



UNIVERSITÀ DEGLI STUDI DI ANCONA
DIPARTIMENTO DI ECONOMIA

**ECONOMIC GROWTH
A DISCUSSION ON FIGURES**

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marzo 1994

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Original title: *Crescita economica, le insidie delle cifre*, Bologna 1993.
Translation by A. Belton, revised by the author. Financial support
by MURST (quota 40%).

INDEX

Introduction	p. 7
PART ONE: STATISTICAL COMPARISONS AND GENERALIZATIONS	
1. What growth?	13
2. The figures available	17
1. 87 countries from 1960 to 1985	17
2. 17 countries from 1897 to 1986	22
3. Some regularities in the growth of modern economies	29
1. Three observations	29
2. How to explain similarities of behaviour	29
3. The capacity constraint	32
4. The demand constraint	34
5. Situations of advantage	35
6. On the "advantage of being a latecomer"	37
PART TWO: THE IMPORTANCE OF GROWTH	
4. GDP and welfare	43
1. Goods, needs, satisfactions	43
2. Growth-generated needs	46
5. GDP and life expectancy	51
1. The figures	51
2. An interpretation of the figures	54
3. Prospects for the future	56
PART THREE: THE CRISIS OF MEASUREMENT	
6. Calculation at constant prices in the case of product innovations and of services	61

7. The problems of services	65
1. The dimensions of the phenomenon	65
2. How productivity is measured: the case of commerce	72
3. The case of credit	76
4. The case of government	79
5. Other observations	83
8. What is to be done	87
Conclusions	95
APPENDIX	
1. Base statistical information	105
1.1. GDP series at constant prices	105
1.2. Statistics on services	126
1.3. Statistics on average life expectancy	132
1.4. Price indices	136
2. Analytical notes	141
2.1. The external constraint	141
2.2. Infrasectoral component and structural component of the variation of productivity	143
3. Techniques of estimation at constant prices	153
3.1. Introduction	153
3.2. Outline of the methods used by ISTAT	157
3.3. Notes on services	162
3.4. Estimation of new products	164
References	171

INTRODUCTION

The figures on national income - which fifty years ago interested only a handful of specialists - are today a matter of everyday discussion among the general public. It has become common practice to refer to levels of per-capita income in order to judge whether and to what extent one country is "better off" than another; and to use the rate of growth (in real terms) as indicative of the rapidity with which a particular country is advancing along the road of "progress".¹

The popular success of these statistical measures of growth is marred, however, by the fact that in many cases those who use these data attribute a significance and a validity to them which they do not actually possess. The harmful consequences of this are twofold, for the uncritical use of statistics yields knowledge which although abundant is false, while the information - limited but nevertheless useful - which could be gained from their cautious analysis is lost from view.

Accordingly, my aim in this essay is to advocate the responsible use, and to oppose the abuse, of statistics on growth.

I develop three major themes, as follows:

Firstly (in Chapters 1, 2 and 3), I conduct a rapid examination of the statistics regarding various countries in the recent and distant past in order to ascertain what we really know about the behaviour of income until the present day. Despite the great amount of data available, the nucleus of reliable information is small - although it is sufficient to draw some interesting conclusions. Not only can one discern significant differences in

¹ I quote from one of the most widely used text-books on economics: "comparing countries with levels of per-capita GNP (gross national product) that vary between \$130 in Bangladesh and more than \$19,830 in Kuwait, it seems natural to use GNP as an index of the welfare of the populations of various countries. And for every economy the growth rate of GNP is also often used to assess its "state of health". A rapid growth of GNP is considered a positive fact, while slow or negative growth is a negative outcome" [Fisher and Dornbusch 1986, pp. 645-646].

growth rates, from period to period and country to country, but one also finds certain uniformities, or "statistical laws", governing the growth rates of the set of countries examined; laws for which it is possible to provide a logical explanation.

Secondly (in Chapters 4 and 5), I discuss the points of contact, but also the divergences, between the notion of economic growth (defined as growth of income, i.e. of the quantity of goods produced) and the seductive and elusive notion of welfare. There are persuasive grounds for thinking that these two notions may diverge, yet if we restrict our analysis only to physiological well-being - indeed to one of its crude but nevertheless suggestive indicators, namely, life expectancy - we realize that there is statistical evidence for a positive correlation between life expectancy and the level of income. In this essay I analyse the relationship between these two variables and show how it changes in the course of time.

The third broad topic addressed by the essay (in Chapters 6, 7 and 8) is the increasing difficulty, in the present evolutionary stage of the advanced economies, of obtaining satisfactory measurements of growth using current statistical technique. This technique - that is, valuation at constant prices of national product - is applicable under two conditions: that the goods constituting national product are measurable in physical units; that it is possible to ascertain their unit price during the period upon which calculations are based. For goods like grain, coal, steel, wool, and so forth, these two conditions are largely fulfilled; but for other goods, such as the products of commodity innovation and services, they are not. Hence it follows that as long as the national product is constituted mainly by goods of the former type, as it is in countries passing through the early phases of modern economic development, measurement at constant prices is applicable with fairly good approximation. It ceases to be applicable, though, when tertiarization and commodity innovation assume large proportions, as they do in present-day Italy. The statistical offices, and not only in Italy, seek to remedy this situation by plugging the leaks in measurement at constant prices by means of various

accounting contrivances. The results, however, are unsatisfactory. It is now necessary to face the facts squarely; to stop asking of the technique of calculation at constant prices questions which it is unable to answer; to reconsider what the questions are to which we can seriously seek a reply.

The essay finishes with a compendium of its main conclusions.

The exposition of what I have to say is organized on two levels. The text from Chapter 1 to the Conclusions expounds the broad lines of my reasoning in straightforward and succinct form, the aim being to facilitate reading even for the layman. Detailed documentation and technical explanations are contained in the Appendix, which forms the second half of the book and is intended for readers with specialized interests.

In the correction of this essay I have been aided by the suggestions and criticisms of students attending my course, of many colleagues in the Department of Economics at the University of Ancona, and of colleagues in other institutions, most notably my mentor Sergio Steve. I thank all of them for their help, and I am especially grateful to Cristiana Di Bari, of Istao, for the intelligence, energy and efficiency with which she has assisted me in every stage of preparation of this book, from the gathering of sources to its final publication.

PART ONE

STATISTICAL COMPARISONS AND GENERALIZATIONS

CHAPTER 1

WHAT GROWTH?

Economic growth is talked about in many different senses, and it is therefore advisable for me to specify from the outset what kind of growth I am concerned with here.

As will be already apparent from the Introduction, I am concerned with the increase in income or product measured by national accounts. But I intend to refrain as far as possible from analysis of short-term oscillations, and to concentrate instead on underlying trends. I shall therefore measure the velocities of growth (average annual percentage rate of change of income) that have come about over periods lasting one or more decades.

I shall also pay careful attention to the choice of the initial and final years of these periods in order to obtain significant measures. For example, in contrast to an unfortunately widespread practice, I shall not measure growth in the twenty- or twenty-five-year period that began around 1950. Those who do so, in fact, find that countries like Italy, Germany and Japan recorded an extremely high increase in growth during that period. Of this increase, however, one cannot be sure how much of it should be interpreted as "growth" and how much as "recovery" from the economic collapse due to the Second World War. In this essay, therefore, I prefer to examine, as the case may be, annual growth rates in the periods 1938-1973 and 1960-1973.

There is also the problem of choosing among the various definitions of income. Here I prefer "gross domestic product at market prices" (which henceforth I abbreviate as GDP), for the sole reason that it is apparently the term most commonly employed.¹ However, it should be borne in mind that for discussion of particular issues other concepts may sometimes be more appropriate: national rather than domestic income, or even

¹ In the few cases where the sources available to me do not refer to GDP but to other definitions, I have estimated GDP by reportioning.

disposable income or the resources employed for internal uses (i.e. consumption plus investment); values net rather than gross of amortization; values at factor cost rather than at market prices. Of course, the classification of countries and of periods in terms of growth rates is liable to alter when one passes from one to another of these specifications, but major changes are rare.

A more crucial choice is that between total GDP and a series of relative measures ranging from GDP per unit of population to GDP per unit of production factors, to GDP per unit of consumption. Here I examine both total GDP and per-capita GDP. Many authors neglect the former of these indicators, although I do not believe it to be less important than the latter; and it is not always true that comparative judgements on the rapidity of growth, among countries and periods, based on observation of the latter hold also for the former, given that the rate of population increase varies considerably over time and among countries.² For instance, Australia occupies a high position in the classification of countries by velocity of growth if we look at total GDP, but it comes near the bottom if we look at per-capita GDP.

Various authors concentrate instead on measures of the growth of GDP per unit of production factors; and not only on the roughest measure, GDP per unit of labour input, but also on indices of total factor productivity. By doing so they venture into treacherous terrain, because whereas the margin of uncertainty in estimates of the population in modern countries is tolerable, that of estimates of employment and of the capital stock is disconcertingly large, even in a country with relatively refined statistics like Italy.³ I therefore believe that there are good grounds

² Recall the approximative relation:

$$\dot{y} \approx \dot{Y} - \dot{P}$$

where $\dot{y}$ is the growth rate of per-capita GDP, $\dot{Y}$ that of total GDP, and $\dot{P}$ that of the population. Only by assuming that $\dot{P}$ is the same in all the countries subject to comparison, can one expect the classification of countries to remain the same according to $\dot{y}$ and according to $\dot{Y}$.

³ The choice of GDP per unit of factor input is instead defensible in cases where one presumes that the errors committed in measuring factor input are similar (by sign and

for examining here, as a relative measure, only Per-capita GDP, since this is certainly more reliable and no less significant than the others.⁴

The growth that I intend to study is not, obviously, that of income in current money (which would appear to increase more rapidly, the more rapid is inflation), but growth purged of monetary changes, i.e. expressed in "real terms". Since this requirement is usually served today by the technique of valuation at constant prices, it is precisely the growth of GDP at constant prices that constitutes the subject of my study. However, I have already mentioned in the Introduction that this particular valuation technique is unable to handle the new developments of the advanced economies, and it thus yields increasingly less convincing results. Therefore, in conducting my analysis, I have had to address a formidable set of questions: What exactly and how serious are the deficiencies in the measures we use? Is there a remedy for these deficiencies? If not, how are we to deal with the notion of growth?

To finish with, I must stress two major limits to my study.

The first derives from the fact that the growth of GDP is inextricably bound up with that of development, defined as structural change: that is, change in the composition and in the use of output, as well as in the social structure. Growth and development should therefore be viewed as two sides of the same problem. However, giving adequate treatment to these two aspects in this essay would render it too cumbersome for myself and for the reader. I have therefore decided to concentrate on growth,

relative magnitude) as those committed in measuring GDP, so that the errors cancel each other out in the ratio between the two measures.

⁴ Consider, for example, a country which, thanks to good government, increases (for simplicity's sake, in equal proportions) its levels of employment and of production, the population remaining constant. This causes an increase in per-capita GDP, but it does not affect GDP per worker. One may therefore say that, in this example, the former ratio gives a more interesting answer than the latter, and it is also an indicator of efficiency: specifically, the efficiency with which the country's overall human resources are managed.

the reader. I have therefore decided to concentrate on growth, treating development only implicitly or obliquely, and with the intention of pursuing the subject elsewhere.

The second limit arises from the fact that the growth studied here is that measured by the national economic accounts, the subject-matter of which, however, is only the flows of goods⁵ (plus a few other categories, like the services gratuitously provided by the government, which for the practical reasons given below are conventionally assimilated to goods).⁶ In short, therefore, the growth studied by this essay is the growth of "commodified" activities, of market values; it is not the growth of the values of civil society, nor of culture, nor of health, nor of other components of a good life and a good society. Economic growth is a concept very different from "human progress"; and this should be constantly borne in mind if the reader is to follow correctly the argument set out in the pages that follow.

5 In this essay the term *goods* is always used to denote everything exchanged on the market, including both "material" things (*commodities*) and "non-material" ones (*services*).

6 See Gnesutta, "Che cos'è produzione", 1983, section 7.1.1.

CHAPTER 2

THE FIGURES AVAILABLE

1. 87 countries from 1960 to 1985

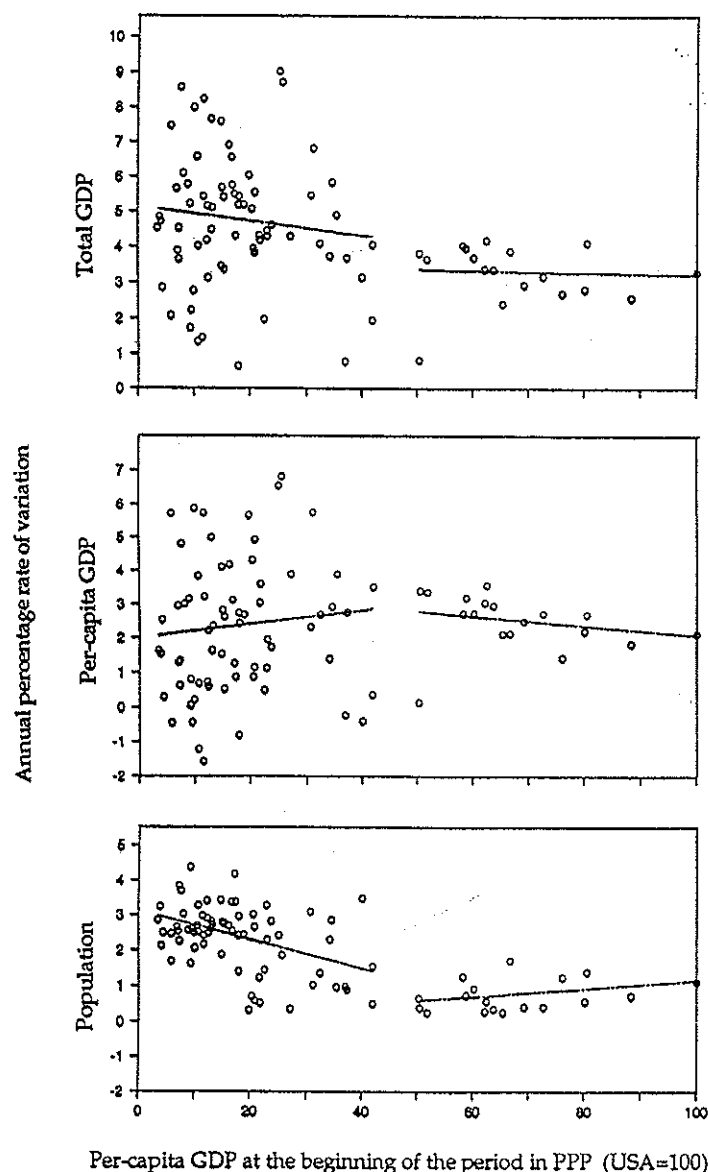
Until midway through the twentieth century, GDP series were published for only a handful of countries. During the second half of this century, however, the practice of publishing GDP estimates has been adopted by almost all the countries of the world. These are generally official publications which are issued annually.

The use of these statistics, especially for international comparisons, raises doubts due to the unreliability of the estimates, the lack of homogeneity among the definitions employed, and the problem of equating values expressed in different monetary units. However, action is being taken to organize the information into comparable form, and I base my analysis here on a project under way for many years, and with a great commitment of resources, at the University of Pennsylvania.

Appendix 1.1 gives details of this source and sets out in analytical form the data-base I have drawn upon. It also explains the criteria that I have used in selecting 87 countries, while discarding others whose data I judged to be ill-suited for comparison. The Appendix also highlights the margin of uncertainty surrounding the figures from the 87 countries I have chosen.

In this section I shall restrict myself to providing a summary review of the information that can be obtained from the data. I refer to figure 1, in which each of the 87 countries considered is represented by a small circle. Indicated on the vertical axes of the three panels in the figure is the annual percentage rate of changes during the twenty-five year period 1960-85 in, respectively, total GDP (upper panel), per-capita GDP (centre panel), and population (lower panel) of the individual countries. Indicated on the horizontal axes of the three panels is the level of per-capita GDP for each country in 1960, the initial year of the period.

Fig. 1. Rates of change of GDP and of population in 87 countries, 1960-1985, according to the initial level of per-capita GDP.



This level is valued in domestic "purchasing power parity" units (PPP), rather than on the basis of the exchange rate, and it is expressed as a percentage of the level of the United States.

One notes first the wide range of variation among levels of income per inhabitant: the country with the lowest income of those in the table, namely Ethiopia, in 1960 had a level equal to just 2% of the country with the highest income, the United States. The range of variation has continued to increase over time until most recent years (see table a.1, in Appendix 1.1).

Secondly, one is struck by the great variability among countries in the growth rates of total GDP and per inhabitant; there is also considerable variability, although somewhat less marked, in rates of population change.

The variability of all three phenomena is much more accentuated among countries with relatively low levels of income.

For ease of analysis, I shall use as a demarcation line a level of income per inhabitant that equals 50% of that of the United States. I shall call "A countries" (i.e. countries with relatively high incomes) those which in the initial year of the period stood at or above this level; and "B countries" those that stood below it. It is interesting to note that, on this criterion, the twenty-five-year change of per-capita GDP in B countries has, in several cases, a value even higher than the 5% annual average, while in others the values are below zero. Among A countries, the change remains between 1% and 4% in all cases.

There is an explanation for the greater homogeneity of behaviour among A countries compared with B ones. The A countries are all well advanced along the road of modern economic development, and therefore participate in a community of material and cultural exchanges. The B countries are instead a heterogeneous group, in the sense that some of them have still to cross the threshold of modern development (and therefore have almost zero income growth per inhabitant), others are crossing it now (and the first steps may lead to a temporarily extremely high rate of income growth), yet others have by now undergone modern development and exhibit rates of income growth similar to those of the A countries. There is a further reason,

one that concerns the quality of the statistics, which may help to explain this difference. In all the A countries, statistical offices follow a common methodological orthodoxy which they more or less respect, and they have a common notion of what results are acceptable, whereas among the B countries daring estimates are presumably more frequent.

If one turns from examination of spread to that of the average values of growth rates, one finds the following differences between the A and B groups of countries. The rate of growth of total GDP in the period considered is markedly greater on average in the B countries than in the A ones; but population too, as we well know, grew much more rapidly in B countries in this period. The two phenomena largely compensate for each other, so that the rate of growth of per-capita GDP does not differ greatly between the two groups of countries.¹

One may comment on this - with reference to the problem of the international distribution of incomes - by stating that there is no evident worsening of the situation in the sense of a widening relative gap in per-capita income between the poor and the rich countries. But the situation has indeed deteriorated, and considerably, in the sense that an increasingly larger proportion of the world's population lives in the poor countries rather than in the rich ones.

Apart from the above comparisons between the A and B groups of countries, it is of interest to establish whether, internally to each of these groups, there are systematic differences in growth rates according to the level of income per inhabitant. In particular, one may enquire whether there is any truth to the hypothesis, advanced by so many scholars, that the less rich among the rich countries grow more rapidly than the richest ones.

To aid the reader, in figure 1 I have marked the six straight

1 To be exact, the rate for the A countries is 0.2 points higher; a difference which I consider negligible given the margin of error in the data and the arbitrariness with which the two groups have been formed.

The reader is reminded that the statistical basis for the outline analysis conducted in this section is presented in analytical form in Appendix 1.1.

lines that are obtained when regression analysis is used. Each of these regression lines indicates the presumed underlying trend that dominates its corresponding cluster of points. I would stress, however, that these indications should be treated very cautiously, given the way in which the points are spread. The coefficients of determination (R^2) are in fact extremely low, especially for total GDP and per-capita GDP.

I pass nevertheless to summing up the information to be gained from the regression lines, beginning with those for the population, since they are the most reliable. One notes a sharp inverse relation (high and negative coefficient of regression) between the rate of population growth and the level of income in B countries, and this is in line with commonsense notions about demographic transition. On the contrary, there is a direct, albeit slight, relation (low and positive coefficient of regression) among the A countries.² This latter finding can be explained by the fact that the richer countries are, for the most part, countries with high rates of immigration.

As for GDP, the rate of growth of total GDP in the A countries is almost equal at the various levels of income (a coefficient of regression of negative sign but with a value close to zero). Hence the rate of growth of per-capita GDP, which is given roughly by the difference between the rate of total GDP and the rate of population growth, stands in a slight inverse relation to the level of income. In the B countries, the rate of growth of total GDP exhibits an inverse relation to the level of income, but one less marked than that exhibited by the rate of population growth. Hence the rate of growth of GDP tends to change in direct relation to the level of income.

Although I have so far examined the twenty-five-year period 1960-85 taken as a whole, it is interesting to see whether changes in the dynamics of growth have taken place within this period. Appendix 1.1 gives the disaggregated data for the two sub-periods 1960-73 and 1973-85. These, in brief, are the conclusions that we may draw from them.

2 The direct relation reported here for the twenty-five-year period 1960-85 as a whole has disappeared in more recent years.

The first and chief conclusion is that there has been a major slowdown in growth. For almost all countries the rates of growth of total GDP, of per-capita GDP, and of the population are lower in the second sub-period than in the first. Among the B countries one finds numerous cases of a decrease in GDP during the second sub-period, but only a few such cases in the first.

The differences already noted between the two groups of countries maintain the same sign over time, in the sense that, in both sub-periods, group A exhibits a lower variability of rates among countries than group B does, a lower average growth rate for both the population and for total GDP, and a roughly similar growth rate of per-capita GDP.

The coefficients of regression, however, show some differences, even of sign, between the two periods. I shall not dwell upon these here, and they are in any case described in Appendix 1.1.

2. 17 countries from 1897 to 1986

In this section I examine all and only the countries for which I possess figures on GDP dating back a hundred years, or at least until the eve of the First World War; and figures which are of sufficient reliability for comparisons to be made. The group selected on these criteria comprises 17 countries, most of which belong to group A of the previous section.³ Not surprisingly, the countries for which the richest statistical information is available are those with higher levels of income.

As in the previous section, I shall not submerge the reader with an avalanche of statistics and detailed explanations (those interested may refer to Appendix 1.1). Instead I move immediately to summary

³ The only countries of these 17 not belonging to group A are Italy, Japan and Spain. Those belonging to group A but not included among these 17 countries are Iceland, Luxembourg, New Zealand and Uruguay.

The statistical estimates used in this paragraph have a number of differences with respect to those of the previous section. These differences are described in Appendix 1.1.

All the 17 countries examined in this section have levels of per-capita GDP which, since the 1970s, have been consistently higher than 50 per cent of the U.S. level until the 1970s, except Spain whose level has oscillated around 50%.

description of the information to be gained from the data.

I refer to figures 2, 3 and 4, which require brief preliminary explanation.

The first two figures plot the various phases of growth - respectively of total GDP (fig. 2) and per inhabitant (fig. 3) - in the 17 countries examined. This form of graphic representation is unsuitable for a much larger group of countries, such as the 87 examined in the previous section. Here, in order to ensure that the tangle of curves does not impede interpretation, the 17 countries have been divided into 6 small sub-groups, each of which is assigned a panel in both figures. Figure 2 (total GDP) shows only the differences in growth rates from phase to phase and from country to country; differences which can be seen at a glance by comparing the slopes of the curves in one panel and among several panels.

Figure 3 (per-capita GDP) also throws light on relative levels of income. For this purpose, the curve for the United States is repeated in each panel so that the reader can rapidly assess the position relative to the U.S.A. of each of the other countries in each time-period.

Fewer explanations are required for figure 4, since it follows the pattern already used in figure 1 - with the advantage that, with a smaller number of points, the name of the country can be given alongside each of them (abbreviated as the initials on car nationality plates). I have had to restrict this figure to the period 1913-1986 because statistics for 4 of the 17 countries are not available before 1913.

The three figures give a good general idea of the behaviour of the 17 countries - the most salient features of which are the following (more detailed information is provided in Appendix 1.1).

Firstly, all seventeen countries exhibit growth, from the point of view of both total GDP and per-capita GDP, not only in the long period taken as a whole, but also in each of the sub-periods into which this has been divided.⁴

⁴ Population also grows during the period as a whole and during each sub-period for the majority of countries, with the following exceptions: France 1897-1938; Austria 1913-1986; Belgium 1913-1938; Germany 1973-1986.

Fig. 2. Total GDP in 17 countries, 1897-1986

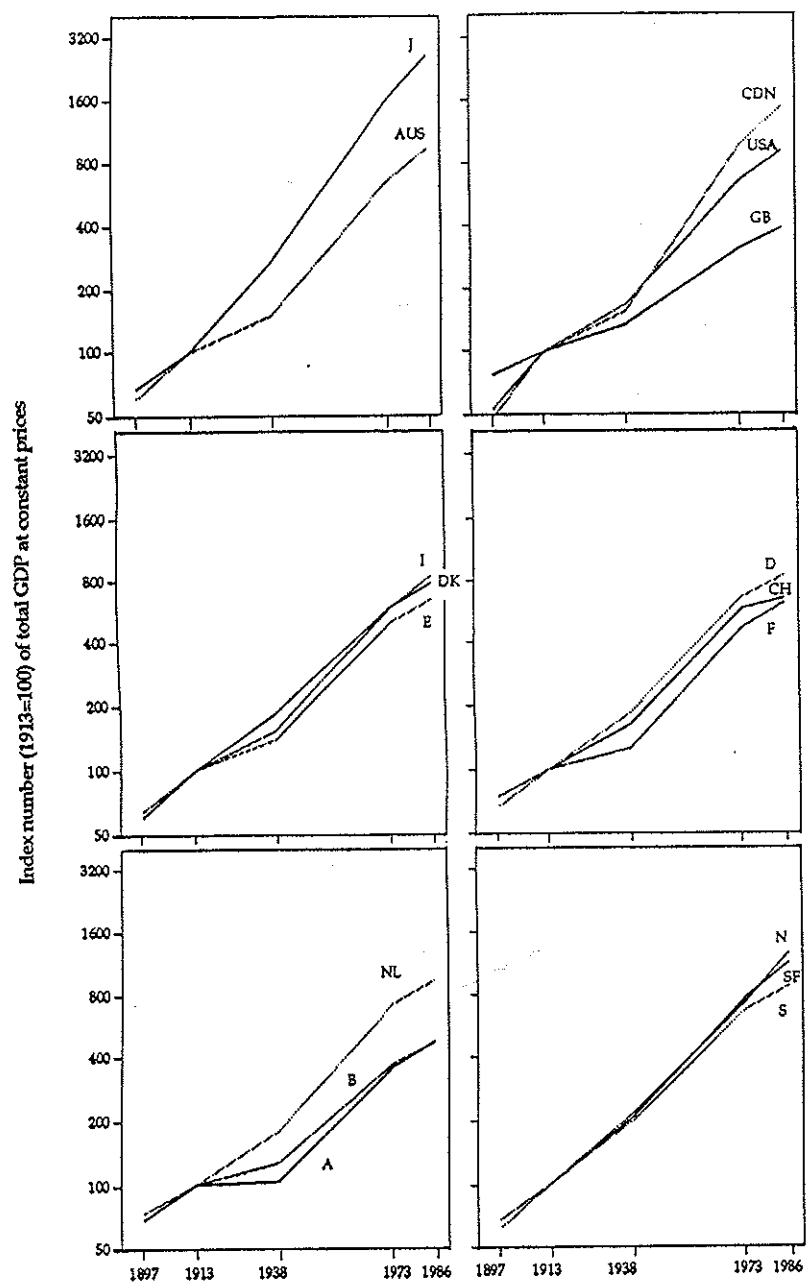
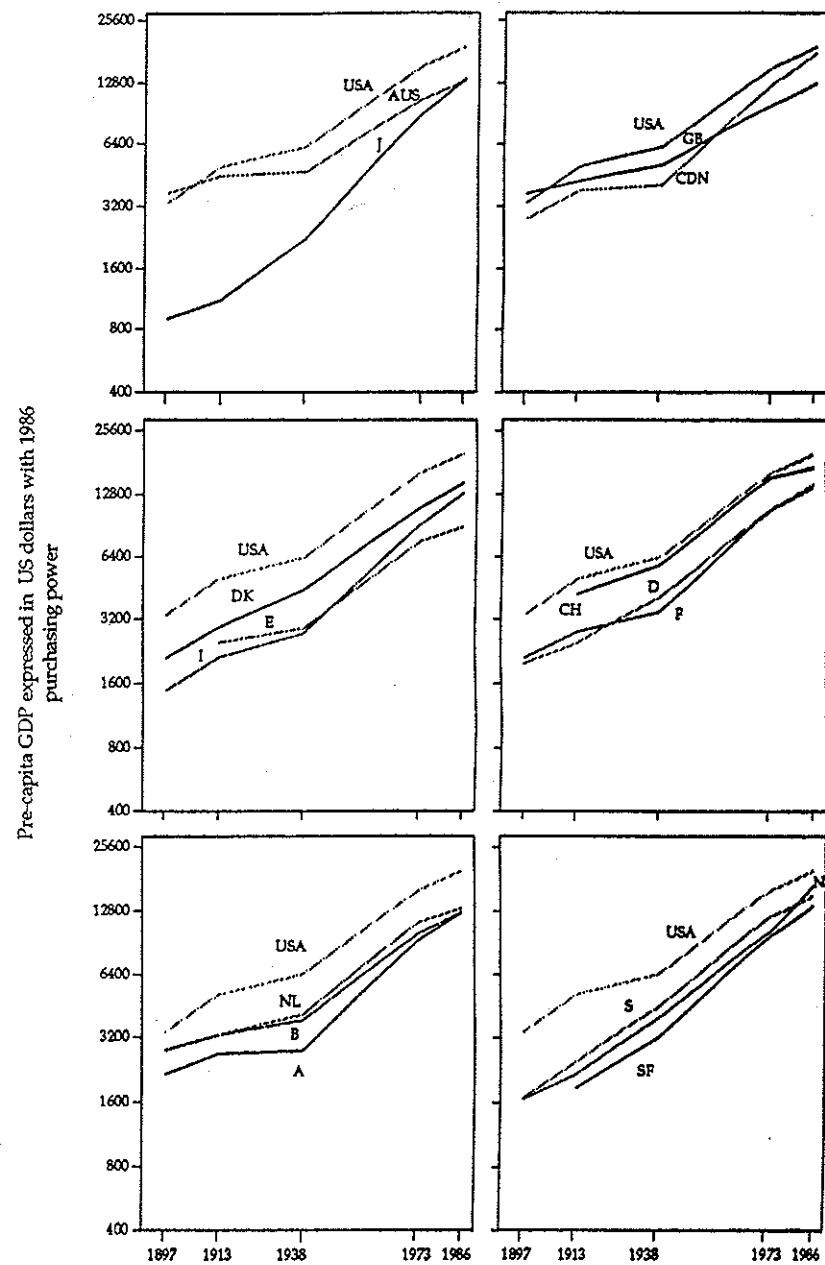


Fig. 3. Per-capita GDP in 17 countries, 1897-1986



Secondly, although the growth rates relative to the period as a whole and to the sub-periods differ from country to country, the variability is modest - at least compared with the extremely high variability I reported in the previous section for the B countries. If, for example, we inspect the annual percentage rate of growth of per-capita GDP in the period 1913-1986, we find that it falls within the interval 1.7 - 2.7 for 14 of the 17 countries examined (the three exceptional countries are the United Kingdom and Australia with a rate of 1.5, and Japan with a rate of 3.4).

