattern" of the structure of output (OECD sample)^a

$\ln \left(\frac{A_{ij}}{100-A_{ij}} \right) =$	$a + b 10^{-3} Y_j + c \ln Y_j + D$				R^2	n
	(t-values)				F	
Agriculture, forestry, and fishing	12.14 (4.98)	0.02 (0.26)	-1.76 (-5.29)	0.04 (0.60)	0.65 158.2	251
Mining and quarrying	13.90 (3.17)	0.49 (3.43)	-2.50 (-4.16)	1.68 (13.36)	0.46 65.4	225
Manufacturing	-10.64 (- 8.46)	-0.26 (-6.57)	1.29 (7.52)	-0.31 (-8.50)	0.34 43.4	244
Intermediate goods industries	-18.80 (- 3.37)	-0.44 (-3.00)	2.16 (2.91)	-0.27 (-3.03)	0.07 5.6	183
Chemicals and allied products	-18.77 (- 3.23)	-0.36 (-2.38)	2.02 (2.61)	-0.25 (-2.64)	0.06 4.56	183
Stone, clay, glass	-14.54 (- 3.94)	-0.45 (-4.68)	1.48 (3.01)	-0.36 (-6.04)	0.52 65.4	183
Basic metals	-25.16 (- 2.48)	-0.56 (-2.09)	2.80 (2.08)	-0.23 (-1.41)	0.02 1.93	183
Investment goods industries	-30.22 (- 6.25)	-0.54 (-4.27)	3.60 (5.59)	-0.43 (-5.53)	0.40 41.8	187
Consumer goods industries	-16.36 (- 7.94)	-0.51 (-9.50)	1.99 (7.25)	-0.30 (-9.18)	0.73 139.4	157
Food, beverages, and tobacco	-11.78 (- 3.23)	-0.36 (-3.65)	1.23 (2.52)	-0.36 (-5.33)	0.35 35.0	192
Textile, apparel, and leather	- 3.21 (- 0.77)	-0.35 (-3.08)	0.16 (0.29)	-0.75 (-9.82)	0.73 171.5	192
Wood and furniture	-23.20 (- 3.82)	-0.58 (-3.61)	2.58 (3.19)	0.03 (0.43)	0.09 6.81	170
Paper, printing and publishing	-15.56 (- 2.43)	-0.21 (-1.19)	1.49 (1.74)	0.22 (1.85)	0.09 7.50	192
Other manufacturing industries	-33.31 (- 2.55)	-0.84 (-2.44)	3.79 (2.18)	-0.58 (-2.78)	0.07 5.3	170
Electricity, gas, and water	-12.41 (- 7.79)	-0.23 (-4.51)	1.17 (5.36)	0.20 (4.36)	0.21 22.0	243
Construction	-12.73 (-12.01)	-0.33 (-9.61)	1.40 (9.66)	-0.04 (-1.36)	0.27 32.5	251

(continued)

Table A1 (continued)

$\ln \left(\frac{A_{ij}}{100-A_{ij}} \right) =$	$a + b 10^{-3} Y_j + c \ln Y_j + D$				R^2 F	n
	(t-values)					
Wholesale and retail trade, restaurants and hotels	- 4.91 (- 3.99)	-0.12 (-3.08)	0.44 (2.63)	-0.02 (-0.53)	0.04 4.5	245
Transport, storage, and communications	- 0.01 (- 0.01)	0.05 (1.31)	-0.33 (-2.24)	0.25 (8.02)	0.22 23.8	250
Transport and storage	-21.06 (- 4.25)	-0.51 (-4.05)	2.43 (3.70)	0.57 (8.81)	0.47 37.7	123
Communications	- 6.92 (- 1.59)	0.04 (0.33)	0.32 (0.55)	0.10 (1.71)	0.24 14.1	123
Finance, insurance, real estate, and business services	- 4.37 (- 2.59)	0.13 (2.41)	0.20 (0.85)	-0.03 (-0.63)	0.46 66.7	235
Financial institutions	- 4.53 (- 0.90)	-0.09 (-0.68)	0.19 (0.28)	-0.13 (-2.01)	0.08 3.8	96
Insurance	- 6.55 (- 0.57)	0.08 (0.28)	0.15 (0.10)	-0.54 (-3.73)	0.17 7.6	96
Real estate and business services	-22.25 (- 3.38)	-0.12 (-0.71)	2.37 (2.72)	-0.08 (-0.91)	0.63 65.2	112
Personal services, other private producers	3.58 (0.89)	0.26 (2.01)	-0.90 (-1.63)	0.36 (3.03)	0.06 6.5	247
Government services	2.53 (1.20)	0.73 (3.96)	-0.69 (-2.40)	-0.20 (-3.37)	0.17 18.2	250

^a The coefficient of determination R^2 has been adjusted for the degrees of freedom; F gives the F-value for the whole regression; the figures in brackets refer to t-values; n is the number of observations.

Source: OECD, National Accounts, vol. II, 1970-1982. Paris 1984. - Own calculations.