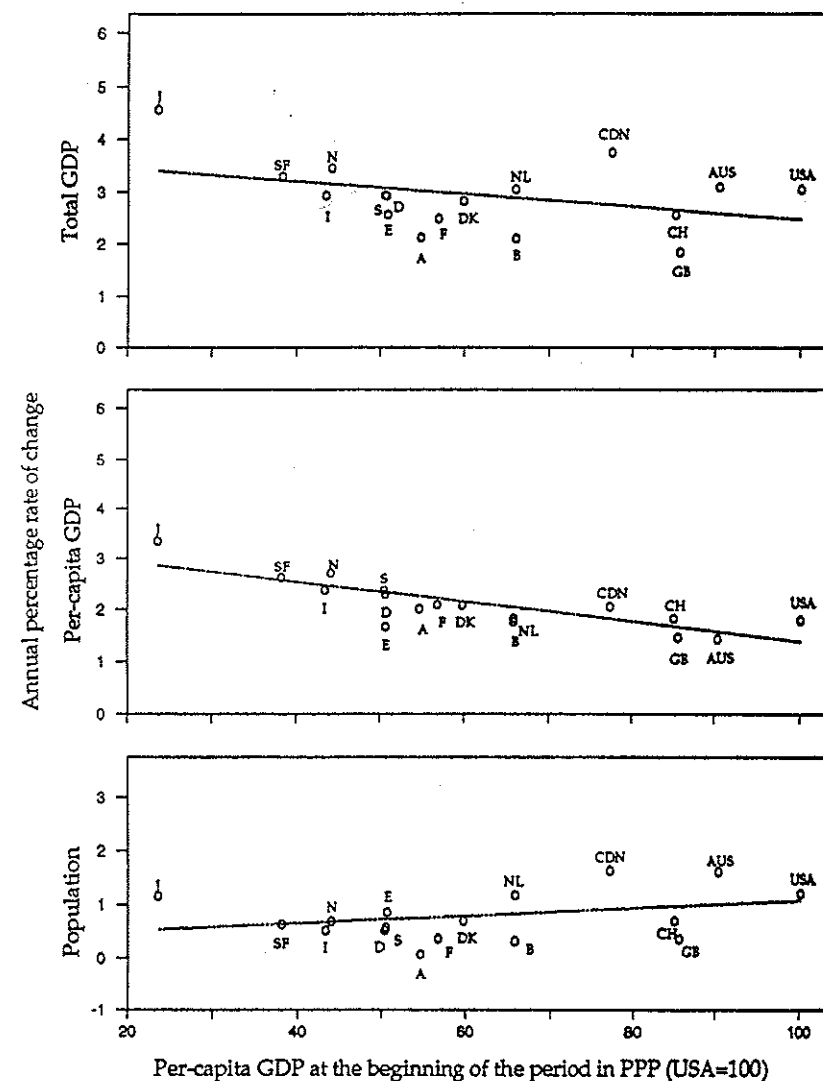
Thirdly, dividing the long period into sub-periods of medium duration reveals an alternating sequence of periods in which growth is "at full-tide" and then "ebbs"; a sequence which proceeds synchronously in the various countries examined. Almost all countries recorded slower growth of total GDP and of per-capita GDP in 1913-38 than in 1897-1913; more rapid growth in 1938-73 than in 1913-38; and slower growth after 1973.⁵

As regards the connection between rates of growth and level of income, the regression lines drawn in figure 4 reveal the following. The rate of growth of the population stands in a direct relation to the level of income, but with a lower angular coefficient than that found in figure 1. The rate of total GDP stands in an inverse relation to it, with a coefficient of not negligible value, whereas in figure 1 the coefficient is close to zero. Hence, for the 17 countries, the rate of change of per-capita GDP in the period 1913-86 is negatively connected with the level of income, with a coefficient somewhat higher than that found in figure 1. The negative relation between rate of change of per-capita GDP and income level is also confirmed by the analysis of individual sub-periods set out in Appendix 1.1, and it proves to be especially marked in one of these sub-periods, namely, 1938-73.

I have summarized above the information yielded by the regression lines, but the somewhat erratic pattern of the points in figure 4 (which is reflected in rather low values for the coefficient of determination R^2) warns us not to over-estimate its significance.

⁵ The main exception is Norway, whose rate of growth of both total GDP and of per-capita GDP constantly increases from one sub-period to another. Moreover, Germany and Japan do not exhibit an "ebb" phase of per-capita GDP in the period 1913-38.

Fig. 4. Rate of change of GDP and of population in 17 countries, 1913-1986, according to the initial level of per-capita GDP.



Before concluding this section, I wish briefly to examine the patterns exhibited by individual countries as regards their rapidity of growth.

I begin with total GDP. Japan achieves by far the highest growth rate: 4.6 per cent annually in the period 1913-1986. Canada, Norway and Finland follow with rates ranging between 3.8 and 3.3. There is then a compact group of countries with rates between 3.1 and 2.9: the other two Scandinavian countries, the United States, Australia, Italy, Germany, and Netherlands. The tail consists of Spain, France and Switzerland, then Austria and Belgium, and lastly the United Kingdom with a rate of 1.9.

Turning to per-capita GDP, we find Japan once again in the lead, well ahead of all the other countries and achieving a rate of 3.4. The United Kingdom is again in last place, which this time it occupies jointly with Australia, both countries recording a rate of 1.5. The intermediate section of the classification is rather different from that for total GDP. There is no separate and compact group of countries, but instead a continuous string of countries with rates ranging from 2.7 to 1.7. Canada and the United States occupy much lower positions than they did in the classification for total GDP; so too does Australia, the other country of immigration. Towards the top of the list we again find Norway, Finland and Sweden, followed by Italy and Germany.

Over a period as long as the one considered in this section, slight differences in annual rates of income growth per inhabitant are enough to cause major changes in their relative levels. A country with an annual percentage rate of growth one point higher than another country improves its level relative to the other by 64% in 50 years and by 170% in 100 years. Although the differences in growth rate among almost all the countries examined here are less than one point, there are some extreme cases like Japan and the United Kingdom with a difference between them amounting to almost two points. Consequently Japan's income level relative to the United Kingdom's rose from 25% in 1897 to 106% in 1986.

SOME REGULARITIES IN THE GROWTH OF MODERN ECONOMIES

1. *Three observations*

From the analysis conducted in the two previous chapters we may draw the following conclusions.

First, if by underlying trend is meant movements not measured year-by-year but over periods of medium duration, then there has been a permanent underlying trend to the growth of total GDP and per-capita GDP in all the relatively rich countries for which reliable statistics are available. No exceptions are found to either the twenty-five-year statistics for the countries in group A or to those spanning almost a century for the 17-country sample. The relatively poor countries, the B group (for whom estimates are more uncertain), do not display the same uniformity of trend in their growth rates: although growth is the predominant pattern, there are several cases of decline.

Second, examination of changes of income over periods of medium duration reveals an alternating sequence of phases of more rapid and more sluggish growth. With very few exceptions, this sequence has proceeded synchronously in all the countries that today are relatively rich, and also in a good many of the poor ones. Six phases can be counted, three of "flow-tide" and three of "ebb-tide", between 1897 and 1986.

Third, within each phase there are small differences in velocities of growth among the relatively rich countries. In the sub-periods 1960-73 and 1973-85 - in which it is possible to compare the A countries with the B ones - the variability indices of the former are just half those of the latter.

2. *How to explain similarities of behaviour*

Therefore, in the three respects specified above, the relatively rich countries display a notable similarity of behaviour. This is not surprising if one remembers that these are all countries which are

closely integrated, and have been so for a long time, into the same cultural world and the same community of exchange. It is in this sense that I have used the term "modern economies" in the heading for this chapter, my intention being to stress that I refer to countries well advanced along the road of "modern economic development" as defined by Kuznets [1966].

All these countries adhere to the system of values that Kuznets calls "secular"; in all of them an acquisitive mentality has developed which seeks success through gains obtained on the market - both the products market and the labour market. All of them, therefore, are driven by the impulse both to "commodify" an increasingly wide range of activities (activities previously performed gratis are turned to gain), and to increase the output of already commodified activities (the productivity of human labour is augmented by the ever greater exploitation of natural resources and by the adoption of increasingly remunerative techniques). Thus, in all these countries, there is a constant push to increase per-capita GDP and therefore - as long as population growth continues as it did during the period examined here - to increase their GDP at an even greater speed.

Of course, this aspiration to growth can only be fulfilled to the extent that conditions effectively allow productive capacity on the one hand, and demand for goods on the other, to increase. Whichever of these two constraints - productive capacity or effective demand - is more stringent at any particular time will determine the rate of effective growth.

The fact that the modern economies are connected by a network of cultural and material exchanges through which information, people and goods are constantly circulating helps to spread among countries both stimuli to grow, and changes in productive capacity and in demand. Value systems and fashions, technological knowledge and production factors are transferred from one country to another. The innovations and accumulation accomplished in one country "spill over" into the others; the enrichment of one country fuels its demand for the products of the others.

What bearing does all this have on the three observations with which I opened this chapter? As regards the first, it means that it

is not surprising that the countries belonging to the modern economic community should exhibit a constant tendency to grow. Of course, one still has to explain what determines the ingress of a particular country to this community: why Italy only joined it at the end of the nineteenth century, much later than Germany; why Turkey entered only after the Second World War; and why countries like Madagascar are still excluded from it. Answers to these questions are proposed in the literature on economic "take-off" and the stages of growth, to which the reader is referred.¹ Also, there is still the question of whether this drive for market growth is bound to continue indefinitely, or whether, beyond certain levels, the impulse for further growth and even the measurability of growth will enter into crisis. I return to this topic later.

As regards the second statement, there is nothing odd about the fact that periods of waxing and waning growth are common to almost all the modern economies, given the transmission effects outlined above. Just as the effects of the mechanisms of the growth of capacity and of demand are transmitted from one country to another, so too are the accelerations and slowdowns in these mechanisms, albeit with some delay and loss. This is not to rule out the possibility that local phenomena may not sometimes predominate in individual countries to counteract the overall tendency (for example, exploitation of the North Sea oilfields meant that growth accelerated in Norway while it slowed in the other modern economies). Although the transmission of fluctuations in growth from one country to another can be explained, we still do not know what causes these fluctuations; a question which the literature on long economic cycles seeks to answer.²

I have still to discuss the third observation - to which, because it requires more detailed treatment, I devote the next section.

1 The most obvious reference is Rostow [1971].

2 The essential reference is Schumpeter [1939]. For recent developments see van Dijn [1983], ISCO [1989], Di Matteo and Vercelli [1992].

3. The capacity constraint

As I have said, the growth rate of GDP is pushed upwards by the aspiration to enrichment that drives the modern economies. It encounters, however, the twofold constraint of the availability of productive capacity and of effective demand, and it therefore settles at the maximum level allowed by whichever of the two constraints happens to be more stringent at any particular time.

We must therefore examine whether and how it is possible for one country to deviate markedly from the average behaviour of the others as regards its growth of capacity and of demand. Rapid analysis will show that possibilities for marked deviations do exist, but that they are rare.

I begin with the growth of productive capacity. Since this phenomenon depends on a large number of factors, my analysis will be easier to follow if I start by distinguishing between two components - population growth and the growth of potential output per inhabitant - which can in turn be further decomposed. Population growth, in fact, comprises the components of natural population movement and migration, and hence, to refine the analysis even further, the policies that influence them. Potential output per inhabitant requires analysis of a complex ramification of factors both immediate (the ratio between the labour force and the total population, working hours, output per hour) and mediated (age structure of the population, educational levels, the level and diffusion of entrepreneurial and organizational skills, the availability of capital and of natural resources, the functioning of civil society and of the government, etc.).

There is already a considerable amount of literature - to which the reader is referred - which shows how to apply an accounting procedure of this kind in order to decompose growth into a number of significant supply-side factors.³

When one proceeds to analysis of the growth effects of

³ The accounting procedures to be found in the literature, in fact, refer to the growth of *effective*, rather than *potential*, output. See the pioneering work by Abramovitz [1956], Kendrick [1956], Solow [1957], Denison [1967] and the general re-examination of growth factors recently conducted by Abramovitz [1989: 3-79].

individual factors, considerable quantitative differences may, of course, emerge between one country and another. For example, the population is currently growing at one per cent annually in some modern countries, while in others it is diminishing. It is unlikely, however, that major differences of the same sign in all these factors can exist in one particular country. This is so for two reasons.

The first is that the velocity of growth of certain fundamental factors is obstructed by certain, so to speak, "physiological" limits. This holds for the rapidity with which capital can be accumulated, organizational structures developed, the educational system extended, levels of schooling raised, and so on. Since I have already explained these matters in a previous study, I shall here only provide a single example: namely, the impossibility of accelerating capital formation by more than a certain amount through increased national saving. There are, in fact, "limits depending on social psychology and on the maintenance of political stability which preclude over-ambitious attempts to extract greater saving by fiscal manoeuvres, income redistribution, physical controls on consumption, etc. Indeed, very few countries have managed to raise their net saving rates above 20 per cent for several years in succession" [Fuà 1985: 30-31].

The second reason is that, in some cases, there operates something like an inverse correlation between these factors. An extremely banal example is provided by countries with above average population growth. If, because of this growth, these countries on the one hand exhibit high values for the factor "working population" growth, on the other, as the reverse side of the coin, so to speak, their availability of capital and natural resources per unit of labour diminishes. And this leads (unless compensatory circumstances intervene) to low values for the factor "productivity".⁴

One finds similar inverse correlations between the rate of investment and its productivity (defined as the incremental ratio between output and capital).

⁴ For a brief analysis of the various possible influences exercised by demography on growth see Fuà [1986: 7-18].

The conclusion to be drawn from the foregoing is that marked deviations from the average in the growth of productive capacity are not impossible, but that they require particularly propitious circumstances which, not surprisingly, are rare.

4. The demand constraint

The growth of demand of a particular country depends on the conditions internal to it; but it also depends - if we are talking about an open economy - on those of the rest of the world, because the export from the one coincides with the import from the other. This linkage would align the rates of growth of various countries if a series of factors for divergence did not intervene.

The literature on growth accounting has devoted much less attention to these aspects of demand than it has to those of supply. To remedy this shortcoming, Appendix 2.1 presents an analytical framework and its application to the statistics for the OECD countries.

The analysis set out in the Appendix shows that every country which maintains a relatively stable ratio between its imports and exports, which has an income elasticity of imports close to the world average, and which holds a stable share of the world market, must necessarily have a rate of growth of GDP close to the world average.

Marked and long-lasting deviations from the average rate of growth of the rest of the world therefore imply that a country diverges significantly and persistently from the above conditions. This is a rather rare occurrence, although slight and transitory deviations are common.

In fact:

- (i) trade imbalances are commonplace and easily managed, but it is exceptional for a country to be able to count on an inflow of capital or of income, or of transfers from the rest of the world, such that it is able to maintain continuous and conspicuous trade deficits over the long term;
- (ii) market shares vary over time, but it is rare for a country to achieve such outstanding competitiveness that it rapidly increases its share over many years;

(iii) as regards the elasticity of imports, although wide oscillations may occur in correspondence to alternating historical phases of the integration and disintegration of the international market (at the world level and for large areas), these are of little importance in the present context because they affect all countries simultaneously. Among the possible factors explaining divergence among countries, of significance instead is the hypothesis that the elasticity of imports varies according to the stage of development that a country has reached. However, the available statistics do not provide sufficient confirmation of this hypothesis. All that remains, therefore, is the possibility that specific conditions may arise in a country, like the exploitation of new natural resources or the adoption of particular policies, which make it particularly successful in restraining imports.

I shall return to this topic in the next section, in which I attempt to establish whether it is possible to identify certain typical situations in which one country is able to grow much more rapidly than the others.

5. Situations of advantage

One may say that a situation is particularly conducive to the rapidity of growth if a country in this situation finds that the above-mentioned constraints of capacity and demand are relaxed.

Two situations with this property immediately spring to mind:

Natural resources. There is, first, the situation in which a country discovers and begins to exploit new natural resources - a recent and striking example being Norway since the discovery of the North Sea oilfields.

Utilization of this new resource has meant that Norway has not only, obviously, increased its productive capacity, but also its outlets, since oil is a resource that brings with it, so to speak, its own placement on the market. Within the analytical framework set out in section 4, the easy placement of oil on the domestic market to substitute previous imports translates into a lesser propensity to import; and its easy placement on the external market translates into an increase in market share.

One gains an idea of the impact of oil on Norway's growth from the fact that, during the period 1973-85, the increase in the value added of the country's mining industry alone accounted for no less than 1.4 annual percentage points of increase in its total GDP. This amounts to saying that oil extraction explains the entire difference between Norway's annual growth rate of GDP (3.9%) and the European average rate (2.7%).

Note that this latter point only concerns the advantages deriving directly from oil production, not those that may have accrued indirectly in terms of the increased capacity and competitiveness of Norway's other productive activities.

Other examples of high positive differentials in GDP growth entirely or principally due to the development of new natural resources are provided by the statistics (unfortunately more unreliable) regarding the oil-producing countries of the Third World.

On the other hand, the situation may arise where changes in the exploitation of natural resources lead to high negative differentials of growth. This happens when a country, after achieving a high level of GDP sustained mainly by the exploitation of important natural resources, finds that this traditional source of income dwindles, either because these resources are physically exhausted or because of technological obsolescence, or because of a downturn in demand. Thus the gains in value added that the country is able to achieve in new productions are not translated into net increases in GDP, since they go at least in part to off-set the reduced earnings from traditional productions. An example of this can perhaps be found in the stagnation of Argentina's economy over the last half-century.

Inflow of production factors from outside. Another particularly advantageous situation arises for a country when it is able to attract a well-balanced inflow of all the production factors: entrepreneurship, capital and labour. An outstanding example is the United States, which for more than a century benefited from the large-scale immigration of all three categories of factor - encouraged by a reassuring political regime, by cultural links and by the enormous wealth of natural resources still to be exploited in

the country.⁵ While it is obvious enough that the simultaneous inflow of all three categories contributed to America's growth of productive capacity and also helped to slacken the external constraint by improving productivity and competitiveness, it is important to draw attention to the decisive role that imported capital played in relaxing the external constraint, by enabling America to maintain a chronic deficit in its balance of current payments.

The rapid growth of the American economy, in fact, was accompanied by persistently negative balances of payments on current account - except for brief intervals - from 1790 (the first year for which information is available) to 1895. These were matched by invariably positive balances of capital movement.⁶

Analogous examples, of lesser duration and dimension, are provided by the other overseas countries populated by European settlers.⁷

6. On the "advantage of being a latecomer"

Whereas the two above cases of "propitious conditions" are quite obvious, there is a third one which, although more debatable, should nevertheless be examined because it is the subject of a considerable amount of research and controversy in the literature. I refer to the latecomer countries. One can, in fact, identify a number of reasons why, other conditions remaining equal, growth tends to be more rapid in the countries that began the growth process later and therefore still occupy low positions in the incomes table.

The main reason for this phenomenon is the following. Economic growth is essentially determined by the adoption of

⁵ Because of this latter aspect, the United States could equally be cited as an example in the above discussion of the advantageous situation deriving from the availability of natural resources.

⁶ See US Bureau of the Census [1960: 564-5]. The principal interruption of deficits on current account came with a series of positive balances between 1876 and 1881.

⁷ See Mitchell [1983], which shows that Australia recorded an uninterrupted series of negative balances on current account from the year when statistics began (1860) to 1892; and Canada from the initial year (1900) to 1915.

increasingly productive technologies and forms of organization. Those countries at the forefront of technological and organizational progress (and therefore presumably at the top of the incomes table) can only grow further if they discover and exploit new knowledge and techniques. The countries left behind, though, have another, more expeditious, strategy available to them: they can appropriate the knowledge and techniques already possessed by the advanced countries. The lower a country's ranking in the classification of technological levels and incomes, the higher the leap it can make - and the higher, therefore, the velocity of growth it can accomplish - if it is able to copy the leader country.

There exists a body of literature which not only gives rigorous analytical formulation to the reasoning roughly outlined above, but also highlights a set of features specific to economic backwardness that could, by hypothesis, increase the likelihood of a country's rapid growth. Among these there are features conducive to an increase in productive capacity - for example, the high profitability of investments and the availability of still under-utilized human resources - and features conducive to an increase in demand, such as low wage claims, which, by favouring competitiveness, slacken the external constraint.

Against the arguments just mentioned for optimism concerning the future of the latecomer countries, however, one can also find a series of reasons for pessimism.

A first reason for scepticism is that the technological and organizational innovations required by the latecomer countries to meet their growth requirements are not necessarily those that have been developed by the advanced countries. If they are not the same (and presumably they are often not), then the advantage deriving to the latecomers in copying the leaders disappears.

Secondly, it is not enough for a latecomer country merely to have a good model to imitate; it must also possess the motivation and capacity necessary to reproduce that model in its own particular circumstances. This entails that the country must already possess, to an adequate extent, a broad set of the features which Abramovitz calls "social capabilities" - chief among which are a political and legal framework, a system of values, some sort

of social mobility, an educational pattern, and infrastructures able to sustain modern economic development.⁸ It must, that is, be a country which is both technologically backward and socially highly advanced; a combination which occurs only rarely (it is widely thought that Japan was once an outstanding example of this fortunate blend of circumstances).

The argument so far points to the conclusion that technological backwardness is indeed a situation conducive to growth, but only when it is attended by a set of complementary conditions that rarely occur. Moreover, as well as technological backwardness, there are other conditions (like those examined in the previous section) that stimulate rapid growth.

Delayed technological development is therefore only one of the factors that account for the differences in the rapidity with which countries grow. The question is whether, in actual fact, this proves to be the (or at least a) dominant factor.

One may seek an answer in the statistics. Those that I rely upon here (see Chapter 2, sections 1-2, and Appendix 1.1) give only a weakly positive reply as regards the small group of countries that are relatively rich today (i.e. the 17-country sample and the A-group countries) and a negative reply for the others (the B countries).

It should be added that the weakly positive reply is further enfeebled, especially as regards the statistics for the 17-country sample, by two further considerations: one regarding the way in which the sample has been formed, the other regarding errors of estimation.

In constructing my sample, I have had to select countries at the top of today's incomes list, in order to obtain reliable statistics. This means that the sample includes both countries that have maintained their relative positions over time, and those which were at the bottom in the past but have since moved to the top. It excludes, however, those that used to be at the top and have now slid to the bottom. The sample is therefore fashioned to include

⁸ For a masterly synthesis of the debate on convergence, I recommend Abramovitz [1990]; and for more extensive treatment, Abramovitz [1989]. In the recent Italian literature see Tamberi [1989].

cases that support the hypothesis of convergence and to exclude those that do not.

As regards estimation errors, if one relies on estimates of current income, every error committed in the rough and ready estimation of the income level of a country in 1897 or 1913 entails an error of opposite sign in the calculation of the growth rate from that date until today. For example, if it were true, as some authors suggest, that the statistics for 1913 incomes used in this study underestimate Japan's level and overestimate Australia's, then it would follow that my calculation of the rate of growth since that date to the present day would be too high for Japan and too low for Australia. Thus every error committed has the effect of revealing more convergence than actually exists.

In his crucial criticism of the statistical proof of the convergence hypothesis, J. B. De Long [1988] shows that if we choose a sample consisting of the countries ranking high in the incomes table at the beginning (rather than at the end) of the period 1870-1979, and if we apply the correct methodology, no inverse correlation between initial relative level and rapidity of growth appears.⁹

Hence it does not seem, with the present state of knowledge, that there are sufficient statistical grounds for indicating technological laggardliness as the principal factor explaining differences in the rates at which countries grow.

PART TWO

THE IMPORTANCE OF GROWTH

⁹ J. B. De Long's sample consists of the 17 countries included in my own plus Argentina, Chile, East Germany, Ireland, New Zealand, and Portugal. He examines both the period 1870-1979 and the period 1913-79, with negative results in each case.

CHAPTER 4

GDP AND WELFARE

1. *Goods, needs, satisfactions*

In Chapter 1 of this essay I stressed that national economic accounts measure the flows of *goods*, plus a few other flows which it has proved expedient to assimilate to them.

Thus, when we read that one country has a higher product per inhabitant (whether GDP or NNP) than another, we can with reasonable confidence assume that the *market activities* or similar of the former country yield greater average product per inhabitant. However, commentators are frequently tempted to go a step further and conclude from these figures that the former country (probably) enjoys greater well-being than the latter. This is an inference that can be disputed.

"Well-being" is an alluring but nebulous concept. Simplifying to the extreme, one presumes that the reasoning of those who take per-capita income to be a proper indicator of well-being proceeds as follows. There exists a set of needs which is (approximately) the same in all countries. The level of well-being is determined by the extent to which these needs are satisfied. Since goods serve to satisfy needs, the country possessing more goods can achieve a higher level of well-being. Although this chain of reasoning concerns comparison among countries, one can construct a similar one for comparisons over time.

However, numerous objections can be raised against the argument just outlined, and those that spring most readily to mind I now list.

a) There are important needs which can be satisfied *also* - and in some instances *only* - by "non-commodified" means; and these needs are ignored by the above reasoning.

b) There is a widespread opinion that the well-being of a

country does not depend solely on its total supply of needs-satisfying goods, but also on their distribution among the population; this too is neglected by the argument.

c) The method we use, in our accounts, to estimate heterogeneous goods values each of them in terms of its price. But we should ask ourselves whether the total value thus obtained is, or is not, a significant measure of the "quantity of needs" which this set of goods is able to satisfy. Economic theory tells us that there is indeed a proportionality (under certain hypotheses) between prices and the *marginal* utility of goods, but not between prices and *total* utility. And it is precisely the latter that interests us here. One must therefore conclude that although the aggregates of national accounting like GDP are extremely interesting as measures of the quantities of goods, they cannot be justifiably used to measure the quantity of satisfactions - as the above reasoning would instead maintain.

Each of these three objections would suffice, if accepted, to refute the reasoning in question. Those, however, who are not dissuaded, but persist with the argument by transferring it to the concrete terrain of statistical measurement, encounter yet another kind of difficulty. They must resolve the issue of which aggregate of national accounting is most suitable for measuring the satisfaction of the population's needs. Is domestic product better or national product? Gross or net? At market prices or at factor cost? Or is it more correct to concentrate only on the domestic uses of product - i.e. on consumption and investment - or, again, solely on consumption? In fact, it is only of consumed goods that one can say that they have been effectively enjoyed by the population in the period examined.

There is a broad current of thought which inclines towards consumption, but suggests that the definition of it presently employed by national accounts should be replaced by one which only and wholly comprises what is truly *final* consumption. This means, first, that changes must be made to the accounting of the consumption of durable goods. Calculation of a given year's consumption should not include (as it presently does) the entire

price of the durable goods purchased during that year by consumers, but only the putative rental (interest and depreciation) of the durable goods at their disposal. This accounting rule should be applied - to give the most obvious examples - to the consumption of cars, of domestic appliances, etc.; and perhaps also to education expenditures (though this is more debatable). Secondly, also entailed by this proposal is that national accounts must exclude spending which national accounts at present classify as final consumption, but which in fact is intermediate - i.e. the purchase of goods with which to produce other goods. A prime example is the transport costs that people incur in travelling to their places of work, although one could go further by saying that spending on a healthy diet, or on recreation, and so on, also serves to maintain productive energies. This kind of reasoning leads one onto a slippery slope at the bottom of which there is nothing, or almost nothing, that can still be considered final consumption. One has to decide at which point to stop; and this is a matter of open debate.¹

My purpose here has been to hint, though in a fragmentary and superficial way, at the probably insuperable problem encountered - at the levels of both economic theory and statistical measurement - by those who endeavour to use national accounts for comparisons of welfare. Since the literature abounds on the question, I shall not further encumber this essay by providing more systematic or detailed treatment.

However, I should still dwell for a moment on a particular case: namely that case in which, on the one hand, more goods are produced, but with methods which have the "negative" effect of either sacrificing pre-existing satisfactions or creating new dissatisfactions, and, on the other, in which GDP series record the increases in production but not the "negative" effects connected with them. I examine this case in the next section.

¹ See Fuà [1949] and subsequent revision [1957: 34-8] for the early debate, and Eisner [1988: 1616-20] for more recent developments.

2. Growth-generated needs

In what follows I refer to two types of problem. The first concerns the situation in which productive change increases the quantity of goods available to people, but deprives them of certain satisfactions which they previously enjoyed in "non-commodified" form, and the recovery of which requires appropriate goods.

I shall give examples of this phenomenon.

Consider, first, the increase in female employment that Italy has been experiencing for a number of years. The transformation of housewives into workers has contributed to the production of goods; but it has correspondingly reduced the non-commodified activity of these women in running the household, looking after children and the elderly, doing the housework, cooking, and so forth. The gap has been bridged (more or less) by developing additional commodified activities: kindergartens, laundries, restaurants and canteens, etc.

Consider, second, the passage from the agricultural economy to the urban, industrial and post-industrial economy - a process which has been under way in Italy for more than half a century. This transformation has brought with it great increases in the production of goods attended by profound change in lifestyles and modes of work. And one aspect of this change has been the disappearance of the non-commodified satisfactions intrinsic to rural life and work, and the consequent need to fill the void (more or less) with commodified satisfactions. There are innumerable examples available, of which I need only cite the most banal: physical exercise and contact with nature. The majority of the rural population used to be surfeited with these satisfactions to the point of nausea; if town dwellers want them today, they must resort to the market. The industries of seaside and mountain holidays, of gymnastics, of sport, etc., have developed precisely in order to satisfy these new wants.

Third, consider the massive development of agricultural techniques which use chemicals in order to increase crop yields. Unfortunately, these chemicals pollute the water table. Hence, in order to restore to consumers the drinking water of which they

have been deprived, new commodified activities are necessary: purification, the drawing of water from mountain springs, etc.

How are productive changes of the type exemplified in the previous paragraphs recorded in the GDP historical series? In all cases, the GDP series records changes in the production of goods without regard for those that have come about in non-commodified satisfactions. For example, and here I refer to the last point made above, the GDP series records both the increased value added achieved in agriculture and that realized in the infrastructures required to purify the water supply. However, it does not tell us - nor would we expect it to - that these infrastructures do not bestow a further satisfaction on the population, but that they instead restore (more or less) a satisfaction that the population has lost.

In fact, a considerable part of what we call modern economic growth consists in the commodification of activities and satisfactions which previously existed outside the market. In metaphorical terms, over recent centuries the tide of the market has risen to submerge an increasingly large area of our lives. We need to ask ourselves what the prospects are for the future, whether it is likely and desirable that the tide will continue to rise indefinitely.

I turn to the second type of problem. This is the situation in which the drive to increase goods production causes damage which is *not* simultaneously repaired by the development of appropriate productions. There are numerous examples of such damage, and they principally concern three kinds of losses: those which are deferred to the future, those which are of uncertain magnitude, and those which are irreparable. An example of deferred loss is the destruction of soil fertility by rapacious agricultural methods. An example of uncertain, but potentially catastrophic, loss is the greenhouse effect and the "hole" in the ozone layer. An example of irreparable and certain loss is the destruction of the historic and artistic heritage of our cities in order to ease the flow of traffic.

In all these cases the yearly GDP series record the immediate

results of productive developments but ignore the damage that will stem from these developments in the future.

A third type of problem is created by the production of new goods; goods whose *raison d'être* is not to satisfy a pre-existing need, but to create a new one in order to satisfy it.

Those prepared to chop logic could argue that this is the case of all product innovations, since they all bring new need-satisfying means onto the scene, and they all create new needs to satisfy. In fact, for a need to be felt there must be an object that corresponds to it, so that whoever produces a new good is the creator of the new need for that good.

Creating a new need, however, is not necessarily harmful to human well-being - at least from the point of view of those (and there are many) who consider the indefinite expansion of aspirations and experience to be beneficial to mankind.² But perhaps we should distinguish between those innovations which are guided by a spirit of progress and those which are not.

There is a welter of product innovations which are apparently determined wholly by the inner logic of the market. I refer to the case in which a new model is created for the sole reason that its *novelty* (and no other intrinsic merit) will attract customers conditioned by advertising and other factors to prefer what is new to what already exists.

The creation of fashion is a macroscopic example of this process. By way of illustration, I propose the following simple parable. Until the First World War, the inhabitants of Pantopia wore their clothes for ten years before buying new ones. Today, the Pantopian clothing manufacturers introduce a new fashion every year and persuade the population that to wear anything outmoded is vulgar (a case of planned obsolescence). The Pantopians' clothes could last for ten years, but they throw them away after a year and replace them with new ones in the latest

2 For the conception of social progress as the march towards the unknown, the classic reference texts are the writings of von Hayek, who urges us to "propitiate the birth of what we are going to desire, when we see it" [Hayek 1969: 48]. See also Ricossa, 1988, ch. 5 "Contro la perfezione".

style. Supplying the population requires an annual flow of clothes ten times greater than it used to be in the past. The national accounts tell us that the level of clothing consumption by today's Pantopians is ten times higher than that of their grandparents. Are we to believe that their level of satisfaction is equally high?

As the reader will gather from the argument developed in this and the previous section, the difficulties and perplexities encountered by those who try to use national economic accounting to estimate well-being are innumerable. To overcome them, a number of authors have sought to *re-classify* the information already contained in national accounts (for example, by shifting the dividing line between consumption and investment) and to *include* additional information (for example, a valuation of the non-commodified services that housewives perform for the family, calculated at "shadow prices"). The aim is to obtain a set of accounts from which it is possible to extract a total more conducive to measurement of the population's well-being.³

Although every endeavour to analyse non-commodified activities and satisfactions, even in quantified terms, deserves the highest commendation, I believe that such analysis should not be conducted within the system of national economic accounts: it should, instead, be kept quite distinct from them. As long as the economic accounts restrict themselves to expounding the flows of goods valued at effective prices, they can provide a notably complete, coherent and useful map of the market. If, however, flows of goods are mixed with other flows of a quite different nature, a hybrid picture is produced which is no longer valid as a map of the market, and does not come close to being an even approximately valid one of "well-being" - measurement of which would require criteria entirely different from market prices, as well as a much wider range of information.

Having insisted at such length on the necessity not to confuse

3 See Eisner [1988] for an excellent summary of the contributions by the principal authors working in this area, of whom he himself is one. Also worth noting is that an authoritative publication by the UN pronounced in favour of this line of enquiry [UN 1979].

measures of economic growth with estimates of well-being, I must acknowledge that, historically, one finds a certain correlation between a country's level of income and its inhabitants' life expectancy; the which can be regarded as furnishing a significant indicator of the *physiological* well-being of the population. I shall explore this topic in the next chapter.

CHAPTER 5

GDP AND LIFE EXPECTANCY

1. *The figures*

While I was working on my graduation thesis more than fifty years ago, I learnt from the statistics then available that the average life expectancy of a country's inhabitants was directly correlated to its level of consumption (or of income) - a level, though, whose definition and measurement was highly uncertain at the time. Today, increased statistical documentation enables us to describe this relationship between life expectancy and income level with greater precision.

By means of comparison conducted among fifty-seven countries and spanning the years since the 1930s, I have obtained the results set out in summary form in figs. 5 and 6.¹

Both figures show the relation between life expectancy at birth (expressed in years) and per-capita GDP (expressed in hundreds of dollars at 1980 purchasing power) in three different time-periods: the 1930s, the 1950s and the 1980s. Figure 5 is divided into three panels corresponding to each of these three time-periods. Each panel comprises all the countries for which I have been able to gather reasonably comparable statistics for the time-period concerned; and, as one would expect, the sample of countries increases in size the closer one approaches the present day. This is an advantage from the point of view of the richness of the information yielded by the figure, but it is a disadvantage as regards the possibility of conducting homogeneous comparison *among* the time-periods. In order to overcome this difficulty, I use small black circles to indicate the sub-sample of 17 countries already studied in Chapter 2, section 2, and which are present in all time-periods. To assist the reader further, I propose figure 6, which shows how the curve shifts from one time-period to another.

1 The base tables and explanation of my sources are given in Appendix 1.3.

Fig. 5. Life expectancy at birth and per-capita GDP in the '30s, '50s, '80s, data for 55 countries

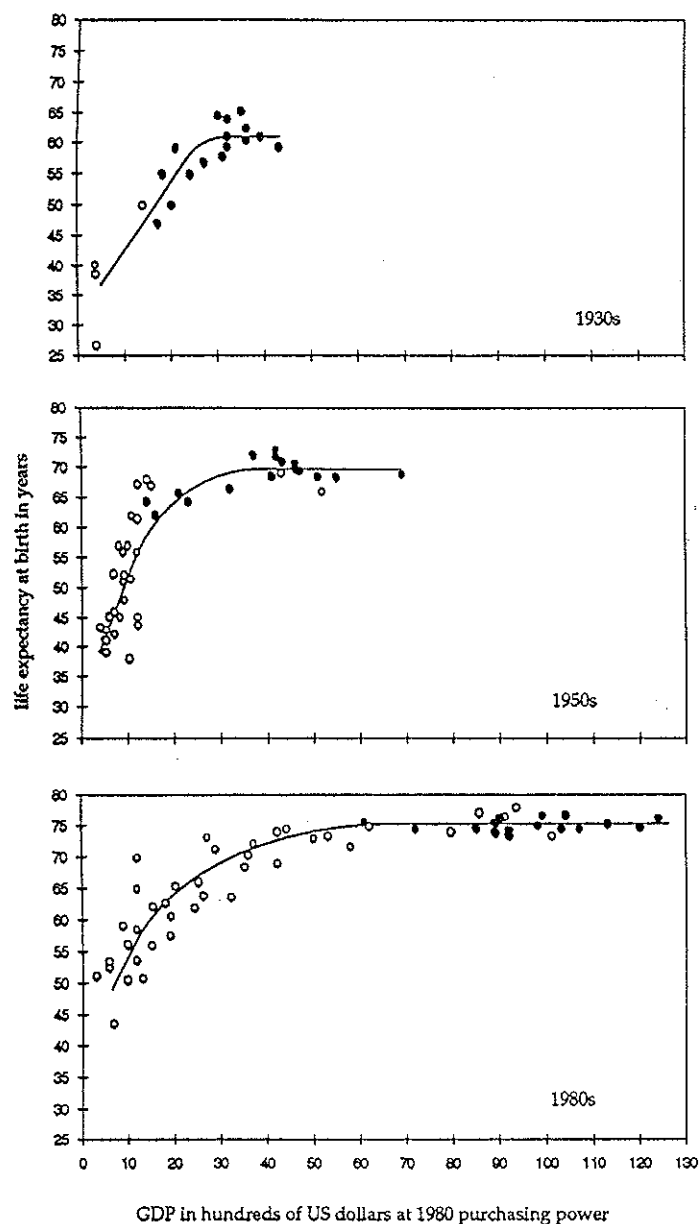
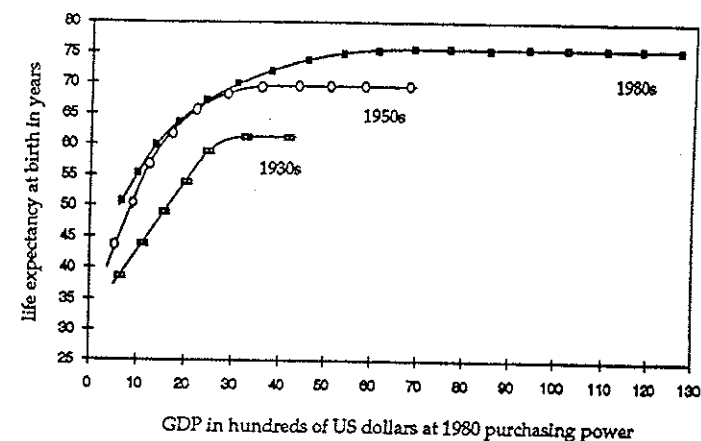


Fig. 6. How the relation between life expectancy at birth and per-capita GDP shifts through time



This is what the two figures tell us. In all three time-periods, the ratio between life expectancy and the level of income follows the same pattern. Within a first interval between 0 and approximately 4 thousand 1980 US dollars (with a still uncertain tendency for this upper limit to increase over time), differences in income among countries are attended by differences of the same sign in life expectancy. Above an income level of 4 thousand dollars, however, life expectancy encounters a "ceiling" beyond which it does not rise whatever the increase in income.

One has, therefore, a curve consisting of a first upwardly sloping section followed by a flat section.² Over time, this curve shifts progressively upwards in both its sections. In other words, for every given level of income measured at constant prices, there is a progressive increase in life expectancy. One may therefore conclude that the extension of the average life-span observable in

² The reader may notice that the alignment of the points is less satisfactory in the upwardly sloping section of the curve than in its horizontal one.

This might be imputed, at least in part, to the fact that available statistics are less accurate as regards lower income countries.

individual countries stems from two different factors: the upward shift of the curve (which benefits all countries) and the rightwards movement of the individual country along the curve (which benefits only those countries which are still in the upwardly sloping section, i.e. with incomes lower than 4 thousand dollars).

2. An interpretation of the figures

Certainly, life expectancy may *also* be influenced by many factors that have no connection, or at any rate no close connection, with income - for example, a country's climate, the physical constitution of its racial stock, its level of violence. Nor, on the other hand, can one exclude that life expectancy does not itself exert an influence on income, insofar as changes in the mortality chart affect the population's age structure and therefore its capacity for work. However, I wish now to concentrate on a single causal chain running from income, through the availability of medical knowledge and the means to apply it, to life expectancy.

From the perspective adopted here, the "ceiling" that we find in figures 5 and 6 can be read as the average life expectancy of a population, during the time-period in question, *if it completely utilizes* (save that margin of imperfection which inevitably arises in practice) the entire heritage of hygienic and medical knowledge that the world has accumulated to date. The close alignment of so many countries at the ceiling is explained, according to this interpretation, by the fact that this knowledge is available to all of them, that many of them manage to make full use of it, and that none of them can (by definition) make more than full use of it.

The upward shift of the ceiling over time can be interpreted as the effect of the steady increase in the world's endowment of hygienic and medical knowledge due to the results achieved by research. It is likely that the speed at which this heritage accumulates has some relationship, albeit not a straightforward one, with the rate of income of the countries in the vanguard of research (in general, the richer countries). This is so for at least two reasons: first because research requires - although not exclusively - economic resources, and because medical research

and income growth are both driven by the same deep-lying forces: the "secular" spirit (in Kuznets's sense) and technical culture.

The reason why not all countries reach the ceiling - even under the idealized hypothesis that the same knowledge is equally accessible to all countries - is a simple one: the implementation of this knowledge requires resources which certain countries lack. In short, it is not sufficient for a healthier life to know what constitutes the best diet, the best housing conditions, and so on, if one does not possess the means to procure them.

A priori reasoning suggests that some means to implement medical knowledge could also be provided by "non-commodified" activities; nevertheless, inspection of the statistics reveals that, historically, the decisive role has been played by commodified activities. We have seen in figures 5 and 6, in fact, that individual countries come more or less close to the life expectancy ceiling (from which one deduces that they exploit the world's endowment of hygienic and medical knowledge more or less completely) according to the income, i.e. the quantity of goods, at their disposal.

We have also seen that the level of income per inhabitant enabling a population to apply its hygienic and medical knowledge to the full - and thus enjoy the maximum life expectancy possible - has remained at the same order of magnitude (around 4 thousand 1980 dollars) since the 1930s until the present day, but with an uncertain tendency to increase. If one believed this tendency to be sufficiently proven, it would be possible to conclude that the progress of hygienic and medical knowledge during this period has indeed succeeded in lengthening life expectancy, but at increasingly greater costs for those who wish to exploit such knowledge to the full.

The almost perfect equality of life expectancy among countries with income levels above 4 thousand dollars may come as a surprise. Reasoning *a priori*, in fact, one would expect the application of hygienic and medical knowledge to be more or less successful according to, not solely the quantity of per-capita disposable income, but also to the way in which this income is

distributed among the population and the use to which it is put. *A posteriori*, however, after examination of the statistics, one must conclude that there have evidently not been, in this period and among rich countries, differences in the distribution and the use of income of such magnitude as to affect average life expectancy more than only marginally.

3. Prospects for the future

Until recently, in order to increase the life expectancy of its population, Italy was able to profit both from the improvement in the world's endowment of health knowledge and from the growth of its national income. Those who take life expectancy as indicative of the well-being, or more precisely the physiological well-being, of the population, can assert that in the past every increase in the national income enhanced the physiological well-being of Italians.

Today, now that Italy has moved well beyond the ceiling of 4 thousand 1980 dollars per inhabitant, it finds itself (according to the analysis conducted in sections 1 and 2) in a different situation. It can no longer count on further growth in its national income to bring automatically, so to speak, an extension of life expectancy as it used to do in the past. By now, the country's hopes for increased life expectancy depend on:

- 1) a further advancement of the frontier of the world's hygienic and medical knowledge; an advancement to which Italy's economic growth may indeed contribute, but only in a manner which is indirect, marginal and uncertain;
- 2) an improvement in the *distribution* and in the *use* of Italian national income; an improvement which is certainly to be sought after, but for whose implementation - on the basis of past experience in Italy and elsewhere - actual manoeuvring margins appear to be very narrow.

Almost all the OECD countries today find themselves in Italy's situation, but the circumstances of all the rest of the world are very different. Living side-by-side on the planet, therefore, is a minority (amounting to just two-tenths of the its population) to which Italy belongs and for which economic growth is no longer of

major significance in terms of physiological well-being; and a minority for whom it is still of crucial importance. From this contrast derive huge and complex problems which cannot but preoccupy even the most abstract theorists of economic growth and of welfare economics.

PART THREE

THE CRISIS OF MEASUREMENT

CHAPTER 6

CALCULATION AT CONSTANT PRICES

IN THE CASE OF PRODUCT INNOVATIONS AND OF SERVICES

Throughout this essay I have cautioned that the yardstick currently used to measure economic growth creates serious difficulties. I shall now examine this matter more thoroughly.

First of all, we should remind ourselves of the logic of valuations at constant prices.

The expression "economic growth" does not refer to such an elementary concept as the increase, between one period and another,¹ of product at current prices. The latter concept reflects, in fact, changes in both the prices and the quantities of the goods produced; while those who speak of economic growth examine the pure increase in so-called "physical" quantities - for example, the number of kilograms, metres, pieces of the commodities produced.

There is the problem that product consists of heterogeneous goods, and of these it makes little sense to lump their respective quantities together (for example, so many quintals of pasta plus so many pairs of shoes). The problem is circumvented by multiplying the quantity of each kind of good by its corresponding unit price and summing the values thus obtained. Care should be taken, however, to apply an identical price list (constant prices system) in the valuation of product during the different periods that one wishes to compare. Generally, an imaginary price system is not used, but the system current in one of the two periods considered. For this period - employed as the basis for comparison - product at constant prices consequently proves identical to product at current prices. By using this procedure, a comparative measure of product levels is obtained which only reflects differences in physical quantities, not the differences in unit prices which historically

¹ Although, for the sake of simplicity, the analysis that follows refers to temporal comparisons, my reasoning also applies to comparisons among countries.

existed between the two periods under examination.²

In most cases it is advisable to use an indirect procedure which leads with sufficient approximation to the same result: one begins with the value at current prices and divides it by a "deflator" (price index) expressing the ratio between current prices and the base prices.

It should be stressed that both the direct and indirect procedures presuppose the fulfilment of two conditions. *First condition*: it must be possible to measure the goods produced in physical units. *Second condition*: the unit price of the goods in the base period must be known.³

As regards the early phases of modern economic development, these two conditions do not raise serious difficulties. The majority of the goods used and created (inputs and outputs) by productive activities still comprised a limited number of items, like wheat, steel bars, cotton threads, etc., for each of which it is possible to identify a historical series of unit prices that is sufficiently representative for practical purposes. For example, if we possess a historical series of the price of a quintal of wheat with well-specified characteristics, we can take the annual rates of variation of that price and consider them to be approximately valid for the other commodity specifications of wheat. As long as productive flows are constituted mainly by goods of this kind, and as long as the goods most difficult to measure represent only a small proportion of total current value added, calculation at constant prices gives a satisfactorily approximate solution to the problem of measuring the growth of national product.

This was presumably the situation of Italy until the middle years of this century; now, however, the country has left it behind.

In the wake of other countries, in fact, Italy is now entering a phase of economic development in which accurate calculation at current prices is impeded by two phenomena: the great intensity

² It should be pointed out, however, that the results of the comparison may vary according to the system of constant prices adopted.

³ For further explanations of the logical significance of national accounts at constant prices, see Gnesutta [1983: 169-74].

and diffusion of product innovation, and the major expansion of services.

I begin with product innovation. Every year sees the appearance of products of a kind or quality which were previously unknown, while other kinds or qualities disappear. Generally, "entries" outnumber "exits", so that there is a constant increase in the number of items to measure; and accurate comparisons among national products at constant prices are consequently more laborious to perform. However, this is a difficulty of secondary importance compared with a much more fundamental obstacle: if a product quality appears for the first time in a particular year, for example 1990, then it is only from that year onwards that its unit price really exists. This is a major problem for those who must measure the national product of 1990 at constant prices based on a previous year, say 1985, since the *second condition* enunciated above is not fulfilled.

In this situation, there are only two options available to those wishing to make an estimate at constant prices. One is to gloss over the fact that there has been an innovation; the other is to imagine what price the new product would have fetched in the base year if (an unreal hypothesis) it had already existed on the market.

It would be interesting to know what percentage of GDP is today constituted by innovative products, and examine the method used by national accounting services in handling these products in accounts at constant prices. But information is scarce, both about the statistical dimension of product innovation and about the practice of accounting offices.

There exists instead quite a large body of literature describing and discussing the array of formulae to date proposed (and in part applied) in the construction of the fictitious "base year" price of a new product. I review these formulae in Appendix 3.4. where, as the interested reader will find, I conclude that none of the expedients proposed is satisfactory. They all introduce an element of subjective choice into national accounting, blurring the meaning of the accounts and thereby rendering their interpretation

uncertain.

Services raise another difficulty for accounting at constant prices, since most of the commodity items in this broad category are ill-suited to measurement in physical units. Thus the *first condition* enunciated above is not fulfilled.⁴

The principal expedient resorted to in dealing with this difficulty is to postulate that there is a known relationship between the quantity (not directly measurable) of the output of a service and a distinct variable (directly measurable), for example, the quantity of labour employed in supplying it. Once this postulate has been accepted, it is possible to calculate the output of the service beginning with measurement of the reference variable. However, as we shall see below, the national accounting values and the price indexes obtained using procedures of this kind are very unconvincing.

The next chapter analyses the problems raised by services. It begins with examination of the statistical dimension of the phenomenon and then discusses the devices used to handle it in national accounts at constant prices.

⁴ There is also the case of innovative services, where neither the first nor the second condition is satisfied. On innovation in services see Colombo [1993: 2-21], who also conducts an interesting review of the literature.

CHAPTER 7

THE PROBLEMS OF SERVICES

1. *The dimensions of the phenomenon*

There are authors who contest the current practice of grouping all productive activities that cannot be classified as "agriculture, forestry and fishing" or "industry" under the single heading of "services"; there are others who accept this practice but do not agree on where to draw the boundary between services and industry.¹

Here, however, there is no need to enter into taxonomic debate; I merely point out that throughout this essay I use the term "services" (or interchangeably the term "tertiary activities") to designate sectors 6-9 of the ISTAT-NACE classification, i.e.:

- 6) Wholesale and retail trade; lodging and catering; recovery and repair.
- 7) Transport and communication.
- 8) Credit and insurance; business services; real estate; other market services.
- 9) General government; other non-market services.²

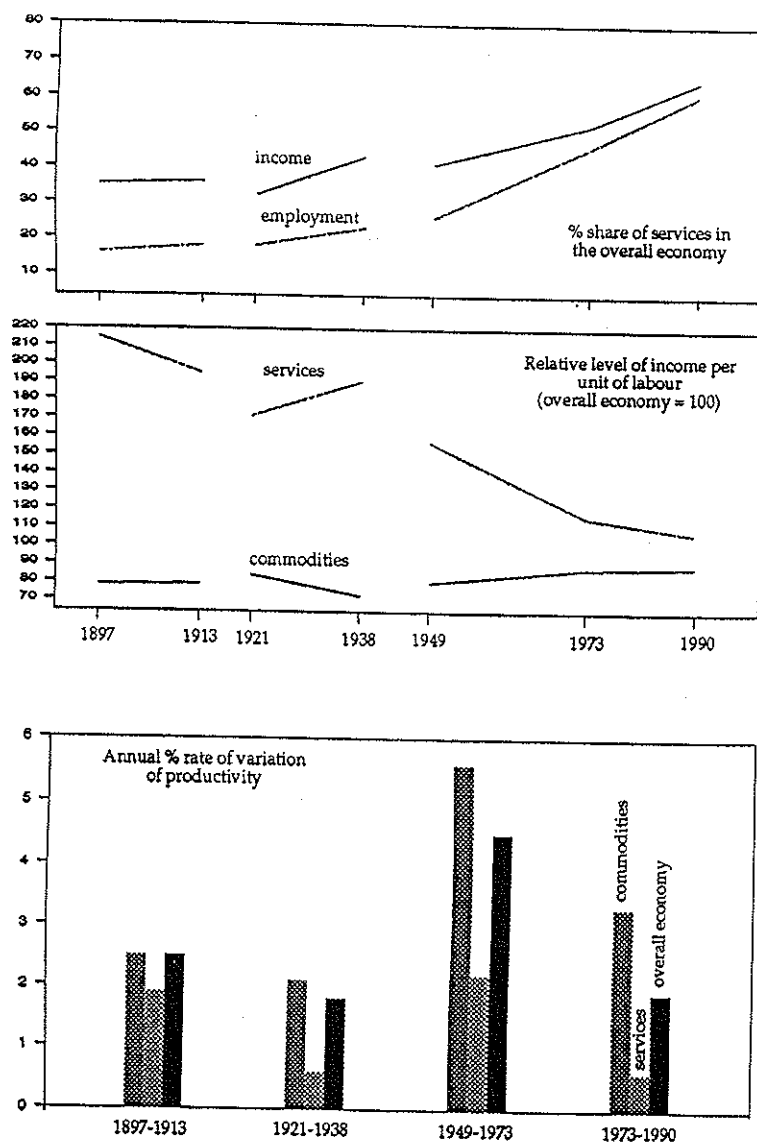
Figure 7 gives a concise picture of the development in the complex of these activities, in terms of employment and output, since the end of the nineteenth century - when Italy began her modern economic growth - until 1990.³

¹ A rapid synthesis of this debate is provided by Ercolani [1990: 1-8] and Tedeschi [1990: 61-6].

² The further division of sectors into branches is illustrated in Appendix 3.2. Code nos. 55-93 comprise branches of services. At certain points of my analysis I shall omit branch no. 73 ("Leasing of real estate") belonging to branch 8. I shall explicitly state whenever I do so, however.

³ More statistical information is given in Appendix 1.2. In particular, table a.10 sets out the numerical values for fig. 7, and table a.11 gives a more detailed picture of the present situation of services and their evolution over the past twenty years, with figures for individual subdivisions.

Fig. 7. The relative dimensions of the production of services in the Italian economy, 1897-1990



The upper panel of the figure shows that services initially accounted for only 16% of overall employment in Italy, and that this share slowly increased until the Second World War. In 1949 the share was 26%, but from that year onwards there was an extremely rapid, linear increase which brought the share to 61% by 1990.

The central panel of the figure shows that services at first enjoyed an extremely high relative level of value added at current prices per unit of labour;⁴ a level that was initially three times higher than that of commodities-producing activities (i.e. agriculture and industry considered *en bloc*), and more than double the average level of the economy as a whole. This relative gap, however, immediately began to narrow, so that by the end of the Second World War the advantage of services over the average of the economy had already declined to 71%, and in 1990 was just 7%.

This signifies that the share of services in the overall economy in terms of value added was initially more than twice the corresponding share in terms of employment, but then began to converge towards it; as the reader can verify from inspection of the upper section of the figure.

This result also implies that over the 93-year period examined, the rate of variation of value added at current prices per unit of labour has been lower in services than in the production of commodities. And in fact one finds a difference of 0.8 annual percentage points to the disadvantage of services in the compound rate measured over the entire period 1897-1990, and of 1.2 percentage points in the sub-period 1949-1990.

Inspection of the lower panel of figure 7 yields further information concerning the value added per unit of labour, which in this case, though, is measured at constant prices. For the sake of brevity, I shall follow the customary usage of summarily designating this as "productivity". I have already mentioned that there is good reason for being suspicious of these valuations at constant prices;

⁴ This is a phenomenon common to other countries in the initial stage of development, and is explained by the fact that qualifications (e.g. literacy) then still rare in the population were required to enter the principal branches of services such as business, the professions and the public administration.

however, in view of the widespread use made of them, it is of interest to see what they can tell us. We find that the rate of increase of productivity, too, in every period of Italian economic growth, is lower in services than in the rest of the economy.

The gap is very wide, in fact. Throughout the postwar period it has remained at around 3 annual percentage points while, as we have seen, the gap of the rates of output increase per worker at current prices has been 1.2 points. This means that the implicit price index of services has increased in this period by approximately 1.8 annual percentage points more than that of commodities.

Having ascertained this gap, we are faced with two alternative courses of action. The first is to preempt any further discussion by reiterating that these figures have little or no significance, given the weakness of the expedients with which the physical quantities and unit prices of services are measured. The second option is to point out that although these figures lack any intrinsic value, they influence the judgments and behaviour of the public;⁵ and that this is a reason for examining them more carefully.

I opt for the second alternative, and I shall now seek to answer the following two questions. First, does the gap revealed by Italian statistics constitute an exceptional case in the worldwide context? Second, what effect on the measurement of the productivity of the Italian economy as a whole is exerted by the fact that an increasing share of the labour force is employed in a sector - services - which is distinguished by a particularly slow increase in productivity?

Some indications regarding the first question can be gained from the international comparisons set out in tables a.12 and a.13 of Appendix 1.2. In all the countries compared, we find that the statistics reveal slower productivity increase for services than for commodities. Although the gap recorded for Italy is indeed wide,

⁵ Today, scholars and politicians frequently denounce the slow increase in the productivity of services (and the consequent rapid increase in their prices) as one of the principal ills afflicting the Italian economy: see e.g. CER [1991]. This anxiety also emerges from the recent annual reports of the Banca d'Italia [1991, I, 78-82 and 101-104; II, 20-1; 1992, II, 15].

it is not the widest. However, and especially when we consider the figures for individual service branches (credit, for example, or government), there are such striking differences between one country and another that there are grounds to believe that their cause lies not in the facts, but in the way the facts have been assessed by national statistical offices. We know, indeed, that these are conventional valuations, and evidently the convention adopted is not the same in all countries (and at all times).

I turn to the second question: how does increasing tertiarization affect our computation of the rise in productivity achieved by the economy as a whole?

The answer is not straightforward, because the increased productivity of the overall economy comprises two components:

- (i) increased productivity within each of the sectors of activity that together make up the economy (the "intrasectoral" component);
- (ii) the increased share of labour employed in sectors with higher productivity, to the detriment of sectors with lower productivity (the "structural" component).

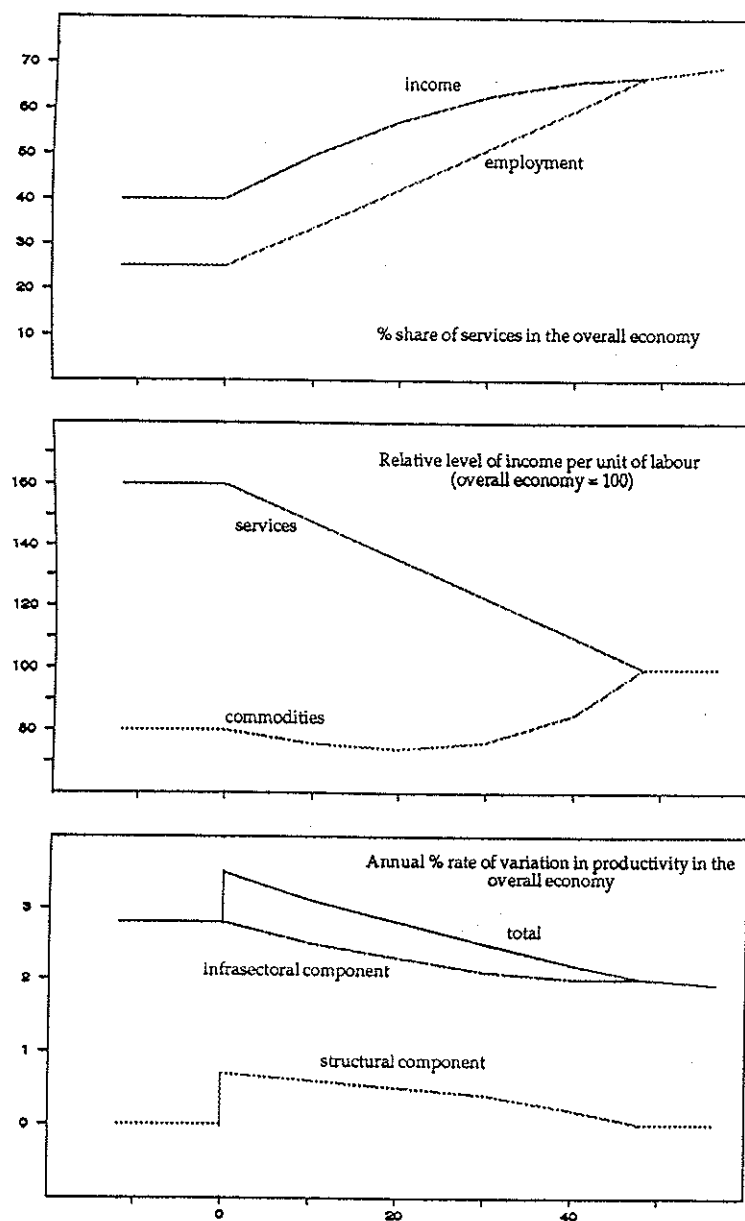
One notes that increasing tertiarization has effects of opposite sign on the two components.

In fact, as long as the services sector has a *rate of productivity increase* lower than that of the commodities sector - and this, according to the statistics, has always been the case - the growth of the share of labour employed in services has a negative effect on the intrasectoral component.

On the other hand, however, as long as the services sector achieves a *level* of output per unit of labour higher than that of the commodities sector - which has always been the case as well, although to a decreasing extent over time - every increase in the share of labour employed in services has a positive effect on the structural component.

In Appendix 2.2. I describe a technique for quantifying these effects, and then give it two applications to the Italian case. Here I only outline the simplest of these two applications, which I illustrate in figure 8.

Fig. 8. Effect of the expansion of services on the economy's productivity, hypothetical scheme



The figure presents a highly schematic model which shows how a country's rate of productivity increase will change if - the rates of productivity increase in the commodities sector and the services sector remaining equal - the latter sector registers an increase in the employment share, accompanied by a fall in the relative level of income per unit of labour. The fundamental parameters of the model are assigned values approximately equal to those for the period of Italy's rapid tertiarization: 1949-1990. In fact, the share of employment and the relative level of income in services on the eve of the year zero of the model are roughly the same as in Italy 1949. And the variation (in annual percentage points) in these two variables in the model is the same as that recorded in Italy in the period 1949-1990.⁶ Also the rates of growth assumed in the model for the productivity of the two sectors are roughly equal to the average rates recorded in Italy during the overall period 1949-1990.

Let us now see what pattern emerges from the model for the productivity of the economy as a whole. At the beginning of year zero, when the share or employment in the tertiary sector, so far stable, began to increase, the structural component, which was previously nil, jumped to 0.7 and thus pushed up the rate of productivity growth of the overall economy from 2.8 to 3.5. Thereafter, however, the two concomitant phenomena of an increase in the employment share and a decline in the relative income of services induced a steady decline in both the structural and the intrasectoral components. At the 20th year, the rate of productivity growth of the whole economy therefore reverted to its level on the eve of year zero and since then has continued to diminish. This decline will persist as long as the employment share of services continues to expand.