Table A2

Estimated coefficients for the "normal pattern" of the structure of labour input (OECD sample)^a

$\ln \left(\frac{A_{ij}}{100-A_{ij}} \right) =$	$a + b 10^{-3} Y_j + c \ln Y_j + D$				R^2	n
	(t-values)				F	
Agriculture, forestry, and fishing	15.63 (2.22)	-0.08 (-0.46)	- 2.02 (- 2.16)	-0.14 (-1.83)	0.69 130.0	174
Mining and quarrying	139.96 (5.06)	2.97 (4.54)	-18.76 (- 5.16)	0.33 (1.55)	0.22 14.6	142
Manufacturing	-27.29 (- 8.20)	-0.70 (-8.32)	3.50 (7.95)	-0.23 (-6.56)	0.38 32.5	155
Intermediate goods industries	-21.66 (- 3.70)	-0.48 (-3.25)	2.48 (3.20)	-0.10 (-1.35)	0.06 3.7	128
Chemicals and allied products	-17.72 (- 2.73)	-0.31 (-1.85)	1.81 (2.10)	-0.02 (-0.26)	0.03 2.2	128
Stone, clay, glass	-20.78 (- 4.99)	-0.62 (-5.88)	2.31 (4.18)	-0.41 (-7.62)	0.61 66.8	128
Basic metals	-37.20 (- 3.22)	-0.74 (-2.51)	4.29 (2.80)	0.05 (0.35)	0.06 3.9	128
Investment goods industries	-46.9 (-10.18)	-0.99 (-8.39)	5.83 (9.53)	-0.27 (-4.49)	0.53 48.3	128
Consumer goods industries	-13.27 (- 6.54)	-0.44 (-8.50)	1.59 (5.90)	-0.09 (-3.38)	0.76 120.2	115
Food, beverages, and tobacco	-22.60 (- 5.28)	-0.52 (-4.81)	2.55 (4.50)	0.28 (4.97)	0.32 20.8	128
Textile, apparel, and leather	7.09 (1.21)	-0.08 (-0.55)	- 1.16 (- 1.50)	-0.70 (-9.22)	0.69 93.9	128
Wood and furniture	-15.93 (- 2.64)	-0.46 (-2.94)	1.69 (2.11)	- 0.11 (- 1.38)	0.24 12.9	115
Paper, printing and publishing	-24.55 (- 2.59)	-0.33 (-1.37)	2.60 (2.06)	0.52 (4.18)	0.25 15.4	128
Other manufacturing industries	-29.65 (- 1.80)	-0.67 (-1.61)	3.30 (1.51)	-0.57 (-2.64)	0.04 2.9	128
Electricity, gas, and water	-13.29 (- 3.62)	-0.21 (-2.21)	1.12 (2.30)	0.20 (4.10)	0.14 8.76	141
Construction	-17.94 (- 8.22)	-0.50 (-8.97)	2.13 (7.35)	0.03 (1.23)	0.54 67.1	168

(continued)

Table A2 (continued)

$\ln \left(\frac{A_{ij}}{100-A_{ij}} \right) =$	$a + b 10^{-3} Y_j + c \ln Y_j + D$				\bar{R}^2	n
	(t-values)				F	
Wholesale and retail trade, restaurants and hotels	1.54 (0.27)	0.06 (0.41)	-0.40 (-0.52)	0.07 (1.06)	0.00 0.6	156
Transport, storage, and communications	-26.93 (- 7.38)	-0.60 (-6.45)	3.20 (6.62)	0.15 (3.85)	0.33 25.2	150
Transport and storage	-26.35 (- 6.88)	-0.61 (-6.18)	3.10 (6.09)	0.41 (8.31)	0.61 50.3	97
Communication	-35.19 (-10.39)	-0.71 (-8.06)	4.08 (9.05)	0.14 (3.19)	0.58 45.5	97
Finance, insurance, real estate, and business services	-17.64 (- 1.90)	-0.08 (-0.33)	1.76 (1.43)	0.13 (1.35)	0.24 15.1	137
Financial institutions	-19.92 (- 3.73)	-0.29 (-2.10)	2.04 (2.87)	-0.19 (-2.38)	0.29 11.3	76
Insurance	- 0.29 (- 0.03)	0.50 (2.07)	-0.89 (-0.74)	-0.05 (0.38)	0.58 29.3	63
Real estate and business services	-20.34 (- 4.48)	0.01 (0.11)	1.94 (3.20)	-0.05 (-0.85)	0.84 143.2	84
Personal services, other private producers	38.48 (3.13)	1.20 (3.83)	-5.54 (-3.40)	0.63 (4.80)	0.19 13.0	150
Government services	-10.65 (- 1.32)	0.04 (0.19)	1.01 (0.94)	-0.20 (-2.35)	0.27 19.9	155

^a The coefficient of determination \bar{R}^2 has been adjusted for the degrees of freedom; F gives the F-value for the whole regression; the figures in brackets refer to t-values; n is the number of observations.

Source: As Table A1.

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