Although the model is only a very crude simulation of Italy's rapid process of tertiarization since the end of the Second World War, we can draw from it three conclusions regarding the

⁶ The model also contains the hypothesis that the tendencies change once the incomes per unit of labour of the two sectors have equalized, which in fact happens in the 48th year. One cannot say that this hypothesis is confirmed by Italian experience, since this latter has not yet reached its 48th year.

country's actual experience:

- (a) the tertiarization process is one of the various factors that help to explain why the productivity of the system grew more rapid in the first decades after the war than it had previously;
- (b) it is also one of the various factors that help to explain why this growth then slowed down;
- (c) if the tertiarization process persists, as it is generally expected to, it will probably continue to slow down the system's growth of productivity as measured by the official statistics.

2. How productivity is measured: the case of commerce

I have already sketched in Chapter 6 the method generally used by statisticians and national accountants to cope with the difficulty, or impossibility, of measuring the output of a service activity directly in physical units. They take as their reference variable not the quantity of the service delivered, but a variable which they presume to be connected to that quantity by a known relation; and after measuring this variable they then arrive at a presumptive valuation of the quantity and unit price of the service.

In this section and the three sections that follow, I intend to examine to what extent this procedure is sound. I shall concentrate on the meaning of the variables taken as reference, and on their adequacy for the purpose. I shall not, however, go into technical details concerning the formulae used for calculation; these are briefly described for the interested reader in Appendix 3.

In order to give concrete content to my discussion, I now give separate treatment, one after the other, to the various categories into which services are classified, beginning with commercial services (wholesale and retail trade).

We are taught at school that the production (output) of commerce is not constituted by the *commodities* that the commercial firm re-sells to the public, but by the *service* it performs in procuring these goods from the producer and in making them available to its customers in the ways that they prefer. Commercial firms receive for this service a reward represented by the trading margin, i.e. the difference between the

receipts earned by re-selling the commodities and the expenditure incurred in acquiring them. If we then subtract from this margin the expenses that commercial firms must meet in intermediate consumption (such as the renting and maintenance of premises, etc.), we obtain the product (value added) of commerce.

These calculations are relatively straightforward at current prices, but when we try to perform them at constant prices we find that it is impossible satisfactorily to measure the quantity of the service rendered in physical units. Only in a backward economy, in fact, is it possible to imagine that in order to measure the quantity of the service rendered by commerce all that one need do is count the quantity of commodities that commerce has intermediated. In a developed economy such as ours, the market is extremely sensitive to other aspects of the service: the range of products offered to the customer; guarantees of the quality of the goods on offer; the information and assistance provided to the customer; the pleasure involved in the shopping ritual; the image of distinction conferred by a shop on its customers; the convenience of delivery and payment; even the elements of game-playing (prizes, lotteries, etc.) that sometimes accompany purchase of the good; and so forth.

A daring scholar might venture a synthetic index with which to express in a single figure the extent to which all these various aspects of a commercial service have developed; aspects which here I call "intensive" as opposed to the "extensive" ones represented by the quantity of commodities traded.⁷ But even if we forgo such precise quantification, we can form some idea of the differing importance assumed - according to firm, sector, place and time - by all these intensive aspects of commercial activity compared with the extensive one. And we find sufficient evidence to maintain that, in Italy's present phase of economic growth, there is a long-term tendency towards the intensification of commercial activity, in the sense of an *increase in quality* (or if the reader

⁷ For the possible construction (a rash undertaking, in my view) of this index one could adopt, *mutatis mutandis*, the same logic and the same techniques as used by the "hedonic method" briefly described in Appendix 3.4.

prefers, an *improvement in quality*) of the service delivered for every unit of commodity traded.

Moreover, the idea that at high levels of national income commerce increasingly evolves into more intensive forms fits well with the view that, in the rich parts of the world, the production of material objects is now approaching a threshold beyond which its cease to be desirable or sustainable; and consequently that if the production of goods is to expand further, it must assume increasingly non-material forms.

Of course, the growing mass of intensive services supplied by commerce also comprises a portion which provokes criticism, because it is apparently intended to satisfy only the most frivolous whims of the public; yet the fact remains that they are still services that the public is willing to pay for. These are therefore goods that cannot be ignored by the national accounting; and in any case goods of equally frivolous connotation are produced by industry, and these are recorded without discussion.

It is important to note that the variability over time and space of the quantity of commercial service rendered per unit of traded commodities obstructs accurate calculation of consumer price indexes (and also wholesale ones). The public which buys a particular commodity (a shirt, for example) from commerce does not, in fact, buy and pay for only that commodity, but rather a package comprising that commodity together with the commercial service connected with it. From one year to another, or from one country to another, a package containing a shirt of identical quality may comprise a different quantity of service. If this is so, then what we have is a different good; and those who interpret the difference in the price of the package as a change in the price of the shirt commit an error. The price indexes currently in use in all countries are vitiated by this kind of error; and if we accept the assumption that the commercial service tends to intensify in the course of economic development, then this defines the *sign* of the error that we tend to commit when we put our trust in these indexes. That is, we tend to overestimate the rise in the price of commodities, and in consequence we underestimate the increase -

in accounts at constant prices - of variables like the turnover of commerce and consumption by households.

We have at this point all the basic notions necessary to conduct critical examination of the logic conventionally adopted in valuations at constant prices of the output from commerce.

The statistical offices of all countries avoid - as is quite understandable - the laborious task of directly measuring the quantity of services delivered; instead, they hazard an indirect estimate of it. This they do by taking as their reference variable the measure at constant prices of the turnover of commerce, or other measures of the quantity of commodities traded. There are two main variants of this procedure.

The first variant, which I shall denote with *a*, postulates that the ratio at constant prices in any year between product (or better the trading margin, from which product is then obtained by subtracting intermediate consumption) and turnover is the same as that recorded in the base year.

Variant *b* instead postulates that, in any year, the above ratio at constant prices is the same as the ratio recorded in the same year between the corresponding variables at current prices. This amounts to assuming equality between the deflator of commercial services and that of the mass of traded commodities.⁸

If one accepts the presumption that the quantity of services supplied per unit of traded commodities has a long-term tendency to increase, one finds that both variants underestimate the increase in the output from commerce in the course of economic development because they calculate it on the basis of turnover, the increase of which at constant prices, as we have seen, tends to be underestimated.⁹

Variant *a* contains a further underestimation factor in that it

8 In Italian national accounting, the product at constant prices of commerce is currently calculated using a summary procedure which deflates product at current prices with an index of the price of commodities. The logic is therefore that of variant *b*.

9 This component of error disappears if traded commodities valued, not at their resale price but at the purchase price paid for them by commerce, are taken as the reference variable.

assumes *a priori* the invariability of the quantity of services supplied per unit of intermediate goods. Although *b* does indeed admit that this quantity changes, it calculates the variation in it on the basis of an entirely arbitrary hypothesis (equality of the deflators) and hence yields a solution that is no more convincing than *a*'s.

3. The case of credit

Output by credit institutions divides between two components. First, there are the services supplied to customers by means of an act of sale, with payment of a price in the form of a fee, commission or similar. This component, for which statisticians use the term "effective services" is of only secondary importance in company receipts. Second, there is a great mass of services which are not supplied for payment but which customers finance indirectly. Credit institutions can in fact cover - more or less than completely - the costs sustained in producing these services by drawing on the interest margin, i.e. on the difference between the interest they earn by lending or investing the financial means entrusted to them and the interest they pay to those who have entrusted them with these means. For this second (and principal) component of the output of credit institutions, statisticians use the term "imputed banking services" (i.b.s). In national accounts at current prices it is conventionally assumed that the overall value of i.b.s. is identical to that of the interest margin.¹⁰

Accurate accounting at constant prices requires price and quantity data for every individual kind of effective and imputed service, a condition that seems impossible to fulfil. Consequently all the national statistical offices for which I possess information rely, as far as i.b.s. are concerned, on conjectural valuation based

10 It is also assumed in national accounts, for simplicity's sake, that i.b.s. are entirely used as intermediate consumption by the productive branches (rather than for final use). Since it is not practically possible to deduct this consumption when calculating the value added of individual production sectors, the value of s.b.i. is deducted *en bloc* from the overall value added of all production sectors in order to determine GDP. More detailed explanations are given in ISTAT [1990b: 127-38].

on reference variables; and in many of these countries they use an identical procedure to handle effective services as well.

Most countries adopt the amount of financial means handled as their reference variable;¹¹ in the belief that measurement of these means can provide the basis for estimate of the quantity of services rendered.¹² The underlying logic is somewhat similar to that we saw applied to commerce. In both cases, having assumed that the value of the service supplied coincides with the margin obtained (in the one case the trading margin, in the other the interest margin), a measure at constant prices of this margin is constructed taking as the reference variable the stock or flow of goods or quasi-goods from which the margin has been drawn (in the one case the commodities traded, in the other the financial means handled).

The formula used to derive the measure of the margin from that of intermediate financial means also comes in two variants, which are analogous to those we saw for commerce. One of these, *a*), postulates that, every year, the ratio at constant prices between the interest margin (or, in a rougher version, the product of credit) and the mass of financial means handled is equal to that recorded in the base year. The other, *b*), postulates instead that, every year, this ratio at constant prices is equal to that observable in the same year between the corresponding variables at current prices.¹³

11 In almost all the countries that adopt this technique, a measure of intermediate financial means defined in terms of *stocks* is taken as the reference variable. This, in concrete terms, is a sum of items in the property accounts of credit companies. The choice of items differs among countries, but the differences are only slight. Only in very few countries is a measure defined in terms of *flows* (sums deposited or withdrawn during the accounting period) taken as the reference.

12 I should point out, however, that there are some countries whose statistical offices follow a radically different procedure from that described in the text. As their reference variable they adopt the quantity of labour employed or, in some specific cases, the number of operations performed by credit institutions. I shall not dwell on the problems raised by this approach, because they are identical with those that I shall discuss below in my examination of government services.

13 In Italian national accounting the product of credit at constant prices is calculated using a summary procedure which consists in deflating the product at current prices with a

Accounts at constant prices thus constructed can be criticised on various grounds. A first criticism concerns the measurement at constant prices of financial means. With commerce the difficulty arises that existing measures of the quantity of commodity embodied in turnover diverge from a hypothetical, well-made measure; here, however, an even more radical difficulty appears, because a univocal measure of the real content of financial means is simply inconceivable. Financial means are not a set of definite goods, but rather a claim with which to purchase any type whatsoever of good (or to be used in other ways). And since the relative prices of individual kinds of good change over time and space, the amount of goods that can be purchased with every, say, million lire changes according to the concrete kind of good for whose purchase that money should serve. The choice of the deflator with which to measure purchasing power is therefore inevitably subjective; and it comes as no surprise to find that the deflator formulae selected for the calculation at constant prices differ from one country to another. This introduces an element of arbitrariness into accounts which weakens their significance.

A second criticism can be brought against the ratio between the quantity of services supplied and the quantity of intermediate means handled. It is clear that what matters to the public is not just the quantity of means handled, but also the form that the banking service takes. Of importance to the public are aspects such as the amount of trust that the bank is able to inspire with its rigour and expertise, the range of services and the reliability of the information that it offers to the customer, its ease of access, the rapidity of its services, and so forth. And it is very probable that the banking system tends to develop not only in the sense that it handles a growing volume of financial means, but also in the sense that it is increasingly able to meet these demands. Recent years have provided striking examples of the new facilities offered to customers by the rapid progress of "intelligent automation" (electronic banking): cash dispensers and automated teller

special index which adopts the logic of variant *a*. For details see Appendix 3.3.

machines, terminals at points of sale, telematic link-ups between bank and clients (remote banking in its corporate, CB, and home, HB, versions), and all the various procedures for automated cheque clearance and payments.¹⁴

In conclusion, one must bear in mind that the quantity (or if one prefers, the quality) of the service supplied by a credit institution per unit of intermediated financial means changes over time and space, with a presumable long-term tendency for quantity to increase (or for quality to improve) in the course of economic development.

Hence variant *a*, which postulates a constant ratio, certainly contains a factor of error that presumably entails an underestimation of the increase in the credit sector's output. On the other hand, there is no certainty that variant *b* will be preferable because, although it admits variations in the ratio, it calculates them in a random manner.¹⁵

4. *The case of government*

The government sells only a minimal proportion of its output; for the rest it produces "non-market services" for which no payment is required and whose cost is financed indirectly, mainly through taxes. These services are therefore not goods in the strict sense; nevertheless it has become customary to include them in the national accounts,¹⁶ assigning them - for accounting purposes - a fictitious price. This price is set equal to the cost sustained by the government in producing these services, i.e. the sum of remuneration of the production factors (labour and capital) plus

14 For a wide-ranging survey of these developments see Mariotti [1993] and for more specific treatment Mancino [1993].

15 In Italy, the ratio at current prices exhibits marked short-period oscillations, and it is difficult to believe that these reflect oscillations in the quality of service.

16 One reason for including them is that if we exclude government services from the product account, we should for the sake of symmetry omit the wages of government employees from the incomes account. These wages would therefore appear not as payment for work rendered but as a unilateral transfer, which would obviously arouse protest.

indirect consumption, plus indirect taxation in those rare cases where the government taxes itself.

This does not raise particular problems for calculations at current prices; but when one moves to valuation at constant prices the difficulties begin.

For accurate valuation, in fact, one must count the units produced of each kind of service and multiply them by the respective unit price (or, in this case, cost) in the base year. One's first impression is that there are many sectors of government for which it is quite feasible to count the amount of actions performed: for example, one could count the number of laws passed by parliament, the sentences issued by the judicial system, the lessons taught or the qualifications awarded by the school system, and so forth. However, on reflection one finds that these calculations have little significance - certainly less significance than counts of the tons of steel produced by the steel industry or of the tons of grain produced by agriculture - because it is not the quantity of these actions that matters but their quality, and this is extremely variable. There are, moreover, sectors of government for which it is difficult to imagine quantifying their production as a series of countable operations. Can one plausibly measure the output of the traffic police in terms of the number of fines they issue? Or worse, the output of the army in terms of the number of enemies killed or taken prisoner?

Consequently, only in a few countries do statistical offices base their estimation at constant prices of the government's output on physical measures of the kind described above. And those that do so restrict the use of physical measurement to only certain government sectors, in particular health services and educational services. As regards health care, they normally use indicators such as the number of days of hospitalization, the number of diagnostic tests carried out, etc.; as regards the school system, the numbers of lesson hours, the number of pupils, etc..

Apart from these few exceptions, the solution adopted by the statistical offices of all countries is to calculate the value at constant prices of government services, not on the basis of the

quantity of actions performed or results produced (output), but on the basis of the quantity of means used to produce them (input). Using this approach, one arrives directly at determination of product by summing the remunerations of the production factors revalued at constant prices. One then determines gross output by adding intermediate consumption, also revalued at constant prices, to product.

Given that much the largest share of the remuneration of the production factors goes to labour, the statistical offices of many countries manage to simplify the calculation of product at constant prices by considering this item alone. That is to say, they postulate that the index of product at constant prices by the government is in every year equal to the index of the quantity of labour employed by the government in that year.

The formula used for this calculation comes in two variants. Variant *a* treats all the workers employed by the government as equivalent, regardless of their job grades, qualifications, responsibilities, etc. The quantity of labour is thus measured by the simple number of people (or in more refined applications, of people-days or people-hours) employed. The product at constant prices of the government in a particular year is therefore determined (using the accelerated procedure outlined above) by taking the product of the base year and extrapolating it to the year in question on the basis of the index of the number of workers; or, alternatively, by taking the product at current prices of the year in question and deflating it with the average wage index.

Variant *b*, instead, first classifies workers into different categories and then attributes to the units (people, days or hours) of each category a weight which corresponds to the average unitary remuneration received by that category in the base year. The government's product at constant prices of the is therefore determined by using, not a simple index (of the number of workers or of the average wage, depending on whether one is working with extrapolation or deflation) as in variant *a*, but an appropriate

complex index.¹⁷

It should be emphasised that the decision to measure product from input entails acceptance of the postulate that this input exhibits constant productivity. More specifically, variant *a* as described above postulates that, at all the times and in all the places being compared, the government obtains the same average quantity of product per worker regardless of the composition of staffing levels, of the equipment and technologies used, or of any other condition.¹⁸ Variant *b* postulates as constant, at all times and in all places, irrespective of conditions, the average productivity of the workers in each category defined by job grade, qualification, etc.

These are postulates that lead readily to highly questionable conclusions. For example, consider the following three hypothetical situations. First, suppose that in order to gain favour with its employees the government introduces across-the-board promotions: variant *b* national accounting will record this shift towards higher grades as an increase in productivity and in product. Second, suppose that for clientelistic reasons staffing levels become overloaded, with the result that motivation and work performance deteriorate: variant *a* national accounting will record this increase in employment as an increase in government output. Third, suppose that the work of public offices is computerized, thereby providing the public with a better service while employing less labour: variant *a* national accounting will record this result as a fall in government output.

In all three of these hypothetical situations, the national accounts give a description of reality which runs counter to common sense. And these are not wilfully fanciful situations: cases

17 In Italy, the product at constant prices of the government is now calculated by extrapolation on the basis of the total number of people employed, i.e. with formula *a*. Formula *b* was used in the past.

18 This applies to variant *a* using (as is the practice in Italy) the rough procedure which considers only the labour used, not the capital. If one uses the procedure which considers capital as well, the average product per unit of labour may vary with a change in capital intensity.

like the first two have already occurred in Italian history, and it is to be hoped that the third case will come about on a large scale in the future.

5. Other observations

In the above sections I have taken considerable pains - at the risk of boring the reader - to demonstrate the unsatisfactory nature of the methods of measurement at constant prices currently used for commerce, credit and government. Although these branches are only three in number, together they account for half the value added and employment of the tertiary sector as a whole. Moreover, the fundamental difficulties encountered by valuation at constant prices described above with reference to these branches also arise in substantially similar form in most of the other service branches.

Accordingly, I now conduct rapid examination of these remaining branches.¹⁹

The service activities that I have not yet examined (see the list in Appendix 3.2., table a.23, which gives the ISTAT 44-branch classification²⁰) are highly diversified: they range from vehicle repair workshops to doctors' surgeries, lawyers' firms, engineering studios, business consultancies; from hotels and bars to private schools; from domestic services to research institutes; from television networks to hairdressing salons; from railways to sports centres; and so on.

19 Before concluding my analysis of credit and government, I should mention a curious fact. According to a survey by the OECD [1987: 11 and 30], the statistical offices of some countries, while basically adopting the conventional techniques I have described, make a rule-of-thumb adjustment designed to account for the productivity increases that these techniques fail to record.

These adjustments are not, in my view, a good remedy for accounting shortcomings. They introduce a subjective element into the figures which renders understanding of their exact significance by users even more improbable and precludes accurate international comparisons.

20 For figures on the sizes of the various branches in terms of value added, see Appendix 1.2, table a.11, and Appendix 3.2, table a.24.

Statistical offices try to estimate the product of these service activities at constant prices by adopting one or other of the two approaches described above. That is, they either rely on a simple measurement of the quantity of production factors employed, or they venture to identify and compute the physical units of the service rendered. Once they have selected their basic procedure, they then have a further choice between the direct procedure and the indirect one using a deflator.

The formula eventually adopted, once these two choices have been made, varies from one kind of service to another; and it varies for every given kind from one country to another.²¹ However, the results obtained are in *almost* all cases equally unsatisfactory, since they display one or other of the fundamental weaknesses discussed in the previous sections. If valuation is based on the quantity of factors employed, then it contravenes the logic of calculating product at constant prices. If, instead, valuation attempts to identify the physical units of the service rendered (for example the medical examination, the restaurant meal, etc.) and the corresponding unit price in the base year, it ignores qualitative differences in the service.

The summary judgement just pronounced applies to the valuation at constant prices of almost all kinds of service; but not to all of them, because there exist one or two for which the quantity of service delivered is rather well represented by the amount of time taken (for example, the very marginal case of baby-sitting); and there are some others for which one cannot state *a priori* that their output is not adequately measurable in physical units. As regards the latter, I shall now examine two cases which warrant discussion because of their quantitative importance. The first is transport and communications; the second the leasing of real estate: each of these representing around one-tenth of the total

21 ISTAT currently calculates the product at constant prices of all these branches by taking their product at current prices and deflating it with a consumer price index (except for recovery and repair services, in which case it applies a weighted average of the consumer price index and the wholesale price index). Note that there is a number of these branches in which also estimation at current prices encounters major problems.

value added of the tertiary sector.

I begin with transport and communications. Available for their production (and effectively used in the construction of accounts at constant prices) are units of measurement like the ton-kilometer, the traveller-mile, the number of telephone calls (perhaps adjusted according to distance and duration), and so on. At first sight, these units of measurement seem to yield extremely significant information about the quantity of service delivered, but on further reflection one realises that they neglect elements that the user regards as important. In the case of railways, for example, they omit the speed, punctuality, frequency, safety, and comfort of the service.

And yet it is precisely in the improvement of "qualitative" aspects such as these, rather than in the increase in the number of ton-kilometers or telephone calls, that lie the most important prospects for the future progress of transport and communications in rich countries with stationary populations. I conclude that although our current technique of valuation at constant prices of transport and communications is able to give approximately correct results in a backward economy, it ceases to be reliable when applied to advanced ones.

Completely different considerations apply to the branch "leasing of real estate", i.e. chiefly of buildings. If we consider the commodity *buildings* to be measurable in physical units - which is the usual practice - this measure provides us with a reliable basis for estimating at constant prices the *service* which consists in the pure and simple availability of that commodity for a year. One obtains the value at constant prices of the "output" corresponding to the availability of buildings belonging to a certain category A (defined according to site, use, or whatever) in a given year *t* simply by counting the total number of units (rooms, square metres, or whatever) of that category present in year *t*, and by multiplying it by the unit rate of annual rent that was paid in the base year for buildings in category A. The leasing of real estate therefore lends itself to valuation at constant prices which closely resembles that performed for commodities; and this may be a reason for not classifying it as a service.

CHAPTER 8

WHAT IS TO BE DONE

My analysis in the previous two chapters confirms a preoccupation that I have expressed ever since the beginning of this essay. My analysis shows, that is, that we do not possess satisfactory techniques for measuring at constant prices the value added in the majority of tertiary activities and in the production of innovative goods. And it demonstrates that the valuations currently used - in the absence of anything better - for these two components in calculation of real GDP are only highly unsatisfactory surrogates for correct measurements at constant prices.

These two components represent by no means a negligible fraction of GDP; indeed - in the present phase of economic development - they constitute its largest and most rapidly growing part.¹ We must therefore be sceptical of the figures on GDP at constant prices: given that most of the addenda are measured so badly, the total must be regarded as unreliable, even as an approximate indication. Hence it is unwise to concentrate so much attention on GDP at constant prices, as if it constituted a reliable

1 I refer, of course, to measures at current prices. Today in Italy, the value added of the tertiary sector, even excluding i.b.s. and the leasing of buildings, has reached 54% of total GDP. I exclude i.b.s. because they are subsequently deducted in the final calculation of GDP; and the leasing of buildings for the reason given at the end of the previous chapter.

I cannot give a univocal specification of the percentage of GDP represented by the production of innovative goods as I did for the tertiary sector. One must consider as innovative goods, in fact, those of a type or a quality present in the year under examination but not in the year selected as the basis for valuation at constant prices. Hence it follows that one cannot define the set of goods classifiable as innovative in a given year until one has specified which year is to be taken as the base; and this set is usually larger the more distant the base year is in the past from the year under examination.

gauge for the growth of our economy. It is unwise to be alarmed or elated because the speed of growth of GDP is half a percentage point higher or lower than what we expected, or than what it used to be in the past, or than what it is in other countries.

This negative judgement concerns only a particular use made of national accounts. It should certainly not be taken to mean that, in the present phase of development, national accounts have lost their usefulness; absolutely not, because these accounts still have extremely important functions to perform, though they are ones *different* from the measurement of growth. Nor should it be taken to mean that it is impossible for national accounts to yield information about growth which is more satisfactory than it is at present. And here two ideas spring to mind which were very familiar to the economists of the past and which deserve to be considered again.

The first idea is this: try using a notion of social product which, unlike GDP or the other aggregates in current use, excludes service activities wholly or in part; a notion which reaches back to the old line of thought which maintained that certain requisites of materiality are essential to the concept of "wealth of nations". This line of thought has been alive for some time. After its predominance among the classical economists it persisted in the Marxist tradition, and indeed was given practical application in Soviet national accounting.² And it has continued, and still does today, to find authoritative proponents in the non-Marxist economic literature as well.³

If we wish to conduct the experiment, we can very easily construct a rough aggregate of "material product" (at constant prices) by taking present national accounts and summing the value added of agriculture and industry.⁴ Let us examine the merits and

shortcomings of this aggregate, compared with GDP, as a growth indicator. There is no doubt that material product gives a more clearcut indication of growth because it is less vitiated by the logical flaws inherent in the valuation at constant prices of services. There is, however, another side to the coin, so to speak, because ignoring services means omitting the majority of market activities; so that in this sense material product is a much less comprehensive indicator than GDP. As regards valuation at constant prices of innovative goods, the two indicators suffer from the same defects. Finally, it should be pointed out that those who wish to propose a measure of material product as the new growth indicator are obliged to explain how it has been constructed and, in particular, how the dividing line between material and non-material productions has been drawn; and this is a controversial matter.

Suspending judgement on whether material product is more or less preferable as a growth indicator than GDP, I pass to the second idea: try shifting attention from the *quantity* of goods contained in the product to the quantity of goods *purchasable* with the product. Let me explain what I mean. Assume that we wish to compare the real value of the GDP obtained by a hypothetical country in year t with that obtained in a previous year r . We may enquire: what quotient do we find if we divide product at current prices in year t by the current price of a ton of grain in the same year? And what quotient do we find if we perform the same operation for year r ? Let us suppose that the answer is 15 million for year t and 10 million for year r . We thus conclude that the GDP of year t , when measured according to its grain-purchasing capacity, is one and a half times higher than that of year r . Instead of grain we could have taken gold as our reference good (the "numeraire" in technical language) - as was for many years the custom in economic literature and in business - or any other good, as long as it is well specified.

This method of comparison is excellent from the point of view

2 An outline description of the accounting of "material product" in the Soviet Union can be found in Siesto [1982: 191-5].

3 See Breglia [1965: 46-60]. Some remarkable suggestions in favour of this line of thought can be found in the writings of Sylos Labini [e.g. 1979: 67-70].

4 The aggregate obtained using this hasty procedure is at odds, of course, with the

particular definition given to "material product" by Soviet accounting.

of simplicity, and it provides clear and precise answers. However, it has the drawback of giving, for one specific comparison, a range of answers which differ greatly according to the good that we select as the numeraire. Returning to the above example, we may find that the product of t exceeds that of r by 50 per cent if we base the comparison between them on the price of grain; that t 's product is instead equal to r 's if we base comparison on the price of gold; and that it is indeed 20 per cent less if we base comparison on the price of oil. The fact, however, that we obtain very different answers according to the good chosen is a perfectly logical one, because price ratios between goods (in our case between grain, gold and oil) vary in time and space. But this leaves us uncertain as to which of the various answers is most significant for the purposes of measuring "economic growth" - unless we believe that there is good reason for selecting a given good or a given bundle of goods as the ideal numeraire; the history of economic thought provides examples of the solutions that have been suggested, of the arguments advanced in their support, and of the debate that they have aroused.

The difficulty I have described explains why this method of comparison, after its centuries-long use, has almost entirely given way in this century to the technique of comparison at constant prices. Note, however, that this technique, too, has the drawback of furnishing a range of alternative answers (according to the situation selected as the constant price base), although in practice the range is narrower and the inconvenience less noticeable.

In recent years - as I have explained in previous chapters - the situation has changed even further because of the massive development of the tertiary sector and of product innovation; phenomena which have seriously undermined the significance of GDP at constant prices. Those who seek a growth indicator applicable to the situation of today consequently find that there are no longer persuasive grounds for preferring GDP at constant prices to GDP measured in purchasing power. This latter indicator, apart from being simpler and clearer, has the notable advantage of avoiding, through the choice of a suitable numeraire, all the

confusion inherent in the measurement at constant prices of both services and innovative commodities. On the other hand, the fact that this indicator yields a wide range of alternative answers is not necessarily a disadvantage. Although it may be worrisome to those who want certainty at all costs, it can induce an attitude of prudent relativism in the intelligent user.

The overall conclusion to be drawn from my discussion is that those who set out to measure growth - understood as the growth of output of goods - in contemporary advanced economies have a plurality of indicators at their disposal, all of which are poorly suited to the purpose and which yield not necessarily coherent answers. These include not only the measures at constant prices of GDP and of the other usual aggregates of national accounting, but also a number of measures of the purchasing power of these aggregates, as well as the measure at constant prices of the less familiar aggregate "material product" at constant prices. There is no serious reason why priority should be given to one of these over the others. Concentrating attention on one of them to the exclusion of the others is an act of laziness and exposes us to the dangers of false certitudes. If we instead examine and compare these various indicators - as well as others if and when we find them - we can imbue our judgement with a healthy relativism.

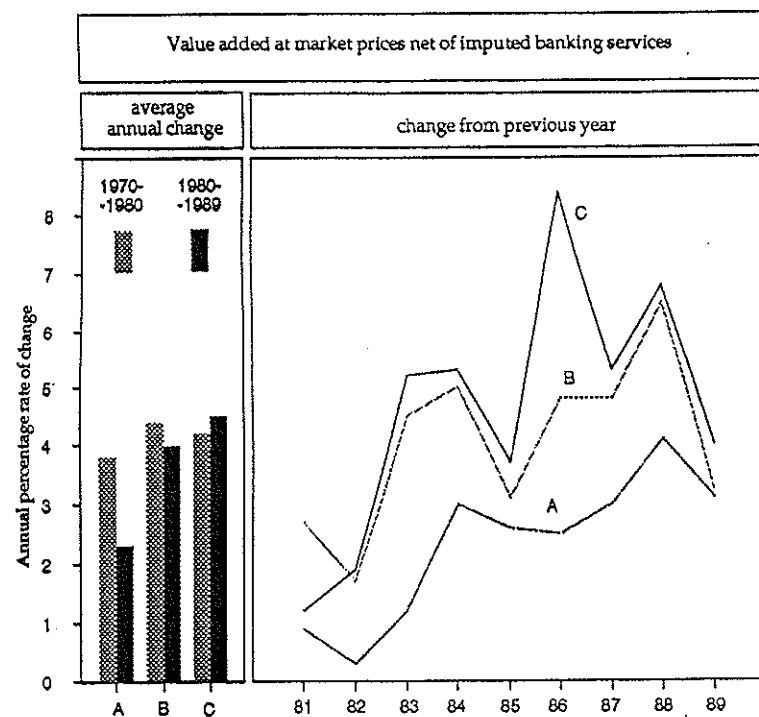
The manner of proceeding recommended here can be illustrated by means of a straightforward application. Figure 9 presents three statistical series for the Italian economy between 1970 and 1989. *A* indicates the conventional measure of GDP at constant prices; *B* the purchasing power of the same GDP referred to household food consumption; *C* the purchasing power of the GDP, referred this time to investments in machines, equipment and means of transport.⁵ If I ask myself a series of questions about the speed of growth and look at the three series in the figure, I receive the

⁵ Note that indicators *B* and *C* denote groups of goods which are almost entirely constituted by material goods. There is, however, also a small services component, due to the margins of distribution included in the prices of the commodities themselves (this component is more relevant in the case of *B*).

following answers:

- 1) What was the rate of growth in the 1980s? Answer: just over 2% according to the conventional measure at constant prices, but around 4% according to purchasing power in both food consumption and machinery.
- 2) Did growth really slow down in the 1980s compared with the 1970s? Answer: according to the conventional measure at constant prices, there was indeed a marked slowdown; but according to purchasing power in food consumption there was only a slight slowdown; and if one looks at purchasing power in machinery there was even a slight acceleration.

Fig. 9. Change in Italy's "real" income, 1970-1989. Three measures compared.



- 3) Is it true that there was a brief fluctuation consisting of an acceleration from 1982 to 1984 followed by a deceleration from 1984 to 1985? Answer: apparently "yes", at least according to the three indicators examined.
- 4) Is it true that the deceleration continued from 1985 to 1986? "Yes", but only according to the conventional measure at constant prices; decidedly "no" if one looks at the two purchasing power indicators.

In this illustrative example, I have only considered a range of three indicators; a larger number would have cluttered up the figure and made it less clear. But if I had to draw up a document in order to provide the public with quantitative information on growth, I would try to use a wider repertoire of indicators. Which would render the information more problematic and less likely to be misleading.

I believe that this consideration applies to all those engaged in the production and dissemination of statistics on growth.

CONCLUSIONS

My aim in this study has been to verify what it is possible to learn from the figures on economic growth (defined as the growth of production of goods) derived from statistical series of GNP at constant prices, in order to defend ourselves against their misinterpretation and misuse.

The results of the exercise can be summarized as follows.

First question: what do we know about the growth of GDP until the present day? We know that the information available to us is sufficiently reliable - because it is non-contradictory, sufficiently clear, and coherent - only as far it concerns a restricted number of countries and a limited temporal horizon. Within these limits, we can discern three uniformities of behaviour. First, once a country has begun to increase its per-capita GDP, this trend continues as an underlying tendency for the whole of the period examined. Second, the growth rate varies over time, and phases alternate in which it is more rapid ("flow-tide") with others in which it is more sluggish ("ebb-tide"). This alternation is largely synchronic among countries. Third, within each of these synchronic phases of flow and ebb, the differences in velocity between one country and another are generally slight. On reflection, these three general uniformities of behaviour are not surprising: a logical explanation (see Chapter 3) can be advanced both for prevailing trends and for the exceptions to them.

Second question: to what extent is the practice of using GDP as the indicator of a population's welfare justified? Apart from the difficulty of agreeing on a definition of welfare - a seductive concept, but an elusive one - there are numerous grounds for disputing that every difference in GDP is matched, always and necessarily, by a corresponding difference in welfare. This is explained in Chapter 4; but then one notes that the statistics for the last half-century reveal an interesting correlation between the per-capita GDP of a country and the life expectancy of its inhabitants - which might be taken to be a rather significant indicator of

physiological welfare, although not of welfare in the general sense. One finds that, in every period examined, the life expectancy in a country is an increasing function of its per-capita GDP, as long as one considers countries with a per-capita GDP below 4,000 US dollars at 1980 purchasing power. However, once this income level has been reached, life expectancy is practically the same in all countries, regardless of whether they exceed the limit by little or by much. With the passage of time, the function shifts upwards; that is to say, there is an increase in life expectancy which corresponds to each given level of income. Chapter 5, which sets out the empirical evidence for this conclusion, also shows that it can be given a logical explanation.

Third question: can we be confident that current techniques of valuation at constant prices provide us with a satisfactory measurement of the quantity of goods produced? The analysis conducted in Chapters 6 and 7 shows that the answer is hardly reassuring; indeed it may be decidedly negative when we take services and the flow of commodity innovations into account. Hence it follows that the GDP at constant prices loses credibility as a measure of the "physical" dimension of output in all cases when the tertiary and innovative components constitute a significant portion of it. Yet this is precisely the situation of today's advanced economies, one of which is Italy.

My analysis also urges critical reappraisal of two topics today at the centre of attention in Italy. First, we must re-examine the thesis which holds that Italian statistics reveal a pathological sluggishness in the increase in the productivity of the service sector; and that this sluggishness, due to a lack of competition, is one of the chief causes of the current difficulties of the Italian economy. One certainly cannot rule out *a priori* that there exist disfunctions imputable to an absence of competition in the tertiary sector, but what we must reject is the validity of the statistical proofs adopted by the proponents of this thesis.

Second, careful reflection is required on the widespread use of the general retail price index and of other price indices as the reference base for updating norms and contracts, and for decision-

taking. The flaws revealed in the logical structure of these indices, in fact, impair the significance that one would wish to attribute to them. There is even the danger that if we take them as a gauge for our actions, we shall incorporate an element of systematic error into our behaviour with respect to our intentions: suffice it to mention the suspicion, outlined in Chapter 7, section 2, that the current retail price index, because of the very way in which it is constructed, yields an exaggerated picture of the underlying trend in price increases.

I turn to the central topic of this essay, namely, the use of GDP as the indicator of growth, to set out the practical prescriptions to be drawn from my analysis. In concrete: has the inquiry shown that reasonable applications can be made of this indicator? Which applications, and in what form?

To begin with, the use of GDP as the indicator of growth raises no serious objections as long as one is examining the initial development stages of a modern economy. I use the adjective "initial" here in the broad sense to cover the period (which in Italy lasted until the Second World War) in which the largest component of GDP at current prices was still constituted by the production of non-innovative commodities (as opposed to innovative goods and to services). In these early stages, GDP at constant prices measures the quantity of goods produced in a country with an acceptable degree of approximation; a finding which is already of immediate and concrete interest. Moreover, following Kuznets and other masters, we find that there are notable functional relations between the *level* of per-capita GDP at constant prices and the *composition* of GDP itself, as well as other aspects of the economic and social structure. Study of these relations proves extremely helpful in organizing our knowledge about the evolutionary laws of the economy. An example is provided by the above-mentioned functional relationship between GDP and life expectancy.

When, however, one passes to examination of a more mature phase of economic development, GDP ceases to be a satisfactory indicator of the quantity of goods produced; and there is little

hope of remedying the situation by seeking to refine the definitions and the statistical methods used. One might consider, instead, the use of formulae different from GDP at constant prices for this purpose, and Chapter 8 gives two examples of possible alternative formulae - although these, too, have their shortcomings.

It would appear, therefore, that the most reasonable advice for those intent on using an indicator of economic growth (defined as the growth of the quantity of goods produced) is the following:

- (i) however mediocre GDP at constant prices may be as an indicator, they should not abandon it, as no significantly better alternative is available;
- (ii) they should, however, take great care not to present it as the true or only measure of growth;
- (iii) to this end, they should always combine GDP at constant prices with a set of alternative indicators, so that growth is represented, not by one specific value but by a range of values. This may induce those utilizing growth figures to adopt a relativist attitude, which is certainly healthier than ill-founded certainty.

Let it be clear that the moderation I advocate only concerns the current practice of using GDP at constant prices as the prime indicator of growth in advanced economies. There is no need to urge moderation, indeed I would recommend more boldness, in the use of both national accounts *at current prices* and statistics expressed in *non-monetary units*.

National accounting at current prices provides a picture of the flows and stocks of goods which may be immune to the kinds of confusion that inevitably arise in accounting at constant prices. It therefore constitutes a map which gives valid guidance to those who operate in the market and to the authorities responsible for its regulation. Of course, national accounting maintains its lucidity, and its totals preserve their clarity, only if the accounts are restricted to registering goods that are effectively marketed, i.e. those which possess a real price. One must therefore resist the recurrent temptation to include - by assigning fictitious prices to

them - such non-marketed items as the work of housewives. If one yields to this temptation, as I explain in Chapter 4, section 2, one ends up with a map that no longer provides true measures of the market - without, however, furnishing significant measures of welfare in exchange.

As regards non-monetary statistics, it is superfluous here to point out their widespread and undoubtedly profitable use in many fields. However, it may be worth stressing that there is a particularly urgent need for an increased endowment of these statistics in the field of the production of services; especially services which do not have an effective price on the market. By way of example, I cite the production of educational services. Those responsible for taking decisions in this sector can do so more intelligently if they possess a battery of statistics on the variables and relations involved in their production. It might prove useful, for instance, to conduct temporal and spatial comparisons of the provenance of pupils, their educational levels, school attendance rates, teaching hours, the number of pupils per class and per teacher, the facilities and equipment available, their utilization, examination results, the post-school careers of pupils, and so forth. Expanding the battery of statistics available, introducing further entries and making entries more detailed, is of extreme importance because it provides decision-makers with more complete and accurate knowledge of the context in which they must operate. However, one should not then yield to the temptation of combining the measurements of individual aspects - each of which valid *per se* - into what is purported to be an overall indicator of the "quantity of educational product obtained". This would be misleading.

Postscript

In concluding my inventory of the results achieved by this study, the question arises as to whether its subject-matter - the growth of the production of marketable goods - really deserves the amount of attention that economists, politicians and the general public continue to devote to it. This is a challenging question which only long and detailed discussion

could satisfactorily answer. Here I merely record the thoughts - in order to satisfy the curious reader - that the question aroused in me as an impulsive first reaction.

I am still convinced that the founders of political economy as an autonomous discipline were well advised to focus their attention on market activities. In the world in which they then lived, growth in the production of marketable goods clearly brought with it (under certain conditions, of course, and with the necessary qualifications) a more rational use of resources, greater social mobility, new freedoms, greater satisfaction of needs, a broadening of social horizons, and so forth. In that historical setting, therefore, there were cogent reasons for maintaining that the quantity of goods produced was one of the principal factors (if not the sole factor) determining the well-being of a nation. Hence, studying the social mechanisms that engender the growth of the market, with the purpose of instructing governments on how to improve these mechanisms for the common good, was an act of high civil duty.

With subsequent developments, however, the ramification of the market into the various spheres of life and the quantity of goods produced have now reached such proportions - in the rich regions of the world, of which ours is one - that further growth no longer has the markedly positive connotation, from the point of view of the population's welfare, that it used to possess in the past. Thus the reasons that justified placing economic growth at the centre of the classical economists' attention are no longer valid.

Does this oblige us to break with the tradition of political economy? The answer is "no" when we consider the task of political economy to be discovery of how social mechanisms can be best managed to ensure the greatest collective welfare: this is still a task of preeminent importance. The answer is "yes", however, when we realise that in order to perform this task, in the rich countries, the focus of analysis must shift away from the traditional theme of the quantity of goods produced to others that can no longer be regarded of secondary importance for the public good.

Consider, for example (apart from the problematic set out in Chapter 4, section 2), the satisfaction or the non-satisfaction that work brings to those who engage in it. Work may become more interesting if those who do it are made to feel that they participate in the management and success of the

productive process; if they are able to recognize the product as their own creation; and so on. Today in the rich countries, it is probably more urgent to study how to restore interest in work in the above sense than how to increase by some percentage points the quantity of goods produced, or the purchasing power obtained as remuneration per hour for work delivered. Yet we economists continue to devote a host of studies to productivity and wages, and almost none to the satisfaction of the worker.

These considerations apply exclusively to the situation of the rich part of the world. They ignore the remaining four-fifths of its population, for whom the quantity of goods is still a matter of enormous urgency. One might therefore object that the rich countries should continue to increase their production, not to satisfy internal requirements, but to stimulate the growth of the poor countries by directing an increasing flow of investments, transfers, demand for products and manpower towards them. This the rich countries are obliged to do for reasons that are not solely altruistic but also selfish, considering that the misery of the poor threatens their tranquillity.

Although this is a valid objection which obliges me to reformulate my thesis with greater precision, it does not force me to abandon it. In fact, all that the poor countries require to satisfy their basic needs is a small percentage of the GDP of the rich countries. Hence the duty of international solidarity does not constitute sufficient reason for the rich part of the world to persist in pursuit of a high rate of growth of its own production as its overriding aim.

In order to heal the division of the world between countries that are more or less satisfied and those that are not, there exists another course of action; one which is at least equally as important and lies within the sphere of culture and the formation of values systems. We ought to combat the dominant conception whereby one single model of development and of living (the model centred on the growth of marketable goods) is proposed and accepted as the only valid one. We ought to urge every population to seek the form of progress that best matches its history, its features and its circumstances, and not to feel inferior merely because another country produces more goods. Today, although this may seem pure Utopia, one must nevertheless think about it.

Those who have read so far will have gained a general idea of the thoughts instinctively provoked in me by the question posed at the

beginning of this postscript. And they will also have noted, I hope without irritation, that my reactions have been expressed in the ingenuously sententious form only to be expected from an elderly professor.

Between a first impromptu reaction and a well-meditated reply there lies detailed and laborious analysis - analysis which would go beyond the scope of this essay and which, therefore, will have to be conducted elsewhere.

APPENDIX

1. BASE STATISTICAL INFORMATION

1.1. GDP series at constant prices

Two distinct statistical bases are used in this book to study the growth of GDP. One of these bases meets the requirement that it must cover a large number of countries, but this is only possible for the recent past; the other statistical base covers a long historical period, but this is possible only for a limited number of countries.

In this section, I shall first briefly describe the sources and characteristics of these two statistical bases and then present a set of tables and figures.

The statistical bases

Statistical base for the study of 87 countries between 1960 and 1985. I have decided to base my analysis on the works of the University of Pennsylvania, since these to my knowledge conduct the most systematic, thorough and wide-ranging international comparison of GDP for the period since 1950 until today. I draw my data from the most recently published results of this comparison, the so-called Penn World Table Mark 4 (abbreviated to PWT4), which covers 130 countries during the thirty-five-year period 1950-1985.¹

However, I have had to be selective in order to exclude from my statistical base the data for those countries and those years which, in the context of the present study, would raise the most serious doubts over their reliability, comparability and significance. I have therefore excluded the following countries: all those with central planning; all those whose data are classified by the authors of the PWT4 at the lowest level ("category D") from the point of view of the reliability of estimates; finally Kuwait. As for

¹ The PWT4 is presented in Summers and Heston [1988]. It links with other important contributions to this line of research, such as Kravis [1975]; Kravis, Heston and Summers [1978a and b]; Summers, Kravis and Heston [1980]; Summers and Heston [1984].

This line of research began back in the 1950s: see Gilbert and Kravis [1954] and Gilbert [1958].

the time-span considered, I have restricted myself to the twenty-five-year period 1960-85, excluding the previous decade for the twofold reason that the national accounts of those years are presumably less reliable, and that the period was still influenced by the large oscillation caused by the war.

However, even after these exclusions, a considerable margin of uncertainty still surrounds my data, and this the reader should constantly bear in mind. This uncertainty is also evidenced by the fact that the data are still subject to substantial corrections from one edition of the PWT to another, even in the case of countries presumed to possess the most advanced statistical systems.

Statistical base for the study of 17 countries between 1897 and 1986. This group comprises all and only those countries which fulfil the following two conditions:

- (a) they are countries which had already commenced their modern economic development (in Kuznets' sense) at the beginning of the twentieth century;
- (b) they are countries for which I possess information that allows relatively precise estimation of GDP in certain key-years distributed over the last ninety years.

Table a.4 sets out the list of the key-years and of the countries considered. My choice of key-years is certainly debatable, but those who seek explanation of its underlying logic are referred to Fuà [1992]. As regards the initial year, it is worth noting that Schumpeter [1939, vol. I: 397] indicated 1897 as the year in which the "third Kondratieff cycle" began.

The construction of my base series followed a hybrid procedure, which I now describe. For the years 1973 and 1986 I used the estimations expressed in 1985 US dollars at purchasing power parity (PPP) published in OECD [1990b]. For all previous key-years, obviously, I did not possess analogous valuations calculated using an internationally uniform procedure, and therefore had to settle for values obtained by deflation procedures which vary from one country to another.

I therefore proceeded with the separate construction for each

country of indices on base 1973 = 1 for the key-years between 1897 and 1949. The information used for this purpose was drawn from three principal sources: Fuà [1992] for Italy, Schwartz [1977] for Spain, Maddison [1984] for all the other countries,² although I consulted numerous other sources in order to check, integrate and correct my data.³

Once the indices on base 1973 had been constructed for each country, I multiplied them by the PPP (1985 dollars) of the 1973 GDP of the same country as reported by the OECD [1990b]. I thus obtained an estimate, albeit an approximate one, of GDP expressed in 1985 dollar PPP for all the key-years prior to 1973.

Because of the method used in constructing the 1897-1986 series, the relative positions of the various countries (i.e. the indices on base USA = 100) in each year of the period were influenced by the estimations in PPP published by OECD for 1973. It should be pointed out that there are some discrepancies between these OECD estimations and the corresponding PWT4 ones, and therefore between the base series used to study the 17 countries 1897-1986 and those used to study the 87 countries 1960-85. Only for 9 of the countries considered are the indices on base USA = 100 of my 1897-1986 series in line with the indices of my 1960-85 series.⁴ For 6 other countries they exhibit a noticeable downwards deviation⁵ and for one country - Italy - a marked upwards one. This latter difference is due to the fact that ISTAT has recently made drastic changes to its estimates; changes which have been

2 I was unable to take account of Maddison's most recent work, in particular Maddison [1991a and b]. Note also that, for Italy, a thorough revision of pre-war series is currently in progress. The results of this revision, however, are not yet available.

3 I mention only two of the least obvious but most useful sources that I consulted: first, the internal (unpublished) documents of the research group studying the economic growth of the industrialized countries led by M. Abramovitz and S. Kuznets; second, the historical comparisons between pre-war and post-war real income published by international organizations in the 1950s [UN 1950 and 1957b; OEEC 1957].

4 These nine countries are Australia, Canada, Finland, Japan, the Netherlands, Spain, Sweden, Switzerland, the United Kingdom.

5 These six countries are Austria, Belgium, Denmark, France, Germany, Norway.

assimilated by OECD but not by PWT4.

The Italian data require me once again to stress the uncertainty of the figures that I use here. According to the previous ISTAT series, which stopped at 1985, Italy had a level of per-capita GDP that was more than one-fifth lower - in PPP - than the French level and almost one-fifth higher than the Spanish one. The new ISTAT series revalues Italian GDP by almost one-fifth, with the result that the per-capita level is now almost the same as the French level and fully two-fifths higher than the Spanish one. How much trust can we place in this new estimation of the countries' relative positions? Not very much, especially if we consider that the statistical office of some other country might also want to revise its estimate as drastically as ISTAT has done.

Notes on the tables and figures

The following documentation should be examined jointly with figures 1, 2, 3 and 4 of Chapter 2, which are complementary to it.

In order not to duplicate information already given in the headings, texts and notes of the various tables and figures, I give here only a limited amount of additional detail.

Tables a.1 to a.3. The rates of variation have been calculated on the basis of the RGDP2 chain index furnished by PWT4, while the relative levels are based on the y index (position at current international prices) provided by the same source.

In table 1, I have used the symbol a to denote countries with populations of more than 10 million, bearing in mind that cases of extremely rapid growth are more surprising if they concern countries of considerable size rather than small ones, like Cyprus or Malta.

Tables a.4 to a.9. The values of each key-year have been calculated as an average of the three-year period centred on the key-year. All the values apply to constant national borders (those effective in 1973). The entry "Germany" refers to the FRG.

For ease of consultation, printed alongside the name of each country in table 4 is the abbreviation used to designate that country in figure 4 and in figures a.4 to a.8.

Figures a.1 and a.2. These provide, for the sub-period 1960-73 and the sub-period 1973-85 respectively, a representation analogous to that provided in fig. 1, Chapter 2 for the overall period 1960-85.

Figure a.3. This figure is only for those who wish to conduct summary verification of a "heroic" explanatory model which links the convergence and divergence of per-capita GDP to the demographic factor.

I abridge into the three following propositions the model to be verified, using for brevity's sake the symbols defined in the notes to table a.3:

- (a) Assume that $\dot{P}$ is a decreasing function of y_0 for relatively low levels of y_0 (the case of the B-countries) and an increasing function of it for higher levels (the case of the A-countries). This U-shaped pattern results from the combined effect of the well-known mechanism of "demographic transition" as regards the natural component of $\dot{P}$ and of the direction of flows towards the richer countries as regards the migratory component.
- (b) Also assume that $\dot{y}$ is a decreasing function of $\dot{P}$ because of the negative effect of $\dot{P}$ on the per-capita availability of natural resources and capital, under the hypothesis that this negative effect will predominate over other effects of opposite sign.
- (c) From propositions (a) and (b) it follows that $\dot{y}$ is an increasing function of y_0 in the B-countries and a decreasing one in the A-countries.

What, then, do the statistics reveal?

Figure a.3 shows that the coefficients of regression have a sign which complies with proposition (b), but that the broad scatter of the points around the regression lines renders this result of little significance.

Figure 1 in Chapter 2 yields similar results. It shows that the angular coefficients of the regression lines of $\dot{P}$ on y_0 and of $\dot{y}$ on y_0 have signs which conform respectively to proposition (a) and (c); but it also shows the poor representativeness of these lines

given the marked scattering of the points.

The summary verification conducted here therefore prompts the conclusion that the "heroic" explanatory model is only weakly substantiated by the data.

Figures a.4 to a.7. These provide a representation analogous to that of fig. 4, Chapter 2 for four distinct sub-periods.

Figure a.8. See the note to figure a.3, bearing in mind that a.8 only comprises relatively rich countries.

The conclusions to be drawn from joint examination of figures a.8 and 4 in verification of the "heroic" explanatory model are even weaker than those that result from figures a.3 and 1.

Table a.1 Relative level and rate of variation of GDP in 87 countries, 1960-1973-1985. Elementary data

	Total GDP			Per-capita GDP					
	annual rate of variation (%)			annual rate of variation (%)			relative level (USA = 100)		
	60-73	73-85	60-85	60-73	73-85	60-85	1960	1973	1985
AFRICA									
1 Algeria*	3.7	6.9	5.2	1.1	3.6	2.3	12	10	16
2 Botswana	8.5	8.7	8.6	5.4	4.3	4.8	8	11	14
3 Cameroon	5.3	6.2	5.7	3.1	2.9	3.0	7	7	8
4 Ethiopia*	3.6	2.1	2.9	1.1	-0.4	0.3	4	3	2
5 Gabon	9.6	5.3	7.5	8.6	2.8	5.8	6	13	15
6 Ivory Coast	7.1	3.3	5.3	2.7	-1.1	0.9	9	9	7
7 Kenya	5.0	4.1	4.6	1.3	0.1	0.7	7	6	5
8 Madagascar	2.1	0.6	1.4	-0.3	-2.1	-1.2	11	6	4
9 Malawi	5.6	3.5	4.6	2.9	0.3	1.7	3	4	3
10 Mali	0.8	3.5	2.1	-1.6	0.9	-0.4	6	3	3
11 Morocco*	6.8	4.8	5.8	4.2	2.2	3.2	9	9	10
12 Nigeria*	3.7	0.7	2.3	1.2	-2.0	-0.4	9	7	4
13 Senegal	2.3	3.4	2.8	-0.1	0.6	0.3	10	7	6
14 South Africa*	5.2	2.3	3.8	2.9	-0.1	1.4	34	35	29
15 Tanzania*	5.5	4.2	4.9	2.3	0.8	1.6	4	3	3
16 Tunisia	5.1	5.9	5.5	3.1	3.4	3.3	12	12	16
17 Zambia	3.4	-0.5	1.5	0.5	-3.7	-1.5	11	11	4
18 Zimbabwe	5.7	2.6	4.2	2.0	-0.6	0.8	12	10	8
ASIA									
19 Bangladesh*	2.4	5.7	3.9	-0.2	3.0	1.3	7	4	5
20 Burma*	4.5	5.1	4.8	2.2	3.0	2.6	4	4	4
21 Hon Kong	10.0	8.0	9.1	7.4	5.8	6.6	25	42	70
22 India*	2.8	4.7	3.7	0.5	2.4	1.4	7	5	6
23 Iran*	8.0	5.1	6.6	4.5	1.8	3.2	17	23	31
24 Iraq	5.7	2.9	4.3	2.4	-0.6	0.9	17	18	17
25 Israel	9.2	2.4	5.9	5.6	0.2	3.0	34	57	51
26 Japan*	9.7	3.9	6.9	8.5	2.9	5.8	31	66	70
27 Jordan	3.0	8.3	5.5	0.0	5.2	2.5	18	12	18
28 Korea*	8.6	7.5	8.0	6.0	5.8	5.9	10	15	23
29 Malaysia	7.5	6.4	7.0	4.6	3.8	4.2	16	19	25
30 Pakistan*	6.2	6.0	6.1	3.2	2.9	3.1	8	8	9
31 Philippines*	5.3	3.7	4.5	2.3	1.0	1.7	13	12	11
32 Saudi Arabia	10.1	0.8	5.5	6.1	-3.6	1.3	17	31	49
33 Singapore	8.3	9.2	8.8	6.0	7.9	6.9	26	38	70
34 Sri Lanka	1.6	5.5	3.5	-0.5	3.9	1.6	15	9	12
35 Syria	6.8	8.5	7.6	3.4	4.9	4.2	15	15	23
36 Taiwan*	9.4	7.0	8.3	6.4	5.1	5.8	12	19	28
37 Thailand*	7.2	6.0	6.6	4.1	3.7	3.9	10	12	14
EUROPE									
38 Austria	4.8	2.5	3.7	4.3	2.5	3.4	52	64	71
39 Belgium	4.8	2.0	3.4	4.3	1.8	3.1	62	75	72
40 Cyprus	7.3	3.8	5.6	6.7	3.1	5.0	21	36	43
41 Denmark	4.2	2.2	3.2	3.5	2.0	2.8	73	84	84
42 Fed. Germany*	4.6	2.1	3.4	3.7	2.2	3.0	64	77	80
43 Finland	5.0	2.7	3.9	4.6	2.3	3.4	50	68	71
44 France*	5.8	2.2	4.0	4.7	1.7	3.2	59	77	78
45 Greece	7.8	2.3	5.1	7.2	1.4	4.4	20	36	36

Table a.1 (continue)

	Total GDP			Per-capita GDP					
	annual rate of			annual rate of			relative level		
	variation (%)			variation (%)			(USA = 100)		
	60-73	73-85	60-85	60-73	73-85	60-85	1960	1973	1985
46 Iceland	5.6	2.5	4.1	4.1	1.4	2.8	58	77	71
47 Ireland	4.3	3.1	3.7	3.6	1.9	2.8	37	43	41
48 Italy ^a	5.5	2.6	4.1	4.8	2.2	3.6	42	54	57
49 Luxembourg	4.4	1.2	2.9	3.5	0.9	2.3	80	90	81
50 Malta	5.0	7.3	6.1	5.1	6.4	5.7	20	27	42
51 Netherlands ^a	5.5	1.8	3.7	4.3	1.2	2.8	60	75	69
52 Norway	4.3	4.2	4.2	3.5	3.8	3.6	62	74	97
53 Portugal	6.5	1.8	4.2	6.5	0.7	3.7	22	33	29
54 Spain ^a	7.1	2.6	4.9	6.0	1.7	3.9	35	49	49
55 Sweden	4.0	1.9	3.0	3.3	1.7	2.5	69	78	75
56 Switzerland	4.4	0.7	2.6	3.0	0.7	1.9	88	92	84
57 Turkey ^a	5.8	4.6	5.2	3.2	2.2	2.7	19	19	20
58 United Kingdom ^a	3.2	1.6	2.5	2.7	1.6	2.2	65	65	68
NORTH AND CENTRAL AMERICA									
59 Barbados	4.9	3.7	4.3	4.5	3.3	3.9	27	30	40
60 Canada ^a	5.4	2.8	4.2	3.8	1.6	2.7	80	92	91
61 Costa Rica	6.4	2.8	4.7	3.2	0.3	1.8	24	24	21
62 Dominican Rep.	6.5	3.7	5.2	3.5	1.3	2.4	13	14	13
63 El Salvador	5.8	0.9	3.4	2.5	-1.4	0.6	15	14	9
64 Guatemala	5.3	2.6	4.0	2.1	-0.4	0.9	21	16	12
65 Haiti	1.0	2.7	1.8	-0.6	0.9	0.1	9	5	5
66 Honduras	5.0	3.1	4.1	1.8	-0.4	0.7	11	9	7
67 Jamaica	5.3	-1.4	2.0	3.8	-2.8	0.5	23	23	13
68 Mexico ^a	6.7	4.2	5.5	3.4	1.3	2.4	31	31	30
69 Nicaragua	6.0	2.9	4.5	3.0	-0.8	1.2	23	22	16
70 Panama	7.5	4.0	5.8	4.6	1.7	3.2	17	24	24
71 Trinidad and Tobago	5.0	3.2	4.1	3.1	2.3	2.7	32	30	56
72 United States ^a	4.1	2.5	3.3	2.8	1.5	2.2	100	100	100
SOUTH AMERICA									
73 Argentina ^a	4.0	-0.1	2.0	2.4	-1.7	0.4	42	39	26
74 Bolivia	5.4	0.9	3.2	2.9	-1.8	0.6	12	12	8
75 Brazil ^a	10.1	5.1	7.7	7.2	2.8	5.0	13	22	25
76 Chile	0.2	1.5	0.8	-0.2	-0.2	-0.2	37	33	26
77 Colombia ^a	6.2	4.2	5.2	3.3	2.2	2.8	18	18	20
78 Ecuador	6.1	5.3	5.7	3.2	2.5	2.9	15	15	18
79 Guiana	2.9	-1.6	0.7	0.8	-2.4	-0.8	18	15	10
80 Paraguay	4.5	6.5	5.5	1.8	3.6	2.7	15	12	15
81 Peru	6.2	1.5	3.9	3.2	-1.0	1.2	21	22	16
82 Surinam	6.1	2.5	4.3	3.9	2.3	3.1	22	24	24
83 Uruguay	1.1	0.7	0.9	0.3	0.1	0.2	50	34	26
84 Venezuela	5.6	0.7	3.2	1.8	-2.6	-0.3	40	32	25
OCEANIA									
85 Australia ^a	5.3	2.5	3.9	3.2	1.1	2.2	67	74	68
86 Fiji	6.4	2.2	4.3	3.6	0.3	2.0	23	24	22
87 New Zealand	3.9	1.6	2.8	2.1	0.7	1.5	76	75	61

Note:

The letter ^a denotes countries with more than 10 million inhabitants in 1960.Table a.2 Rate of variation of GDP in 87 countries, 1960-1973-1985.
Average values and indices of variability for large geographical areas

	Total GDP			Per-capita GDP		
	1960-73	1973-85	1960-85	1960-73	1973-85	1960-85
ALL 87 COUNTRIES						
average	5.5	3.5	4.5	3.3	1.5	2.4
range of variation	9.9	10.9	8.4	10.2	11.5	8.4
standard deviation	2.1	2.3	1.8	2.1	2.2	1.8
18 COUNTRIES IN AFRICA						
average	5.0	3.8	4.4	2.2	0.7	1.5
range of variation	8.8	9.3	7.2	10.2	7.9	7.3
standard deviation	2.1	2.3	1.9	2.2	2.1	1.9
19 COUNTRIES IN ASIA						
average	6.6	5.6	6.1	3.8	3.1	3.5
range of variation	8.5	8.5	5.6	9.0	11.5	5.9
standard deviation	2.7	2.2	1.7	2.6	2.6	1.9
21 COUNTRIES IN EUROPE						
average	5.2	2.7	4.0	4.4	2.1	3.3
range of variation	4.6	6.6	3.6	4.5	5.7	3.9
standard deviation	1.1	1.4	0.9	1.2	1.2	0.9
14 COUNTRIES IN NORTH AND CENTRAL AMERICA						
average	5.3	2.7	4.1	3.0	0.6	1.8
range of variation	6.5	5.6	4.0	5.2	6.2	3.8
standard deviation	1.5	1.4	1.1	1.2	1.6	1.1
12 COUNTRIES IN SOUTH AMERICA						
average	4.9	2.2	3.6	2.5	0.3	1.5
range of variation	9.9	8.1	7.0	7.4	6.2	5.8
standard deviation	2.5	2.4	2.1	1.9	2.1	1.7
3 COUNTRIES IN OCEANIA						
average	5.2	2.1	3.7	3.0	0.7	1.9
range of variation	2.5	1.0	1.6	1.5	0.8	0.7
standard deviation	1.0	0.4	0.7	0.6	0.3	0.3

Table a.3 Rate of variation of GDP and of the population in 87 countries distinguished according to initial level of income, 1960-1973-1985. Average value, indices of variability and numerical results of regression analysis

	average	range of variation	standard deviation	regression line
1960-1973				
$\dot{y}$ (paesi A)	3.42	4.46	1.02	$\dot{y} = 4.33 - 0.0135 \cdot y_0$
$\dot{y}$ (paesi B)	3.25	10.20	2.28	$\dot{y} = 2.23 + 0.0583 \cdot y_0$
$\dot{Y}$ (paesi A)	4.47	4.71	1.06	$\dot{Y} = 4.32 + 0.0021 \cdot y_0$
$\dot{Y}$ (paesi B)	5.71	9.88	2.26	$\dot{Y} = 5.28 + 0.0244 \cdot y_0$
$\dot{p}$ (paesi A)	1.05	1.70	0.48	$\dot{p} = 0.00 + 0.0156 \cdot y_0$
$\dot{p}$ (paesi B)	2.45	4.60	0.99	$\dot{p} = 3.05 - 0.0339 \cdot y_0$
1973-1985				
$\dot{y}$ (paesi A)	1.71	3.54	0.80	$\dot{y} = 2.93 - 0.0162 \cdot y_0$
$\dot{y}$ (paesi B)	1.41	11.54	2.48	$\dot{y} = 1.16 + 0.0135 \cdot y_0$
$\dot{Y}$ (paesi A)	2.29	3.47	0.78	$\dot{Y} = 3.88 - 0.0210 \cdot y_0$
$\dot{Y}$ (paesi B)	3.81	10.85	2.46	$\dot{Y} = 4.36 - 0.0301 \cdot y_0$
$\dot{p}$ (paesi A)	0.58	2.29	0.56	$\dot{p} = 0.95 - 0.0048 \cdot y_0$
$\dot{p}$ (paesi B)	2.39	4.25	0.98	$\dot{p} = 3.20 - 0.0435 \cdot y_0$
1960-1985				
$\dot{y}$ (paesi A)	2.54	3.43	0.80	$\dot{y} = 3.50 - 0.0143 \cdot y_0$
$\dot{y}$ (paesi B)	2.37	8.39	1.95	$\dot{y} = 2.02 + 0.0202 \cdot y_0$
$\dot{Y}$ (paesi A)	3.32	3.36	0.80	$\dot{Y} = 3.51 - 0.0029 \cdot y_0$
$\dot{Y}$ (paesi B)	4.79	8.36	1.87	$\dot{Y} = 5.15 - 0.0208 \cdot y_0$
$\dot{p}$ (paesi A)	0.78	1.47	0.43	$\dot{p} = 0.01 + 0.0113 \cdot y_0$
$\dot{p}$ (paesi B)	2.41	4.06	0.93	$\dot{p} = 3.13 - 0.0410 \cdot y_0$

Legend:

$\dot{y}$ = annual percentage variation of per-capita GDP

$\dot{Y}$ = annual percentage variation of total GDP

$\dot{p}$ = annual percentage variation of the population

y_0 = level of per-capita GDP at the beginning of the period (percentage of the USA level)

Notes:

"A-countries" are those with $y_0 \geq 50\%$ USA; "B-countries" those with $y_0 < 50\%$ USA.

The table indicates percentages in points rather than in decimal form.

Table a.4 Total GDP in 17 countries, 1897-1913-1921-1938-1949-1973-1986. 1913 indices = 100

	1897	1913	1921	1938	1949	1973	1986
Australia (AUS)	61	100	108	150	213	649	948
Austria (A)	68	100	73	103	96	357	473
Belgium (B)	73	100	98	126	140	371	469
Canada (CDN)	49	100	105	154	288	956	1,497
Denmark (DK)	60	100	111	186	232	594	779
Finland (SF)	n.d.	100	98	203	239	757	1,095
France (F)	74	100	87	125	136	463	616
Germany (D)	66	100	94	182	152	655	836
Italy (I)	64	100	103	154	161	586	848
Japan (J)	68	100	144	272	184	1,611	2,673
Netherlands (NL)	n.d.	100	124	178	235	715	917
Norway (N)	67	100	119	212	283	725	1,216
Spain (E)	n.d.	100	118	140	n.d.	499	650
Sweden (S)	61	100	108	195	269	662	847
Switzerland (CH)	n.d.	100	n.d.	161	203	575	648
United Kingdom (GB)	78	100	92	134	157	309	389
United States (USA)	54	100	120	166	272	656	915

Table a.5 Per-capita GDP in 17 countries, 1897-1913-1921-1938-1949-1973-1986. 1913 indices = 100

	1897	1913	1921	1938	1949	1973	1986
Australia	83	100	96	105	128	234	288
Austria	81	100	80	103	94	331	439
Belgium	86	100	99	116	125	292	365
Canada	74	100	91	106	163	330	450
Denmark	72	100	102	149	165	357	459
Finland	n.d.	100	94	168	183	491	675
France	76	100	92	124	138	370	463
Germany	81	100	93	162	122	416	538
Italy	71	100	102	128	133	410	568
Japan	82	100	132	195	116	760	1,125
Netherlands	n.d.	100	110	124	146	328	382
Norway	77	100	109	177	214	448	721
Spain	n.d.	100	112	116	n.d.	293	342
Sweden	68	100	102	174	217	457	568
Switzerland	n.d.	100	n.d.	136	169	345	381
United Kingdom	88	100	89	120	133	236	294
United States	68	100	107	125	177	304	372

Table a.6 *Total GDP in 17 countries, 1897-1913-1938-1973-1986. Annual percentage rate of variation*

	1897-1913	1913-1938	1938-1973	1973-1986	1913-1986
Australia	3.1	1.6	4.3	3.0	3.1
Austria	2.4	0.1	3.6	2.2	2.2
Belgium	2.0	0.9	3.1	1.8	2.1
Canada	4.6	1.7	5.4	3.5	3.8
Denmark	3.2	2.5	3.4	2.1	2.9
Finland	n.d.	2.9	3.8	2.9	3.3
France	1.9	0.9	3.8	2.2	2.5
Germany	2.6	2.4	3.7	1.9	3.0
Italy	2.8	1.7	3.9	2.9	3.0
Japan	2.4	4.1	5.2	4.0	4.6
Norway	2.5	3.1	3.6	4.1	3.5
Netherlands	n.d.	2.3	4.1	1.9	3.1
Spain	n.d.	1.4	3.7	2.1	2.6
Sweden	3.1	2.7	3.6	1.9	3.0
Switzerland	n.d.	1.9	3.7	0.9	2.6
United Kingdom	1.6	1.2	2.4	1.8	1.9
United States	3.9	2.0	4.0	2.6	3.1
average	2.8	2.0	3.8	2.5	2.9
range of variation	3.0	4.0	2.9	3.1	2.7
standard deviation	0.8	0.9	0.7	0.8	0.6

Table a.7 *Per-capita GDP in 17 countries, 1897-1913-1938-1973-1986. Annual percentage rate of variation*

	1897-1913	1913-1938	1938-1973	1973-1986	1913-1986
Australia	1.2	0.2	2.3	1.6	1.5
Austria	1.3	0.1	3.4	2.2	2.0
Belgium	0.9	0.6	2.7	1.7	1.8
Canada	1.9	0.2	3.3	2.4	2.1
Denmark	2.1	1.6	2.5	2.0	2.1
Finland	n.d.	2.1	3.1	2.5	2.6
France	1.7	0.9	3.2	1.7	2.1
Germany	1.3	1.9	2.7	2.0	2.3
Italy	2.2	1.0	3.4	2.5	2.4
Japan	1.2	2.7	4.0	3.1	3.4
Netherlands	n.d.	0.9	2.8	1.2	1.9
Norway	1.6	2.3	2.7	3.7	2.7
Spain	n.d.	0.6	2.7	1.2	1.7
Sweden	2.4	2.2	2.8	1.7	2.4
Switzerland	n.d.	1.2	2.7	0.8	1.8
United Kingdom	0.8	0.7	2.0	1.7	1.5
United States	2.4	0.9	2.6	1.6	1.8
average	1.6	1.2	2.9	2.0	2.1
range of variation	1.6	2.6	2.0	3.0	1.9
standard deviation	0.5	0.8	0.5	0.7	0.5

Table a.8 *Per-capita GDP in 17 countries, 1897-1913-1921-1938-1949-1973-1986. Relative level in PPP (USA = 100)*

	1897	1913	1921	1938	1949	1973	1986
Australia	110	90	81	76	65	70	70
Austria	65	54	41	45	29	59	64
Belgium	83	66	61	61	47	63	65
Canada	84	77	66	66	71	84	94
Denmark	63	60	57	71	56	70	74
Finland	n.d.	38	34	51	39	62	69
France	63	57	49	56	44	69	70
Germany	60	50	44	65	35	69	73
Italy	45	43	41	44	33	58	66
Japan	28	24	29	37	15	59	71
Netherlands	n.d.	66	68	65	54	71	68
Norway	50	44	45	62	53	65	85
Spain	n.d.	51	53	47	n.d.	49	47
Sweden	50	50	48	70	62	76	77
Switzerland	n.d.	85	n.d.	92	81	96	87
United Kingdom	110	85	71	82	64	66	67
United States	100	100	100	100	100	100	100
range of variation	82	76	71	63	85	51	53
standard deviation	25	20	18	17	21	13	12

Table a.9 Rate of variation of GDP and of the population in 87 countries, 1897-1913-1938-1973-1986. Average value, indices of variability and numerical results of regression analysis

	average	range of variation	standard deviation	regression line
1897-1913 ^a				
$\dot{y}$	1.63	1.64	0.52	$\dot{y} = 2.04 - 0.0058 \cdot y_0$
$\dot{Y}$	2.79	2.99	0.79	$\dot{Y} = 2.52 + 0.0040 \cdot y_0$
$\dot{P}$	1.14	2.44	0.59	$\dot{P} = 0.47 + 0.0096 \cdot y_0$
1913-1938				
$\dot{y}$	1.19	2.59	0.79	$\dot{y} = 2.72 - 0.0249 \cdot y_0$
$\dot{Y}$	1.97	3.97	0.92	$\dot{Y} = 3.22 - 0.0204 \cdot y_0$
$\dot{P}$	0.77	1.51	0.46	$\dot{P} = 0.48 + 0.0047 \cdot y_0$
1938-1973				
$\dot{y}$	2.87	2.01	0.46	$\dot{y} = 4.14 - 0.0198 \cdot y_0$
$\dot{Y}$	3.84	2.94	0.66	$\dot{Y} = 4.52 - 0.0106 \cdot y_0$
$\dot{P}$	0.94	1.78	0.47	$\dot{P} = 0.36 + 0.0091 \cdot y_0$
1973-1986				
$\dot{y}$	1.97	2.97	0.70	$\dot{y} = 3.35 - 0.0197 \cdot y_0$
$\dot{Y}$	2.45	3.13	0.81	$\dot{Y} = 3.44 - 0.0142 \cdot y_0$
$\dot{P}$	0.47	1.42	0.41	$\dot{P} = 0.09 + 0.0055 \cdot y_0$
1913-1986				
$\dot{y}$	2.13	1.91	0.47	$\dot{y} = 3.32 - 0.0194 \cdot y_0$
$\dot{Y}$	2.95	2.73	0.63	$\dot{Y} = 3.70 - 0.0123 \cdot y_0$
$\dot{P}$	0.80	1.56	0.43	$\dot{P} = 0.36 + 0.0072 \cdot y_0$

Legend:

$\dot{y}$ = annual percentage variation of per-capita GDP

$\dot{Y}$ = annual percentage variation of total GDP

$\dot{P}$ = annual percentage variation of the population

y_0 = level of per-capita GDP at the beginning of the period (percentage of the USA level)

^a 13 countries

Note:

The table indicates percentages in points rather than in decimal form.

Fig. a.1. Rate of variation of GDP and of the population in 87 countries, 1960-1973, according to the initial level of per-capita GDP.

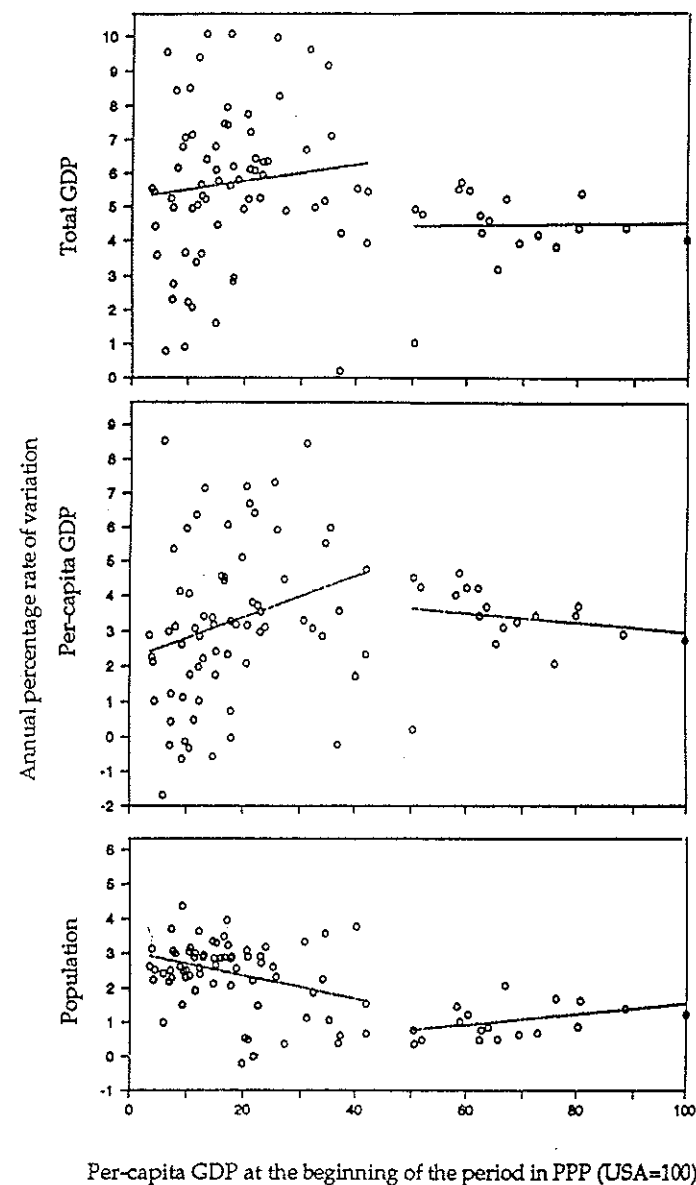


Fig. a.2. Rate of variation of GDP and of the population in 87 countries, 1973-1985, according to the initial level of per-capita GDP.

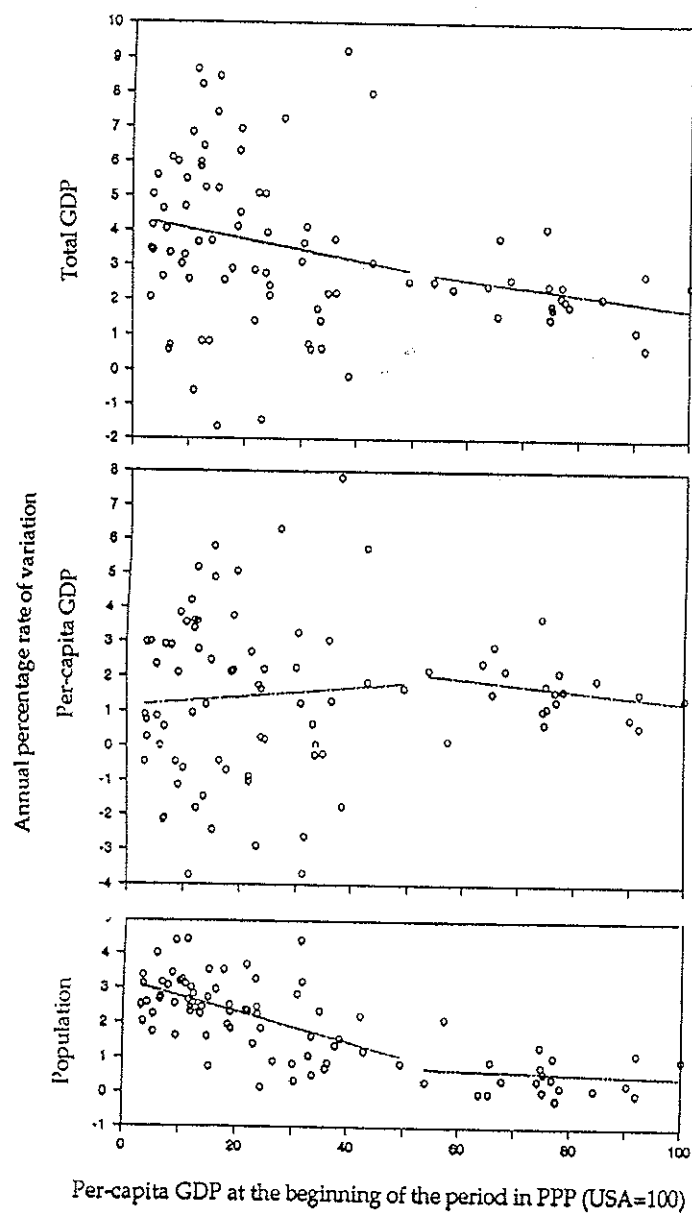


Fig. a.3. Rate of variation of Per-capita GDP in 87 countries, 1973-1985, according to the rate of variation of the population.

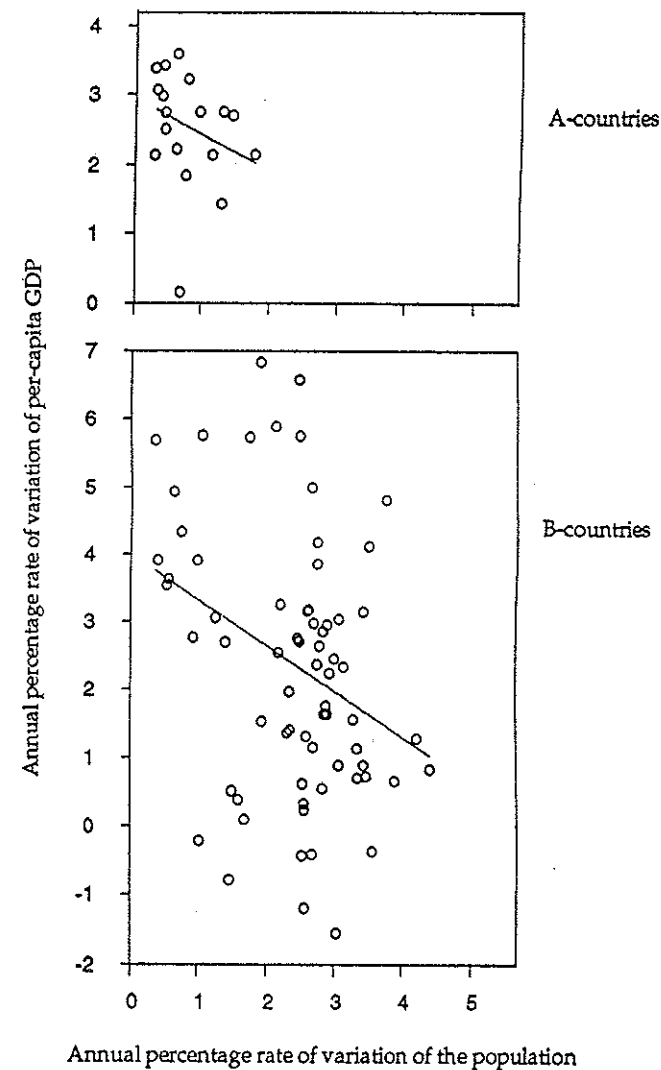


Fig. a.4. Rate of variation of GDP and of the population in 13 countries, 1897-1913, according to the initial level of per-capita GDP.

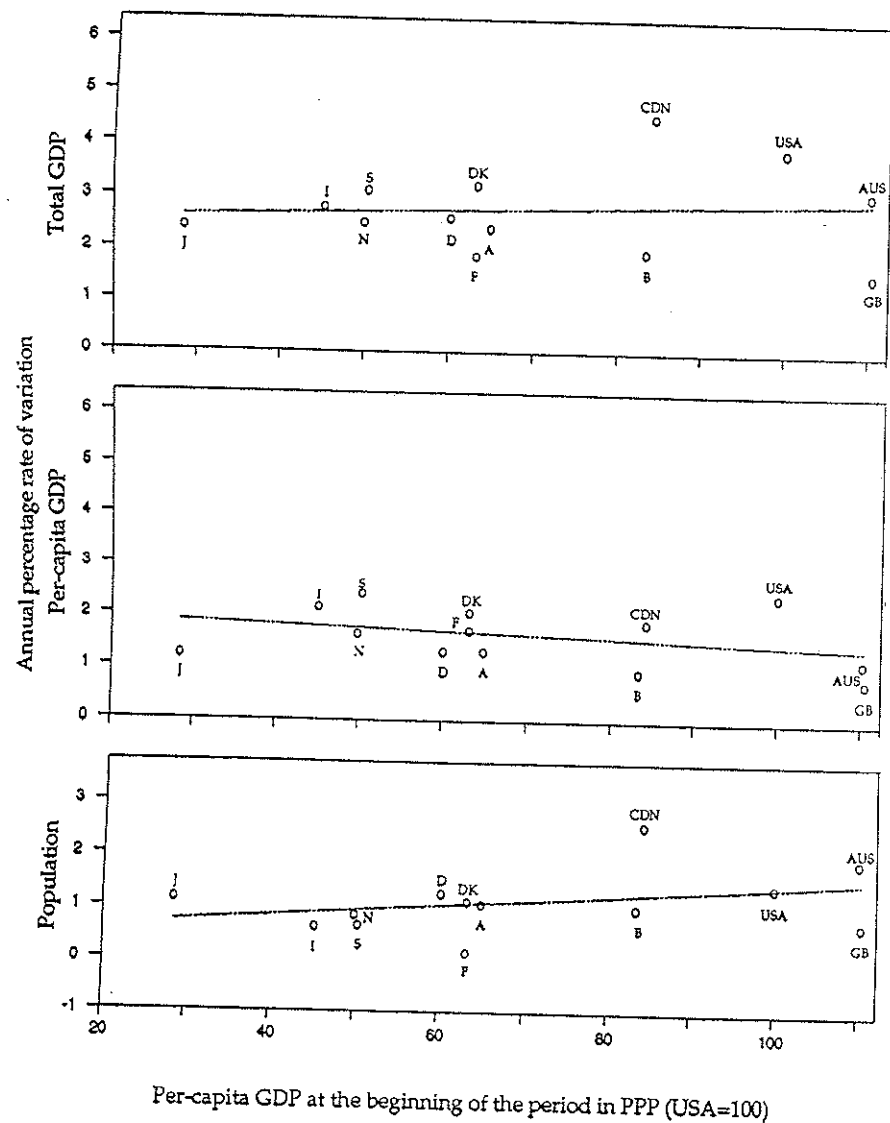


Fig. a.5. Rate of variation of GDP and of the population in 17 countries, 1913-1938, according to the initial level of per-capita GDP.

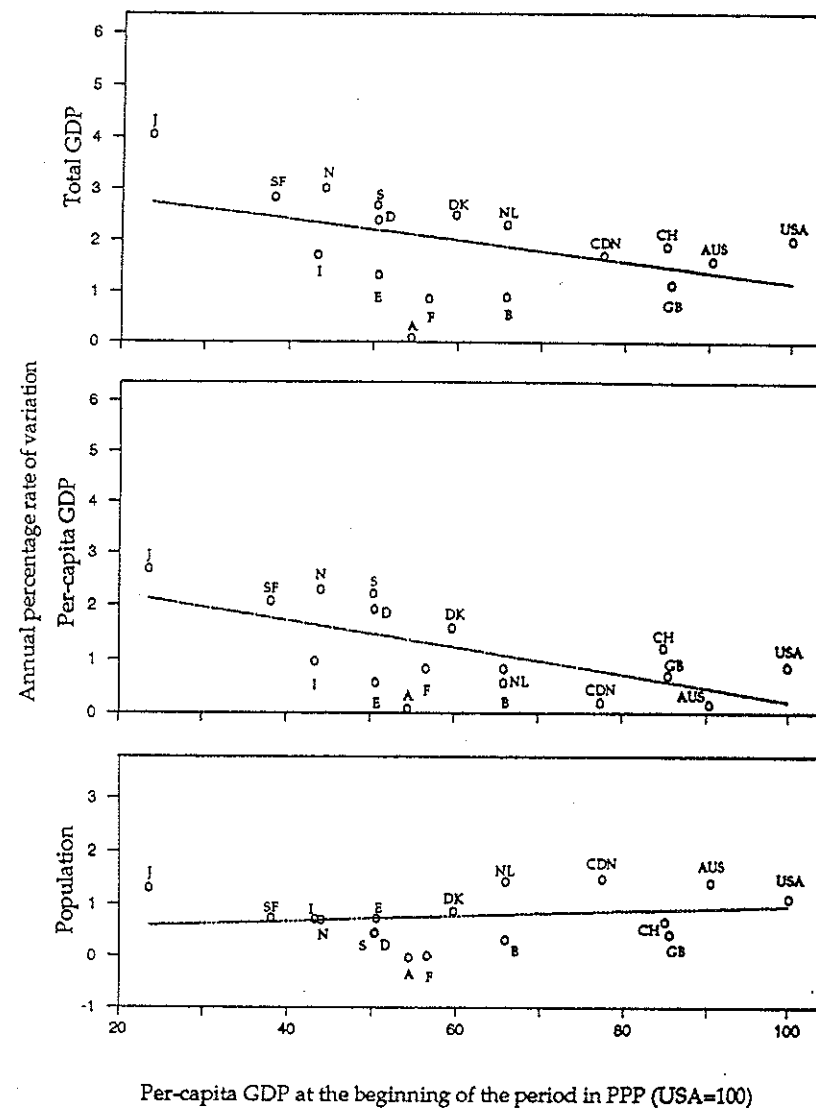


Fig. a.6. Rate of variation of GDP and of the population in 17 countries, 1938-1973, according to the initial level of per-capita GDP.

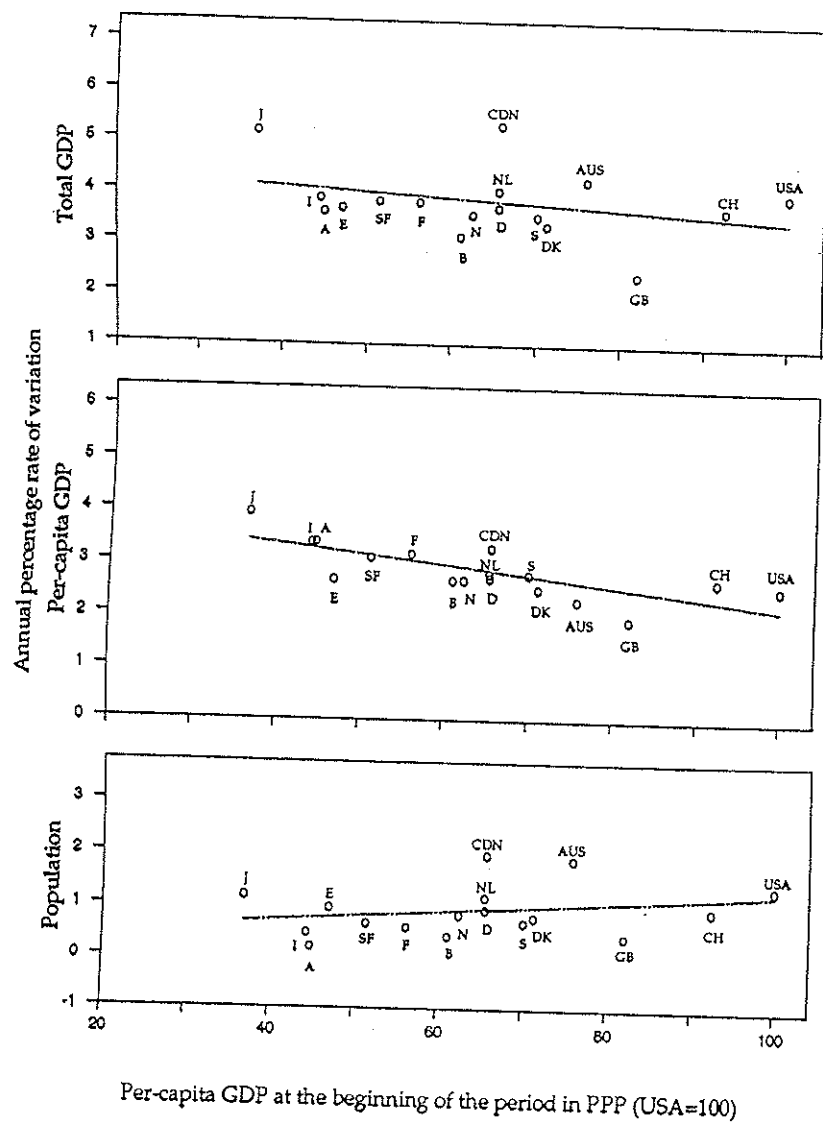


Fig. a.7. Rate of variation of GDP and of the population in 17 countries, 1973-1986, according to the initial level of per-capita GDP.

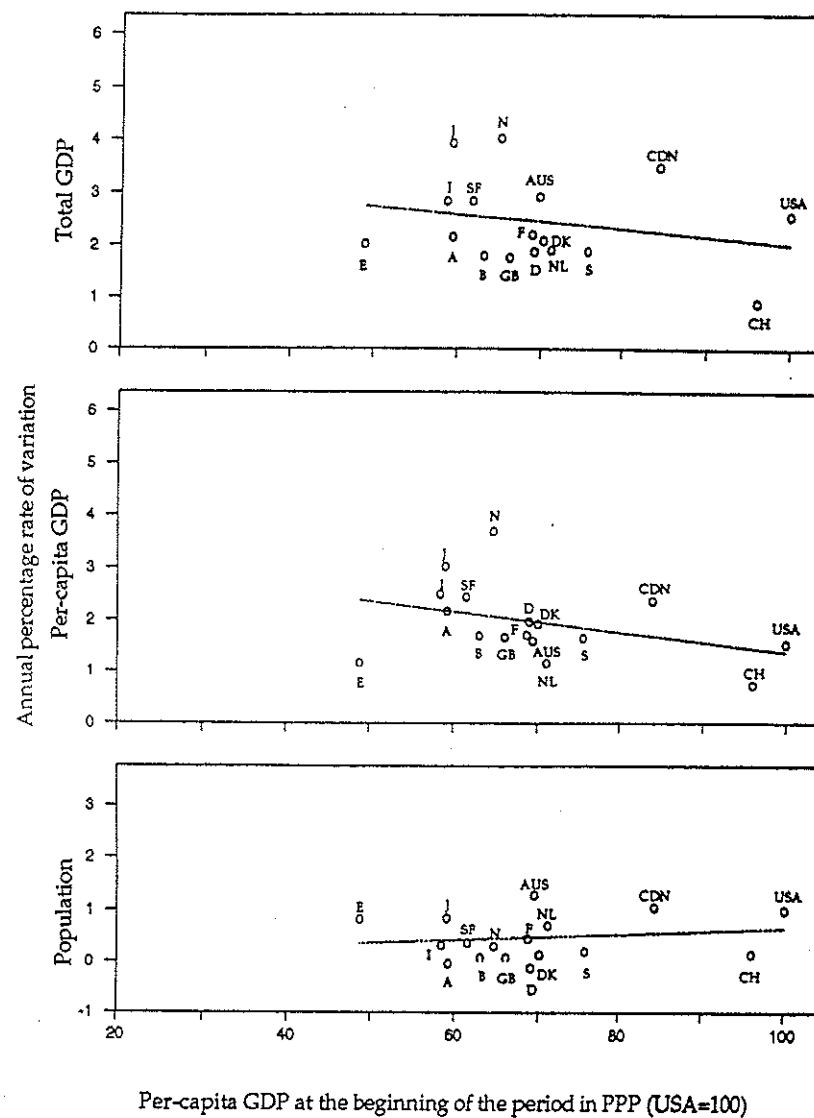
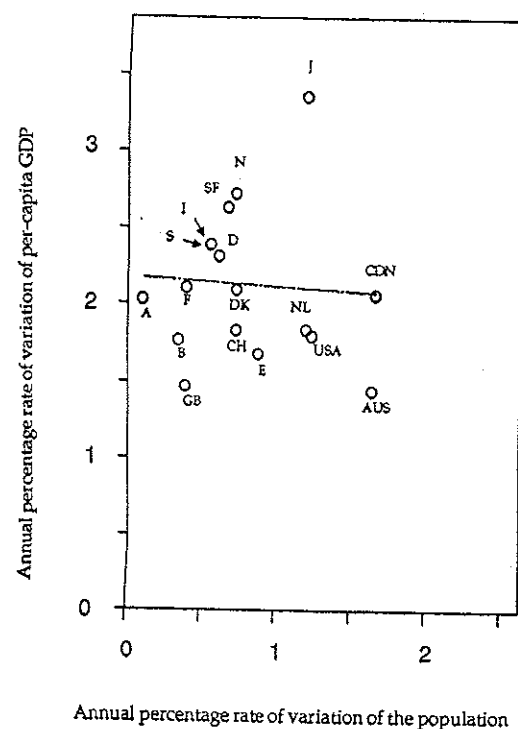


Fig. a.8. Rate of variation of per-capita GDP in 17 countries, 1913-1986, according to the rate of variation of the population.



1.2. Statistics on services

Notes on the tables

Table a.10. The data on employment and on value added at current prices are based on Fuà [1992] for the years from 1897 to 1949; on ISCO [1990] for 1973; on ISCO [1991] for 1990.

The rates of variation of value added at constant prices have been calculated on series at 1938 prices for the period 1897-1938; at 1963 prices for the period 1949-73; at 1980 prices for the period 1973-90. The 1938 and 1963 price series are taken from Fuà [1992]; those at 1980 prices from ISCO [1990]. To obtain the value for 1973 at 1963 prices, I took the value for the year 1972 at 1963 prices

published in ISCO [1973] and multiplied it by the ratio between the year 1973 and the year 1972 of the 1970 price series published in ISCO [1986]. Using the same procedure I calculated the value of the year 1990 at 1980 prices drawing on ISCO [1989 and 1991].

The value added of the economy as a whole is gross of imputed banking services.

Table a.11. The elaboration is based on ISTAT [1989a] and on *Relazione Generale* [1991]. The rates of variation of values at constant prices have been calculated by concatenating the 1980 indices on base 1970 at 1980 prices with the 1990 indices on base 1980 at 1985 prices.

Table a. 12. The figures are taken from an elaboration by Ercolani [1990: 19] based on ISTAT [1989a] for Italy and on OECD for Japan, the United States and Sweden, and on EUROSTAT for the other countries. In the case of the United States, market services include the branch "electricity, gas and water".

Table a.13. Elaboration based on OECD [1990c].

Table a.10 Relative sizes of the production of services in the Italian economy 1897-1913-1921-1938-1949-1973-1990

	1897	1913	1921	1938	1949	1973	1990
Percentage share of services in the overall economy							
Labour units employed	16	18	18	23	26	46	61
Value added at factor cost (current prices)	35	36	32	43	41	52	65
Relative level of value added at current prices per labour unit (overall economy = 100)							
Services	215	195	171	190	157	116	107
Production of commodities	78	79	84	73	80	88	89
	1897-13		1921-38		1949-73		1973-90
Average annual percentage variation of value added at constant prices per labour unit							
Services	1.9		0.6		2.2		0.6
Production of commodities	2.5		2.1		5.6		3.3
Overall economy	2.5		1.8		4.5		1.9

Table a.11 *Services in the Italian national accounts, 1970-1990*

	Value added at market prices, current price		Annual percentage rate of variation 1970-1990							
	in % of total		in millions of lire per labour unit 1990	Value added		Implicit price index	Labour units employed	Value added per labour unit		
	1970	1990		at current prices	at constant prices			at current prices	at constant prices	
Agriculture	82	34	18.4	10.8	0.5	10.3	-2.60	13.8	3.2	
Industry	433	351	62.1	14.7	2.8	11.6	-0.46	15.2	3.3	
Market services	401	522	64.3	17.4	3.7	13.2	2.75	14.3	0.9	
Trade, Hotels and Restaurants	165	199	48.8	17.0	3.3	13.3	1.92	14.8	1.3	
Transport and Communications	58	62	50.4	16.3	4.5	11.3	1.94	14.1	2.6	
Financial services and Insurance	35	54	158.1	18.5	3.4	14.6	3.74	14.2	-0.3	
Real estate	57	74	---	17.4	3.5	13.4	---	---	---	
Other market services	86	132	53.6	18.4	4.5	13.3	5.03	12.7	-0.5	
Non-market services	112	145	42.0	17.4	2.1	15.0	2.14	15.0	-0.1	
Government	102	136	46.0	17.6	n.d.	n.d.	2.16	15.1	n.d.	
Other non-market services	10	9	18.5	15.2	n.d.	n.d.	2.05	12.9	n.d.	
- Imputed banking services	-28	-52	---	19.5	3.6	15.3	---	---	---	
Total net of imputed banking services	1,000	1,000	52.5	15.9	3.0	12.6	0.79	15.0	2.2	

Table a.12 *Annual percentage rate of variation of output per employed person in 10 countries, 1970-86. Comparison between the production of commodities and services*

	Production of commodities	Production of services	
		market	non-market
Belgium	5.0	1.2	0.7
Denmark	3.4	1.5	-0.1
France	3.7	2.0	1.0
Germany	2.9	2.7	0.4
Italy	3.6	0.8	-0.1
Japan	5.0	3.0	1.6
Netherlands	3.7	1.9	0.4
Sweden	3.2	1.4	-0.7
United Kingdom	3.5	1.6	0.3
United States	2.1	0.4	0.7

Table a.13 The growth of productivity of services distinguished by branch in 9 countries, 1987 indices (1977 = 100)

	Manufacturing			Trade			Transport			Financial services			Credit			Community services			Government		
	Y	L	Y/L	Y	L	Y/L	Y	L	Y/L	Y	L	Y/L	Y	L	Y/L	Y	L	Y/L	Y	L	Y/L
Denmark	121	105	115	121	93	130	115	110	128	128	152	85	126	193	65	109	104	135	128	105	105
Finland	155	93	147	146	106	138	147	109	174	144	144	121	182	133	137	140	120	140	140	135	103
France ^a	100	80	117	117	104	112	154	109	143	125	115	115	---	---	---	---	---	125	120	105	105
Germany ^b	108	93	125	118	102	116	139	101	142	120	119	119	148	123	120	161	133	119	114	104	104
Italy ^d	136	86	154	110	126	87	154	120	146	177	83	---	---	---	---	---	---	116	116	100	100
Japan ^c	191	105	170	170	109	156	134	101	166	131	127	127	---	---	---	155	144	128	107	120	120
Norway	109	87	121	121	120	101	134	101	149	189	79	79	130	165	79	129	122	149	137	109	109
Netherlands ^e	106	88	124	126	112	112	---	---	---	---	---	---	---	---	---	---	---	105	111	110	101
United States	131	97	135	136	129	106	131	115	145	175	83	83	149	157	95	143	136	114	116	99	99

^a In France, the item "financial services" includes community services and credit.

^b In Germany, the item "community services" includes community services and credit.

^c In Japan, the item "financial services" includes credit.

^d In Italy, the item "financial services" includes credit.

^e In the Netherlands, the item "manufacturing" includes mining. The item "trade" includes transport, financial services, credit and community services (including repairs).

Legend:

Y = value added at constant prices; L = employed persons

Notes on intermediate services

In Chapter 7, I explained that there are no satisfactory techniques for measuring at constant prices the growth of output (and therefore of productivity) in most service activities. The makeshift techniques currently used do not capture the "true" amount of growth (which is a problematic notion in any case) and presumably - in the majority of cases - underestimate it.

This suspicion of an underestimation of growth with reference to services used as an input to the production of commodities prompts the following considerations.

If the available statistics at constant prices do indeed underestimate the growth of value added (and of productivity) in activities producing intermediate services, this has the specular effect of overestimation of the growth of value added⁶ (and of productivity) in the productive activities that use these services.⁷

Two conclusions can be drawn. First: when we calculate the growth of GDP, the error committed in measuring intermediate services is elided (but not so the error committed in measuring final services). Second: when we calculate the difference between the growth of productivity in services and the growth of productivity in commodity-producing activities, the error committed in measuring intermediate services is duplicated.

A considerable amount of recent literature has addressed the phenomenon of the intermediate services (also called "services to

6 I refer to all cases in which value added at constant prices is calculated using the orthodox procedure (see appendix 3.1).

7 Ercolani draws attention to the fact that the unsatisfactory measurement of the quantity of services produced has repercussions on the estimation of commodities, not only (as indicated in the main text) as regards value added but also as regards final demand. Estimation of final demand may be affected in particular when the price of the commodity paid by the purchaser includes assistance and maintenance services. For example, in the recent past the car manufacturing companies have considerably increased the conditions of guarantee offered to purchasers, and it is probable that most of the statistical offices of the world have not taken account of this extension (which is equivalent to an increase in the quantity of goods sold, price remaining equal) in calculating the indices of quantity and price for the good "car".

production" or "services purchased by firms"), and reports that the phenomenon is in rapid expansion in the current evolutionary phase of the advanced economies. According to available estimates, in Italy between one-quarter and one-third of the overall output from services is today employed as an input for productive activities.

For a concise treatment of the phenomenon of intermediate services, with a survey of the international literature, see Ercolani [1990: 40-52]. As regards Italy, especial mention should be made of a series of studies by Momigliano and Siniscalco [Momigliano and Siniscalco 1986; Siniscalco 1988; see also Pellegrini 1988 and Mazziotta 1989]. Grubel and Walker have recently published an analysis of intermediate services in the United States, although I am not convinced by their methodology.

1.3. Statistics on average life expectancy

The three tables that follow constitute the basis for figures 5 and 6 in Chapter 5. They comprise all the countries for which I possess sufficiently comparable information on life expectancy at birth and on per-capita GDP for at least one of the periods 1930-38, 1950-55, 1980-85 (or years close to them) and preferably all of them. Obviously, the number of countries for which I have sufficient information increases from one period to the next.

The data on life expectancy at birth are all taken from UN [1957a, 1980 and 1988].

The data on GDP are derived from the following sources:

- (i) for the 17 countries in my historical series 1897-1986 from the same sources as used to compile that series;
- (ii) for all the other countries, the values for the 1950s and 1980s are based on the CGDP series constructed by Summers and Heston [1988]. The values for the 1930s are my conjectural estimations based on a variety of sources, in particular the estimates by Bairoch [1981: 10] with reference to 1929.

Table a.14 *Life expectancy at birth and Per-capita GDP in 21 countries, 1930s.*

	Reference period of life-expectancy table	Life expectancy in years	Per-capita GDP in 1938, expressed in 00 1980 US dollars (PPP)
Australia	1938	65.3	35
Austria	1938	59.0	21
Belgium	1938	57.9	31
Canada	1938	61.1	32
Denmark	1938	62.3	36
Egypt	1936-38	38.6	4
Finland	1938	55.0	24
France	1938	56.9	27
Germany	1938	59.4	32
Greece	1926-30	50.0	14
India	1921-31	26.7	4
Italy	1938	54.9	18
Japan	1938	47.0	17
Netherlands	1938	64.6	30
Norway	1938	64.1	32
Spain	1938	50.0	20
Sweden	1938	63.5	31
Switzerland	1938	61.1	39
Taiwan	1926-31	40.1	4
United Kingdom	1938	60.4	36
United States	1938	59.4	43

Table a.15 Life expectancy at birth and per-capita GDP in 45 countries, 1950s.

	Reference period of life-expectancy table	Life expectancy in years	Per-capita GDP in 1938, expressed in 00 1980 US dollars (PPP)
Australia	1953-55	69.9	46
Austria	1949-51	64.4	23
Belgium	1959-63	70.6	46
Bolivia	1950-55	38.0	10
Brazil	1955-60	56.1	9
Canada	1950-52	68.6	55
Colombia	1950-52	45.1	12
Costa Rica	1949-51	55.9	12
Cyprus	1950-55	67.1	15
Denmark	1951-55	71.2	43
Dominican Republic	1950-55	45.2	8
Ecuador	1949-51	52.0	9
El Salvador	1949-51	51.2	9
Finland	1951-55	66.6	32
France	1950-51	66.5	32
Germany	1958-59	69.3	47
Greece	1955-59	68.1	14
Guatemala	1949-51	43.7	12
Honduras	1950-55	42.2	7
Iceland	1951-60	72.9	42
India	1951-60	41.2	5
Ireland	1950-52	65.8	21
Italy	1950-53	65.5	21
Japan	1951-55	64.4	14
Kenya	1950-55	43.4	4
Korea	1955-60	52.4	7
Luxembourg	1950-55	66.1	52
Malaysia	1956-58	57.0	10
Malta	1955-57	67.3	12
Morocco	1950-55	43.0	5
Netherlands	1951-55	72.2	37
New Zealand	1950-52	69.2	43
Norway	1951-55	72.9	42
Pakistan	1950-55	39.1	5
Panama	1952-54	61.8	11
Paraguay	1950-55	51.6	10
Philippines	1950-55	46.1	7
Portugal	1955-56	61.3	12
Spain	1950	62.1	16
Sri Lanka	1950-54	57.0	8
Sweden	1951-55	72.0	42
Switzerland	1948-53	68.6	51
Thailand	1950-55	45.2	6
Turkey	1950-51	48.2	9
United Kingdom	1950-52	68.7	41
United States	1950-55	69.0	69

Table a.16 Life expectancy at birth and per-capita GDP in 55 countries, 1980s.

	Reference period of life-expectancy table	Life expectancy in years	Per-capita GDP in 1938, expressed in 00 1980 US dollars (PPP)
Argentina	1975-80	68.8	42
Australia	1985	75.5	89
Austria	1985	73.9	89
Belgium	1979-82	73.4	92
Bolivia	1980-85	50.8	13
Botswana	1981	56.0	15
Brazil	1980-85	63.5	32
Canada	1980-82	75.4	113
Chile	1985	68.4	35
Colombia	1980-85	63.7	26
Costa Rica	1980-85	73.1	27
Cyprus	1979-81	74.1	42
Denmark	1984-85	74.6	107
Dominican Republic	1980-85	62.7	18
El Salvador	1980-85	64.9	12
Finland	1985	74.3	92
France	1983-85	75.1	98
Germany	1983-85	74.5	103
Greece	1980	74.3	44
Guatemala	1979-80	57.3	19
Hong Kong	1985	76.5	91
Iceland	1983-84	77.1	86
India	1976-80	52.3	6
Indonesia	1980-85	53.6	12
Ireland	1980-82	72.9	50
Israel	1984	74.9	62
Italy	1981	74.4	72
Ivory Coast	1980-85	50.5	10
Japan	1985	77.7	94
Kenya	1980-85	53.0	6
Korea	1978-79	65.9	25
Luxembourg	1980-82	73.4	101
Malaysia	1984	70.2	36
Malta	1985	73.4	53
Morocco	1980-85	58.3	12
Netherlands	1984-85	76.3	90
New Zealand	1985	73.9	80
Norway	1984-85	76.2	124
Pakistan	1976-78	59.1	9
Panama	1980-85	71.0	29
Paraguay	1980-85	65.2	20
Philippines	1980-85	62.0	15
Portugal	1979-82	71.8	37
Senegal	1980-85	43.3	7
Singapore	1980	71.4	58

Table a.15 (continue)

Spain	1980	75.6	61
Sri Lanka	1981	69.7	12
Sweden	1985	76.7	99
Switzerland	1984-85	76.8	104
Tanzania	1980-85	51.0	3
Tunisia	1980-85	60.6	19
Turkey	1980-85	61.7	24
United Kingdom	1983-85	74.5	85
United States	1984	74.7	120
Zimbabwe	1980-85	55.8	10

Having completed these tables and Chapter 5, I read an excellent book by Livi Bacci which, *inter alia*, conducts international comparisons of life expectancy since 1750 and analyses the relationship between life expectancy and per-capita GDP [Livi Bacci 1989: 109-16]. As regards the latter relationship, since his express intent is to restrict himself to only preliminary analysis, Livi Bacci does not show how it shifts over time. Apart from this, I find in the picture he paints an important support and supplement to my conclusions, and I warmly recommend his book. I ought also to mention the work done on the relationship between mortality and development by Preston. His approach differs from mine, but his conclusion comes close. See Preston [1976 and 1985]; also World Bank [1993: 34-5].

1.4. Price indices

The two tables that follow are complementary to figure 9 in Chapter 8, and likewise refer to the Italian economy in the period 1970-1989.

Table a.17 contains the annual rates of variation of 13 different price indices. The sources are respectively ISCO [1990] for the implicit indices, and ISTAT [1989b, 1989c and 1990a] for the Laspeyres indices.

Table a.18 compares the rates of variation of six measures alternative to real income. Considered as income is value added at market prices net of i.b.s. [ISCO 1990]. Considered as alternative measures of its real content are, respectively, the conventional measure at constant prices and five different measures of

purchasing power calculated by dividing the income at current prices by five of the implicit price indices set out in table a.17. The above-mentioned figure 9 gives a graphic representation of part of table a.18, just described.

There are considerable differences of trend among the price indices given in table a.17.

Beginning with the implicit indices of value added, one notes that those for the service sector exhibit annual rates of increase which are almost invariably higher than those for the commodity sector and for the economy as a whole.⁸

Within the service sector there are not negligible differences between one branch and another. Some indication of this is provided by table a.11 in appendix 1.2., which shows that it is the branch of non-market services which displays the highest long-term increase in its implicit price index.⁹

Turning to examination of the implicit price indices by category of resource use, one finds that the rates of increase of the prices of household consumption goods come very close to those of GDP if we consider them *en bloc*, whereas they are systematically lower as regards food. This is explained by the fact that spending on food has low service content (which consists entirely of distributive margins), while the service component has considerable weight in the rest of household consumption.

8 In the entire period examined there are only three years - 1973, 1976 and 1982 - in which price rises in the service sector are higher than those in the economy as a whole. One notes the curious phenomenon in 1982 of an rate of increase of the overall price level which exceeds both that of services and of commodities. This is explained by the fact that in that year there was an extremely modest increase in the deflator of the i.b.s.. Although these are included in calculation of services, they are subtracted when one passes to calculation of the value added of the economy as a whole. This prompts me to point out that in the entire period examined the i.b.s. deflator, like the overall credit deflator, displays marked upswings and downswings with respect to the average behaviour of the economy. This is not surprising, though, when one considers how these estimates are made (see section 2 of Chapter 7).

9 This holds for all the years of the period considered, apart from 1974, 1975, 1982, 1984 and 1986.

Table a.17 *Some price indices compared, Italy 1970-1989. Annual percentage rate of variation*

	1970- -1980	1980- -1989	1981	1982	1983	1984	1985	1986	1987	1988	1989
IMPLICIT PRICE INDICES OF THE NATIONAL ACCOUNTS											
Total value added net of i.b.s.	14.8	10.6	18.8	17.0	14.5	11.4	9.1	7.9	5.7	5.9	6.1
Production of commodities	14.1	9.1	16.2	16.5	12.5	9.8	7.7	6.3	3.6	4.5	5.6
Production of services	15.8	11.6	21.1	16.7	16.4	12.5	9.9	9.3	6.4	7.1	6.2
Household consumption	14.6	10.2	18.1	16.9	15.1	11.8	9.0	5.8	5.0	5.2	6.0
of which:											
Food	14.1	8.7	16.6	15.3	10.9	9.2	8.5	5.5	3.8	3.6	6.0
Gross fixed investment	16.6	9.1	21.5	16.0	11.6	9.1	8.2	3.4	3.5	4.8	10.5
of which:											
Machinery, Equipment and Vehicles	14.3	8.3	18.4	15.1	10.2	8.9	7.9	3.2	3.3	3.3	5.2
LASPEYRES PRICE INDICES											
Consumers' prices paid by blue-collar and white-collar households	14.0	10.1	18.7	16.4	15.0	10.4	10.9	6.1	4.6	5.0	6.6
of which:											
Food	13.3	9.1	16.3	16.0	12.9	9.2	8.5	5.3	4.0	4.0	6.1
Prices charged by the producers of industrial goods	n.d.	n.d.	14.8	13.1	10.2	2.7	7.3	0.2	3.0	3.6	n.d.
of which:											
Final investment goods	n.d.	n.d.	11.6	11.5	9.6	1.9	7.8	7.0	5.3	3.1	n.d.

Table a.18 *Some measures of "real" income compared, Italy 1970-1989. Annual percentage rate of variation*

	1970- -1980	1980- -1989	1981	1982	1983	1984	1985	1986	1987	1988	1989
Value added at current prices	19.1	13.1	19.8	17.3	15.9	14.7	11.9	10.6	8.8	10.2	9.4
V. A. at 1980 prices (conventional measure)	3.8	2.3	0.9	0.3	1.2	3.0	2.6	2.5	3.0	4.1	3.1
Purchasing power with reference to the implicit price index of:											
production of commodities	4.4	3.7	3.1	0.7	3.0	4.5	3.9	4.0	5.0	5.6	3.6
household consumption	3.9	2.6	1.4	0.3	0.7	2.6	2.7	4.5	3.6	4.8	3.2
household food consumption	4.4	4.0	2.7	1.7	4.5	5.0	3.1	4.8	4.8	6.5	3.2
capital expenditure	2.2	3.6	-1.4	1.1	3.9	5.1	3.4	7.0	5.1	5.2	-1.0
investment in machines, equipment and vehicles	4.2	4.5	1.2	1.9	5.2	5.3	3.7	8.4	5.3	6.8	4.0

Similarly, inspection of capital expenditure shows that the item "machines, equipment and vehicles" - also characterized by low service content - exhibits price rises systematically lower than rises in the price index of GDP,¹⁰ although this is not the case of overall capital expenditure.

Finally, the Laspeyres indices show that the behaviour of the consumers' price indices is very similar to that of the corresponding implicit indices of the national accounts. No comment is possible on the Laspeyres indices for producers' prices, since corresponding indices are not published in the national accounts.

¹⁰ There are three exceptional years during the period considered: 1974, when the price rise for this item was exceptionally high (+30% as opposed to +19% for the GDP implicit price index), and 1975 and 1976, years in which the rise was only slightly higher than the increase in GDP implicit price index.

2. ANALYTICAL NOTES

2.1. The external constraint

I use the symbols as defined below, with the specification that the subscript a indicates that the symbol refers to the individual country examined, while the subscript u indicates that the symbol refers to all countries considered *en bloc*.

Y	= GDP
X	= exports of goods
M	= imports of goods
$R_a = X_a / M_a$	= export/import ratio of country a
$K_a = X_a / M_u$	= share of world market held by country a

The upper-case letters express the values of the variables in year 0; the corresponding lower-case letters express the (compound) annual percentage rate of variation of the variables between year 0 and year t .

The Greek letter ϵ denotes the ratio m / y = import elasticity to GDP.

I shall examine the relations that tie the variations in one country's GDP to those in the world's GDP. I begin with the export/import ratio $R_a = X_a / M_a$ at year zero.

After t years this ratio will have become:

$$[1] \quad R_a(1+r_a)^t = \frac{X_a(1+x_a)^t}{M_a(1+m_a)^t}$$

Specifying the relations between imports and GDP, and exports by a and imports by u , [1] can be rewritten as follows:

$$[2] \quad (1+r_a)^t = \frac{(1+\epsilon_u \cdot y_u)^t \cdot (1+k_a)^t}{(1+\epsilon_a \cdot y_a)^t} = \frac{(1+\epsilon_u \cdot y_u)^t \cdot \frac{(1+x_a)^t}{(1+m_u)^t}}{(1+\epsilon_a \cdot y_a)^t}$$

This gives the following approximate equality between the rates of variation:

$$[3] \quad y_a \cong y_u \cdot \frac{\varepsilon_u}{\varepsilon_a} + (x_a - m_u) \cdot \frac{1}{\varepsilon_a} - r_a \cdot \frac{1}{\varepsilon_a}$$

Formula [3] yields the following conclusion. If one considers a hypothetical country with an export/import ratio kept approximately stable, with an import elasticity close to the world average, and with a rather rigid market share, one finds that this hypothetical country cannot have a rate of variation of GDP very different from the world average.

Formula [3] also enables us to conduct interesting analysis of the real divergences that occur among the rates of variation of GDP of the countries concerned. [3] can, in fact, be rewritten in the following form, which displays the difference between the rate of country *a* and the rate of the world as a whole decomposed into three significant addenda.

$$[4] \quad y_a - y_u \cong \left(\frac{\varepsilon_u}{\varepsilon_a} - 1 \right) \cdot y_u + (x_a - m_u) \cdot \frac{1}{\varepsilon_a} + (m_a - x_a) \cdot \frac{1}{\varepsilon_a}$$

The first addendum measures that part of the difference due to the gap between the import elasticities; the second addendum measures that part due to variations in market share; the third (with negative sign) that part which corresponds to variations in the export/import ratio.

Table a.19 shows the results obtained when this technique is applied to the national accounting data currently available.

Unfortunately, homogeneous information for the world as a whole is lacking, and analysis must therefore be restricted to the OECD countries. This, of course, considerably reduces the logical value of the exercise. The formulae set out above, in fact, start from the premise that what is exported by one country must go to one of the other countries, and that what is imported into one country must come from one of the other countries.

This is necessarily true within the worldwide context as a whole, but it is not true within a more restricted one.

Nevertheless, within the context of the OECD, the bulk of international trade takes place among its member-countries, and not between them and the rest of the world.¹ Thus the premise of the above formulae is infringed only to a limited extent, and the formulae yield information that certainly warrants attention until more rigorous analysis is possible.

Mention must still be made of the degree of approximation of the calculations. In table a.19, the approximation error resulting from application of formula [4] is greater than 0.1% in only 3 out of the 48 decompositions performed.²

2.2. Intrasectoral component and structural component of the variation of productivity

Technique of analysis

I refer to the productivity of an aggregate composed of a number of productive sectors: for example, GDP per worker, or average output per worker in industry. The productivity of the aggregate may vary for two different reasons: because productivity has changed within the individual sectors of which the aggregate is composed (the "intrasectoral component" of the variation of productivity of the aggregate), or because the relative weights of the individual sectors have changed ("structural component"). The task I set myself here is to quantify the two components, for which purpose I employ and develop a technique already used in a previous study of mine (to which the reader is referred for more detailed explanation).³ In broad outline, the decomposition procedure is as follows.

1 According to OECD [1990a], 77% of international trade (imports + exports) by its member-countries in 1987 took place among the countries themselves.

2 Ireland 1973-78, 0.2% error; Iceland 1961-73, 0.2% error; Turkey 1973-87, 0.3% error.

3 See Fuà [1922; especially 221-4].

Table a.19 Annual percentage rate of variation of GDP in 24 OECD countries, 1961-1973-1987, and analysis of deviations away from the average with regard to the external constraint

	1961-1973					1973-1987				
	Rate of variation		Deviation from OECD average due to:			Deviation from OECD average due to:			Total	
	(1)	(2)	import elasticity gap (3)	export share variation (4)	import/export ratio variation (5)	import elasticity gap (3)	export share variation (4)	import/export ratio variation (5)	(2)	(5)
Australia	5.4	0.7	2.7	-1.6	-0.4	0.2	0.6	-0.5	0.3	0.3
Austria	4.9	0.2	-0.1	0.2	0.0	-0.8	0.5	-0.2	-0.5	-0.5
Belgium	4.9	0.2	0.0	0.3	-0.2	-0.3	-0.3	-0.2	-0.9	-0.2
Canada	5.4	0.7	0.7	0.1	0.0	-0.4	0.9	0.3	0.8	0.3
Denmark	4.0	-0.7	0.5	-1.3	0.1	0.9	-0.1	-1.4	-0.7	-0.7
Finland	4.8	0.1	1.0	-1.0	0.0	0.2	0.0	-0.5	0.2	0.2
France	5.3	0.6	-0.4	0.5	0.4	0.0	0.0	-0.5	-0.8	-0.8
Germany	4.2	-0.5	-0.5	-0.2	0.2	-0.6	0.0	-0.5	-0.2	-0.2
Greece	7.3	2.6	0.7	2.2	-0.3	1.6	1.7	-1.2	1.6	1.6
Iceland	5.7	1.0	0.4	-1.6	2.0	0.1	1.2	-1.1	0.8	0.8
Ireland	4.3	-0.4	-0.6	-0.1	0.3	0.7	0.4	-0.8	0.2	0.2
Italy	5.0	0.3	-0.3	0.7	-0.1	2.9	0.4	-0.8	2.9	2.9
Japan	9.2	4.5	1.1	4.5	-1.0	2.5	4.5	-5.4	1.2	1.2
Luxembourg	4.0	-0.7	0.8	-1.2	-0.2	-0.1	-0.5	-0.1	-0.6	-0.6
Netherlands	5.0	0.3	0.0	0.4	0.0	-0.4	-0.3	-0.2	-0.9	-0.9
New Zealand	3.9	-0.8	0.7	-2.5	0.9	-1.5	0.2	-1.6	-1.5	-1.5
Norway	4.2	-0.4	0.6	-1.4	0.3	2.7	0.7	-2.0	1.3	1.3
Portugal	6.7	2.0	0.9	0.6	0.5	0.9	0.6	-1.4	0.0	0.0
Spain	6.8	2.1	-0.9	1.4	1.4	-0.8	0.9	-0.6	-0.5	-0.5
Sweden	4.0	-0.7	0.6	-0.5	-0.7	0.1	-0.3	-0.5	-0.8	-0.8
Switzerland	4.2	-0.5	0.3	-1.1	0.3	-1.7	-0.2	0.2	-1.7	-1.7
Turkey	6.3	1.6	2.2	0.1	-0.7	0.1	5.5	-3.3	2.0	2.0
United Kingdom	3.0	-1.7	0.1	-1.8	0.0	-0.5	-0.4	0.1	-0.8	-0.8
United States	3.8	-0.9	-0.3	-0.9	0.4	-0.7	0.5	0.2	-0.1	-0.1

Referent for the symbols used in the text:

$$(1) = y_a; \quad (2) = y_a - y_u; \quad (3) = \left(\frac{y_u}{y_a} - 1 \right) \cdot y_a; \quad (4) = (x_a - m_u) \cdot \frac{1}{\epsilon_a}; \quad (5) = (m_a - x_a) \cdot \frac{1}{\epsilon_a}$$

The following symbols are used:

Y = value added

L = quantity of labour employed

$$\Pi = \frac{Y}{L} \equiv \text{productivity}$$

The superscripts *tot* or *x* affixed above and to the right of a symbol denote whether the value indicated refers to the entire set of productive activities or to the individual branch of activity being considered. The subscripts 0 or *n* affixed below and to the right of a symbol indicate whether it refers to the initial year or to the final year of the period in question.

I concentrate on measurement of the following phenomena: the rate of variation of productivity, respectively of the set of productive activities and of the individual branches *x*; the relative levels of productivity of the individual branches; the relative share of labour employed by the individual branches; the variation of this share. More specifically, I adopt the following definitions:

- (i) the average annual rate of variation of the productivity of the set (Π^{tot}) and of the individual branch (Π^x) in the time interval from 0 to *n*, defined respectively by [1] and [2]

$$[1] \quad \Pi^{tot} \equiv \frac{\Pi_n^{tot} - \Pi_0^{tot}}{\Pi_n^{tot} + \Pi_0^{tot}} \cdot \frac{2}{n}$$

$$[2] \quad \Pi^x \equiv \frac{\Pi_n^x - \Pi_0^x}{\Pi_n^x + \Pi_0^x} \cdot \frac{2}{n}$$

- (ii) the average relative level of productivity of branch *x* in the period from 0 to *n*, denoted by $\bar{\pi}^x$ and defined by [3]

$$[3] \quad \bar{\pi}^x \equiv \frac{\Pi_n^x - \Pi_0^x}{\Pi_n^{tot} + \Pi_0^{tot}}$$

(iii) the average relative share of labour employed by branch x in the period, denoted by $\bar{l}^x$ and defined by [4]

$$[4] \quad \bar{l}^x \equiv \left(\frac{L_n^x}{L_n^{tot}} + \frac{L_0^x}{L_0^{tot}} \right) \cdot \frac{1}{2}$$

(iv) the average annual variation of the above share, denoted by Δl^x and defined by [5]

$$[5] \quad \Delta l^x \equiv \left(\frac{L_n^x}{L_n^{tot}} - \frac{L_0^x}{L_0^{tot}} \right) \cdot \frac{1}{n}$$

A series of elementary algebraic operations, which I omit for the sake of brevity, yield the identity:

$$\dot{\Pi}^{tot} \equiv \sum \dot{\Pi}^x \cdot \bar{l}^x \cdot \bar{\pi}^x + \sum \Delta l^x \cdot (\bar{\pi}^x - 1)$$

The rate of variation of productivity can therefore be decomposed into two meaningful parts. The first is the summation of the rates of variation of productivity of the individual branches, each weighted with the branch's share of employment and with its relative level of productivity (which is equivalent to the summation of the rates of variation of productivity weighted with the branch's share of value added).

The second part consists of the summation of the annual average variations of each branch's share of employment, weighted with the relative gap (of + or - sign) between the branch's productivity and the average productivity of the set.

A three-sector analysis of Italian statistics 1921-1990

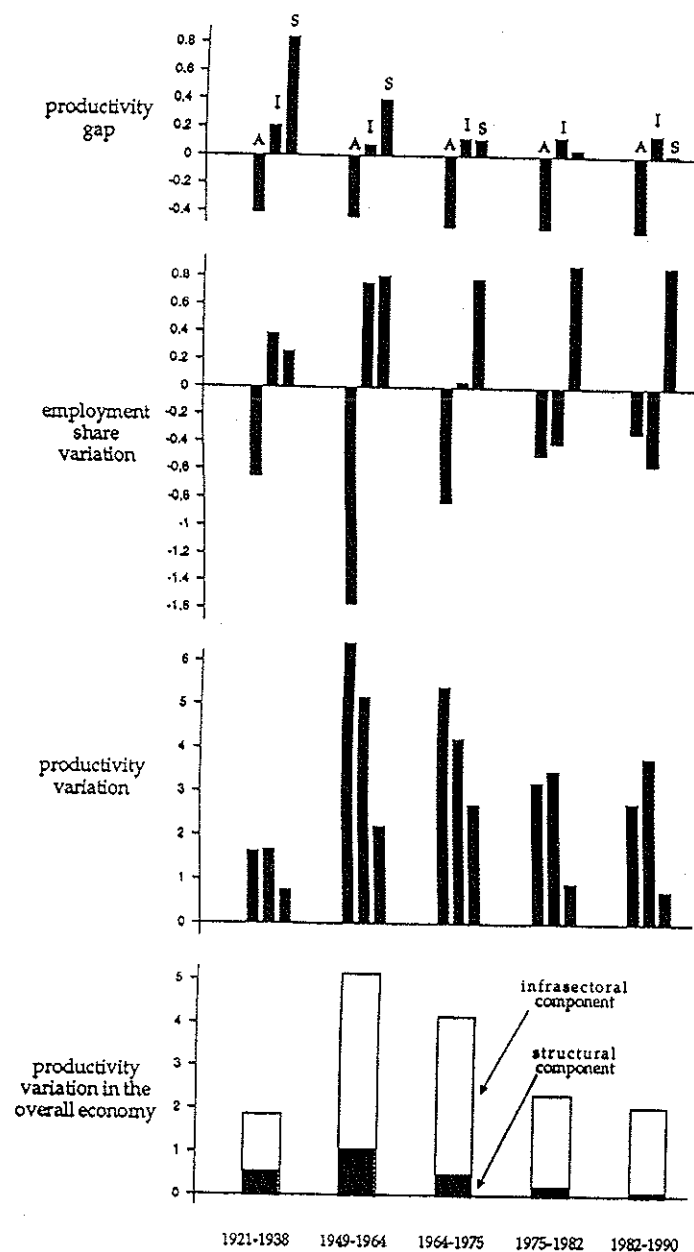
Table a.20 and figure a.9 (which reproduces the contents of the table in graphic form) set out the results obtained when the analytical technique described in the previous section is applied to Italian statistics from 1921 to 1990, excluding the interval 1938-1949.

Table a.20 *Decomposition of the annual variation of productivity of the Italian economy, 1921-1938-1949-1964-1975-1982-1990*

		1921- -1938 (1938 prices)	1949- -1964 (1963 prices)	1964- -1975 (1970 prices)	1975- -1982 (1980 prices)	1982- -1990 (1985 prices)
Relative share of employment	A	54.99	36.25	19.88	13.81	10.83
	I	24.44	31.87	37.80	35.57	31.94
$\bar{l}^x$	S	20.58	31.88	42.32	50.62	57.23
Relative level of productivity	A	58.63	55.53	49.46	48.21	45.57
	I	120.68	108.17	113.36	113.92	116.10
$\bar{\pi}^x$	S	184.41	140.37	111.56	104.71	101.91
Employment share variation	A	-0.65	-1.57	-0.83	-0.49	-0.32
	I	0.39	0.76	0.04	-0.40	-0.56
Δl^x	S	0.26	0.81	0.79	0.89	0.88
Productivity variation	A	1.63	6.44	5.41	3.21	2.75
	I	1.67	5.17	4.23	3.49	3.80
$\dot{\Pi}^x$	S	0.76	2.22	2.71	0.93	0.76
Productivity variation in overall economy		1.87	5.16	4.14	2.36	2.09
$\dot{\Pi}^{tot}$						
part due to variations in:						
- productivity of the branches		1.30	4.07	3.62	2.12	1.99
- relative weight of the branches		0.57	1.09	0.52	0.24	0.10

Note: the logic underlying the decomposition is explained in the text.

Fig. a.9 Structure and productivity of the Italian economy, 1921-1990.



Five sub-periods are examined separately, with an appropriate system of constant prices adopted for each of them.

My sources are the following:

1921-38: Fuà [1992: 210, 214]

1949-64: 1949 only, Fuà as above. The 1964 estimates were obtained by taking the 1967 estimates in the same source and reportioning them on the basis of ISCO [1986: 31, 47, 140];

1964-75: ISCO [1986: 31, 47, 140];

1975-83: ISCO [1990: 19, 35, 103];

1982-90: *Relazione Generale* [1991: vol. I, 171-2 and 184-5].

The item "overall economy" excludes real estate (since this is an activity which does not involve the use of labour) and is divided into three sectors denoted by A (agriculture), I (industry), S (services, both market and non-market).

A model simulating the effects of tertiarization

I refer here to the model used in section 1, Chapter 7, where I explained the purpose of the model, briefly outlined its results in figure 8, and discussed the information to be gained from it concerning the Italian economy.

My remaining task is to specify the numerical values of figure 8. This I do in table a.21.

I believe it useful, moreover, to recapitulate the relations on which the model is based.

As regards Italy's relative position in terms of employment and output, I employ two functions which yield a stylized picture of the Italian economy 1949-1990.

The formulae are:

$$\bar{I}_s = 25 + 0.875t$$

$$\bar{\Pi}_s = 160 - 1.25t$$

where t denotes time expressed in years, $\bar{I}_s$ employment in services expressed as a percentage of total employment, and $\bar{\Pi}_s$ output per unit of labour in services expressed as a percentage of the average of the entire economy (the percentage is calculated on values at constant prices in the manner explained below).

Table a.21 Numerical values of figure 8

Year	-1	0	10	20	30	40	50	60
Share of services ^a								
Income	40	40	50	57	63	66	67	70
Employment	25	25	34	43	51	60	67	70
Relative level of income per unit of labour ^a								
Services	160	160	148	135	123	110	100	100
Commodities	80	80	76	74	76	85	100	100
Annual % variation of the productivity of the overall economy								
Infrasectoral component	2.8	2.8	2.5	2.3	2.1	2.0	2.0	1.9
Structural component	0.0	0.7	0.6	0.5	0.4	0.2	0.0	0.0
Total	2.8	3.5	3.1	2.8	2.5	2.2	2.0	1.9

^a As a percentage of the overall economy

I assume that the two above relations hold from year zero to the moment when $\bar{\Pi}_s$ reaches 100, which occurs in the 48th year. I hypothesise that after the 48th year $\bar{\Pi}_s$ remains constant and $\bar{I}_s$ begins to decelerate. I also hypothesise that for a certain interval of time until the eve of year zero both $\bar{\Pi}_s$ and $\bar{I}_s$ remain constant. The above assumptions regarding the service sector, of course, also determine the relative position of the commodities sector.

As regards the increase in output at constant prices per unit of labour, I hypothesise that the entire period considered in the simulation is characterized by the following annual rates of variation (approximately equal to Italy's average rates of variation 1949-1990):

- service sector, 1 per cent;
- commodity sector, 4 per cent.

I advise the reader that I have used a particular method of calculation at constant prices in this exercise: an "annual chain" calculation.⁴ This means that the difference between the present estimation at constant prices and the corresponding estimation at current prices is considerable as regards the *rates of variation*, but negligible as regards the *relative levels* of output per unit of labour.

⁴ On the technique of the annual chain index, see Fuà and Gallegati [1993].

Note

The analytical technique described and applied in this appendix treats the sectoral rates of variation of productivity as exogenously given and mutually independent. It is therefore susceptible to criticism if one assumes the point of view indicated in appendix 1.2, note on intermediate services.

3. TECHNIQUES OF ESTIMATION AT CONSTANT PRICES

3.1 Introduction

This introductory section addresses two general problems which are preliminary to those that will be given more specific treatment in what follows. The first of these problems is encountered in the estimation at constant prices of any aggregate of national accounting: namely the choice between direct calculation and indirect calculation by means of deflation or extrapolation. The second is a problem specific to the calculation at constant prices of value added and concerns the choice between the orthodox procedure improperly called "double deflation" and abbreviated procedures.

Direct calculation and indirect calculation

I shall use the symbol p to denote the price and the symbol q to denote the quantity of each of the types and qualities of goods composing the aggregate. The suffix 0 below and to the right of the symbol indicates that the value is for the base year of the calculation, while the suffix t denotes the year under examination. The value of the aggregate in the base year and in the year examined is therefore defined by the following formulae:

$$[1] \text{ base-year value (current prices = constant prices) } = \sum q_0 \cdot p_0$$

$$[2] t\text{-year value at current prices} = \sum q_t \cdot p_t$$

$$[3] t\text{-year value at constant prices} = \sum q_t \cdot p_0$$

Of course, the identical value of [3] can be rewritten in different forms, of which the two that follow are of particular interest:

$$[4] t\text{-year value at constant prices (indirect calculation by}$$

deflation)

$$= \sum q_t \cdot p_t / \frac{\sum q_t \cdot p_t}{\sum q_t \cdot p_0}$$

[5] t -year value at constant prices (indirect calculation by extrapolation)

$$= \sum q_0 \cdot p_0 \cdot \frac{\sum q_t \cdot p_0}{\sum q_0 \cdot p_0}$$

Formula [4] gives the value at constant prices of year t as the ratio between the value at current prices of that year and an appropriate price index; formula [5] gives the same value as the product of the value of the base year and of an appropriate quantity index.

In practice, the indirect procedures indicated by formulae [4] and [5] are often preferred to the direct procedure indicated by formula [3].

This preference stems from the fact that the value of the aggregates at current prices is relatively easy to come by, whereas the value of the aggregates at constant prices has to be constructed. And if it is to be constructed correctly on the basis of [3] it is necessary to examine one-by-one all the types and qualities of goods contained in the aggregate, an undertaking which in many cases is impracticable. By contrast, calculation of the value of the aggregates at constant prices on the basis of [4] or [5], when the values at current prices are available, is relatively straightforward. It is true that one must procure the necessary price or quantity index, but this condition is easily satisfied if (as is usually the case) one settles for an index that has been calculated not on the entire set of goods but on a representative sample of them. Of course, the estimation of the value at constant prices obtained by this procedure is only an approximation to the

exact value defined by [3]; an approximation which is more or less satisfactory depending on the degree of representativeness of the index used.

In this connection, mention is frequently made of the conventional belief that there is generally greater similarity among individual goods as regards changes in prices than as regards changes in quantities. Hence, the argument runs, there is less likelihood of error when we use a sampling procedure for estimating price variations than when we use it for estimating quantity variations.

This is a oft-cited reason for preferring deflation (formula 4) to extrapolation (formula 5). Also in favour of deflation is the fact that those responsible for compiling the national accounts have at their disposal a rich array of ready-made price indices produced for other uses in almost all the countries of the world.

This, however, raises a further problem. The price indices most frequently available are Laspeyres-type indices (in which the weights are given by the base-year quantities), while the index in formula [3] is a Paasche-type index (weighted with the quantity of the year under examination). Given the unavailability of the Paasche index, the compiler of the accounts at constant prices compromises by making only approximate calculations, that is, by deflating the current value with a Laspeyres price index. But in this approximate application, the indirect procedure no longer yields a result identical with that obtained using the direct procedure.

The sign of the divergence between the two results can be predicted with a good degree of probability. One finds, in fact, that goods with a high p_t/p_0 ratio exhibit a low q_t/q_0 ratio; that is, there is an inverse correlation between the relative prices and the relative quantities of individual goods. Insofar as this inverse correlation holds, one may expect the difference between the Laspeyres and Paasche indices to assume the signs indicated in the

following table:¹

	Laspeyres	Paasche
price index in year t	$\frac{\sum_{i=1}^{i=z} p_t^i \cdot q_0^i}{\sum_{i=1}^{i=z} p_0^i \cdot q_0^i}$	$\frac{\sum_{i=1}^{i=z} p_t^i \cdot q_t^i}{\sum_{i=1}^{i=z} p_0^i \cdot q_t^i}$
quantity index in year t	$\frac{\sum_{i=1}^{i=z} q_t^i \cdot p_0^i}{\sum_{i=1}^{i=z} q_0^i \cdot p_0^i}$	$\frac{\sum_{i=1}^{i=z} q_t^i \cdot p_t^i}{\sum_{i=1}^{i=z} q_0^i \cdot p_t^i}$

Value added: orthodox calculation and abbreviated calculation

Given that product (value added, v.a.) is defined as the difference between output and input, the orthodox procedure for its measurement consists in estimation at constant prices of, separately, minuend and subtrahend and then calculation of the difference. This procedure is commonly called "double deflation", though this denomination is inappropriate because it is entirely unnecessary for the value at constant prices of the minuend and subtrahend to be calculated by deflation; they can also be obtained (and sometimes are) by extrapolation or by direct valuation.

Instead of the orthodox procedure one sometimes finds, particularly in the case of services, an abbreviated procedure which obtains the v.a. at constant prices of the year examined from the current v.a. of the same year by means of deflation, or from the v.a. of the base-year by means of extrapolation. Of course, the results obtained are only an approximation to those obtained using the orthodox procedure.

Abbreviated procedures may be chosen because some of the statistics required to apply the orthodox procedure are unavailable. They may also be preferred because they are simpler

¹ Some exemplificatory statistical comparisons among quantity indices can be found in Fuà [1992: 368-71].

or more convenient. The use of abbreviated procedures, moreover, prevents an outcome that may arise with the orthodox procedure: namely that the calculation, although performed correctly, yields a v.a. at constant prices of negative sign. A result of this kind, although it has logical coherence and interest for the specialist, is difficult for the general public to understand and to appreciate.

Mention should finally be made of a procedure which at first sight is abbreviated but is in fact orthodox. This procedure consists in the deflation of the v.a. at current prices of the year under examination with a special index constructed using a deflator of output and a deflator of input. Constructing this "v.a. deflator" therefore requires the same statistical information as used for "double deflation". The formula for an index for a hypothetical year t is:

$$m_t \cdot p_t^{PR} - (m_t - 1) \cdot p_t^{CI}$$

where p_t^{PR} is the output deflator, p_t^{CI} is the input deflator, and m_t is the ratio between output and value added of the year in question - both valued, however, at the base-year prices.²

3.2. Outline of the methods used by ISTAT

I believe it useful for the reader to consult ISTAT's description of its methodology in the original text. The next few pages therefore reproduce section 12.2.1 in its entirety and part of section 12.2.2, both written by Susanna Mantegazza, of ISTAT [1990b]. I have slightly altered the references to other parts of ISTAT [1990b] in order to make them clearer (these alterations are indicated by square brackets), and I have added two tables in order to complete those accompanying the original ISTAT text.

Value added at market prices by branch

As will be seen, value added at constant prices by branch was estimated using either output and input price indices or, directly, the value added deflators obtained

² On this procedure see ISTAT [1990: 284-9].

by means of the double deflation method [expounded in ISTAT 1990b, ch. 12].³

Described below is the information base of domestic prices, and import and export prices, used in the application of the above-mentioned method.

As regards the prices per branch of foreign trade, these were estimated using the historical series of the indices of the average unit values of imports and exports on base 1980 elaborated with the Fisher formula. Although not entirely correct, use of this formula was necessary because of the notable unreliability of Paasche indices at the level of the individual branch.

The principal indicators of the prices of output for internal use were the producers' wholesale and retail price indices, except for certain branches: energy production, credit and insurance, and collective services. These were calculated separately because other information was available.

Used for agriculture and energy production were, respectively, the deflator of gross saleable production and the deflators of energy output by subsector. In fact, sufficient information was available as regards these branches for year-by-year outputs to be calculated as products between prices and quantities (see [ISTAT 1990b], sections 4.1 and 4.2). Consequently, outputs at constant prices were calculated using the direct method; that is, by multiplying the quantities of each year by the base-year prices. From the ratio between outputs at current prices and outputs at constant prices the deflators were thus implicitly obtained.

Used for the branch of credit and insurance was the imputed banking services deflator implicitly obtained as the ratio between the value indices and the quantity indices. The values of imputed banking services were given by the interest margins calculated every year by the *Banca d'Italia* (defined as the total of interest receivable minus the total of interest payable; see [ISTAT 1990b] section 4.5.8); the quantities were instead calculated for every year according to the following procedure:

- (a) the current value of intermediated funds reported by the *Banca d'Italia* (defined as the overall total of assets net of expenditure losses and contingent liabilities) was converted into real terms using the internal demand deflator;
- (b) the result was multiplied by the ratio between the interest margin and the intermediated funds of the base year.

Posited as invariant in the period considered was the incidence of the interest margins on the total of intermediated funds expressed at constant prices.

Finally, used for government services was the collective consumption deflator, calculation of which is described in the next section.

³ The results obtained may have been adjusted to balance the values of the aggregates contained in the resources-uses account.

As regards the other branches of industry, when possible (see the attached table) producers' price indices were used. For food, beverages and tobacco, these indices were available for the entire period 1980-1986, whereas data for chemical products, textiles and clothings, leather goods, and the paper and rubber industries, were only available from 1985 onwards. It was therefore necessary to combine these series with those for wholesale price indices by means of a coefficient calculated as the average of the ratios between the two indices for the years 1985 and 1986.

Since producers' price indices had still not been compiled for the other branches of the industrial sector, wholesale price indices were used (net of value added tax). For branch 51 (other industrial products) a weighted average of retail and wholesale price indices (with weights of, respectively, 0.8 and 0.2) was used. The index of the cost of constructing a residential building was used for branch 53 (buildings).

As regards market services, retail price indices were used in most cases; for branches 55 (recovery goods) and 57 (trade) it was decided to use a weighted average of the retail and wholesale price indices (with weights of, respectively, 0.8 and 0.2).

The table [a.22] shows the price indicators used for each branch in detail. [The information is supplemented by table a.23, which gives the code numbers for the branches, and by table a. 24, which gives, only for services, the percentage weights of the value added of the various branches in the overall economy].

Once production prices for the domestic market had been determined, the next step was to estimate the prices of overall output as a weighted average (with weights derived from the intersectoral table for 1980) of production prices for the domestic market and prices of exports. The methodology described above yielded, for each of the 44 branches, the historical series for the years 1980-1986 of:

- input prices;
- output prices;
- value added deflators.

Table a.22 Price indices used in each branch to estimate output prices

branch code nos.	price indices
1	gross saleable production deflator
3,5,7,9,11	energy outputs deflators
13,15,19,23,25,27,29,45	wholesale price indices
17,41,43,47,49	producers' price indices linked with wholesale prices
31,33,35,37,39	producers' price indices
53	index number of the cost of constructing a residential building
59,61,63,65,67,71,73,75,77,79,93	retail price indices
69	imputed banking services deflator
81,85,89	collective consumption deflators

Table a.23 44-branch classification of economic activities

code no.	denomination
1	Agriculture, forestry and fishing
3	Coal and lignite
5	Coke-making
7	Oil products
8	Water, electricity and gas
11	Nuclear fuels
13	Ferrous and non-ferrous ores and metals
15	Non-metallic minerals and mineral products
17	Chemical and pharmaceutical products
19	Metal products excluding machines and transport equipment
21	Agricultural and industrial machinery
23	Office and data processing machines, precision and optical instruments
25	Electrical goods
27	Vehicles and engines
29	Other transport equipment
31	Fresh and conserved meats
33	Milk and dairy products
35	Other food products excluding beverages
37	Beverages
39	Tobacco products
41	Textiles and clothing
43	Leather goods
45	Wood and wooden furniture
47	Paper products, printing and publishing
49	Rubber and plastic products
51	Products of other manufacturing industries
53	Public works
55	Recovery and repair
57	Wholesale and retail trade
59	Lodging and catering services
61	Inland transport
63	Maritime and air transport
65	Auxiliary transport services
67	Communication
69	Credit and insurance
71	Services to business
73	Real estate
75	Teaching and research (market)
77	Health services (market)
79	Recreational, cultural and other market services
81	Government services (non-market)
85	Teaching and research (non-market)
89	Health services (non-market)
93	Domestic and other non-market services

Table a.24 Percentage shares of branches of services in the value added of the overall economy

MARKET SERVICES	
recovery and repair (55); wholesale and retail trade (57)	15.6
lodging and catering (59)	3.5
transport (61,63,65); communication (67)	6.2
credit and insurance (69)	4.7
real estate (73)	6.2
other market services (71,75,77,79)	12.3
of which: services to business (71), teaching and research (75), health services (77), recreational and cultural services (79)	6.2* 6.1*
NON-MARKET SERVICES	
government services (81,85,89)	12.6
others [domestic services and social private institutions] (93)	0.8
TOTAL	61.9

Source: ISTAT [1989a: 31]

Notes: Value added at 1988 market prices. The total is gross of imputed banking services. The code number in the 44-branch classification are given in round brackets. Shares marked by an asterisk are estimates based on the percentage composition of value added at factor cost in 1985 which can be deduced from ISTAT [1990b].

With these series available, calculation at constant prices of value added at market prices (net of value added tax) was conducted as follows:

- for the branches of agriculture and industry, output (at market prices net of value added tax) and input (at market prices) were deflated separately, and the value added calculated as the difference between them;
- for the branches of services, the current value added at market prices (net of value added tax) of each individual branch was deflated directly using the corresponding deflators.

Collective consumption

As regards this aggregate, it is extremely difficult to construct indices able to represent the price trend of a sector which does not sell its output at market prices proper. Since it was impossible to calculate government services at constant prices using suitable deflators, and since in any case only indirect calculation was possible, the method adopted was to conduct separate estimation of value added and input in real terms, thereby obtaining collective consumption at constant prices as the sum of the two deflated aggregates.

Value added at constant prices was estimated by extrapolation, using an index constructed on the basis of changes in employment. This procedure is quite frequently used in estimation of the value added of non-market services, and for two reasons: first, as said, because these are services without corresponding market prices; second, because the characteristics of these services are particularly difficult to quantify.

Input at constant prices was estimated by using the price indices of the inputs to each branch of government. That is to say, for each of the three branches of government, estimation used a price of the overall input obtained as the weighted average of the prices of home-produced inputs and the prices of imported inputs, with weights given by the intersectoral table for 1980.

3.3. Notes on services

Bibliography

There is an abundant literature on the techniques of estimation at constant prices. I cite in particular Hill [1971] and UN [1979] for general treatment of the subject; and chapter 5 of Ercolani [1990] as well as chapter 5 of UN [1979] for treatment of services in particular. Wide-ranging analysis of the dynamics of productivity in services is to be found in Pellegrini [1991]. The works of Ercolani and Pellegrini also provide a wealth of bibliographical information.

The OECD has published the results of a detailed comparative survey of the methods used by the statistical offices of its member-countries in estimating the value added at constant prices of the various branches of the service sector [OECD 1987]. The survey makes interesting reading, although the information given is sometimes at odds with matters as they stand today (I noted some discrepancies with regard to Italy).

For current practice in Italy the obligatory reference is ISTAT [1990b], which also contains some theoretical discussion.

Formulae for valuating commerce and credit

In completion of the verbal analysis conducted in sections 2 and 3 of Chapter 7, I now provide a formalized version of the calculation methods discussed in those sections, my intention also being to highlight the differences between "orthodox" calculation and the principal forms of "abbreviated" calculation (as distinguished in section 1 above).

Given the analogy existing between commerce and credit (already stressed in section 3 of Chapter 7) as regards the difficulties involved in measurement, and the devices employed to overcome them, I find it convenient to present a single formula for both branches.

I use the following symbols:

symbol	meaning	
	commerce	credit
F	Flow of intermediated commodities	Stock (or flows) of intermediated financial means
MA	Commercial margin	Interest margin
CI	input	
$Y = MA - CI$	value of commerce	Value added of i. b. s.
p	price index used to deflate F	
p^I	deflator of CI	

F , MA , CI^1 and Y are values at current prices. $\bar{Y}$ (overlined) denotes value added at constant prices. A suffix below and to the right of the symbol indicates, as usual, the year to which the variable refers (base year = 0; year under consideration = t).

The various calculation methods discussed in section 3 of Chapter 7 are represented by the following formulae:

[1] double deflation formula a

$$\bar{Y}_t = \frac{MA_0}{F_0} \cdot \frac{F_t}{p_t} - \frac{CI_t}{p_t^I}$$

1 CI is an abbreviation of the Italian "consumi intermedi" (=input).

[2] double deflation formula b

$$\bar{Y}_t = \frac{MA_t}{F_t} \cdot \frac{F_t}{p_t} - \frac{CI_t}{p_t^I}$$

[3] deflation of current v. a. formula a

$$\bar{Y}_t = \frac{Y_t}{p_t} \cdot \frac{MA_0 / F_0}{MA_t / F_t}$$

[4] deflation of current v.a. formula b

$$\bar{Y}_t = \frac{Y_t}{p_t}$$

[5] extrapolation

$$\bar{Y}_t = \frac{Y_0}{F_0} \cdot \frac{F_t}{p_t}$$

Note that method [2] gives a value of $\bar{Y}_t$ higher than that yielded by [1] in all cases in which MA grows more rapidly than F ; that is, if $MA_t / MA_0 > F_t / F_0$.

Also methods [3], [4] and [5] give higher values of $\bar{Y}_t$ than [1], if the following three disequalities hold:

$$MA_t / MA_0 > F_t / F_0$$

$$CI_t / CI_0 > F_t / F_0$$

$$p_t / p_0 > p_t^I / p_0^I$$

For commerce in particular this may be considered a rather common occurrence.

3.4. Estimation of new products

For an introduction to the methods used to handle new qualities or types of product in national accounts at constant prices, the reader is referred to Chapter 3 of UN [1979], which makes a classification and a detailed examination of the many problems that may arise, and suggests which of these methods is the least unsatisfactory.

By contrast, to my knowledge there are no publications which

specify the methods effectively adopted by individual statistical offices.

As regards Italy, however, we may refer to the information provided by ISTAT concerning Laspeyres-type price indices. We learn that construction of these indices relies on concatenation whenever the quality of the goods on the market changes. Since the bulk of product at constant prices is calculated by deflation using these indices, it follows that estimation of new products in Italian economic accounts encounters the problem of formula [2] - which I examine below.

Using the price indices of similar products

At the beginning of this appendix (section 3.1) I pointed out that when a set of goods comprises numerous different kinds or qualities, it is current practice to use a price index constructed, not on all these kinds but on a sample of them.

The same procedure is widely adopted to handle the problem of valuing at constant prices a product that was not yet present in the market in the base year. That is to say, the expedient is adopted of using as deflator the price index constructed on one or more pre-existing similar products.

The weakness of this expedient is that it postulates an approximate constancy of ratio between the price (unknown) of the product in question and the price of the product on which the index has been constructed. This postulate is always questionable, but even more so when it refers to the price ratio between a new product and an already mature one.

The information available relative to the period in which the old (V)² and the new (N) co-exist on the market shows in fact that the price ratio N/V is by no means constant over time. In general, the ratio has its maximum level at the moment when N appears on the market; it declines rapidly during the initial phase of the new production; and it then stabilizes when N , too, enters maturity.

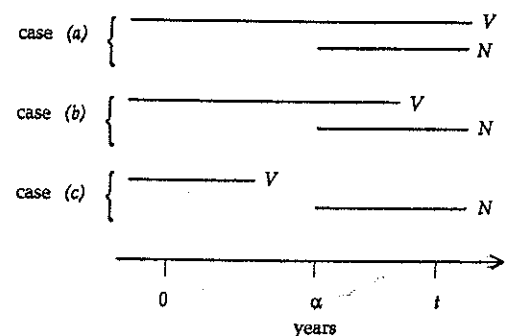
This empirical observation of the tendency of the relative price

2 V is an abbreviation of the Italian "vecchio" (= old).

N/V to decline during the first life-phase of the new product should be borne in mind. It will prove useful when we discuss the calculation formulae.

However, there is also a problem of subjective evaluation. The aim of the technique under examination is to construct the imaginary price of N in the base year (when no effective price existed because N itself did not exist) using the known price of V in the base year and the price ratio between N and V observed during the period in which the two products have co-existed. And yet this value changes over time. How, then, are we to decide which of the values observed is most appropriate for construction of a "good" imaginary price of N in the base year? I know of no rigorous criterion for selection of this value, but there seems to be general agreement that the N/V ratio in the earliest years of the new product's life is not suitable for the purpose because it is still "abnormally high" as a result of the product's rarity and novelty. This *subjective evaluation* should therefore also be borne in mind.

This said, I pass to examination of the formulae that can be used for calculation. There are three possible cases, as set out below:



In case (a) the old product V , which was already present in the year 0 selected as base of the constant price system, continues to be marketed after the year α in which the new product N is introduced and is still present in the year under examination t . In case (b), V is still being marketed in year α but is withdrawn before year t . In case (c), V is withdrawn before year α .

The price indices available as deflators for measuring the category of products comprising V and N in year t at year 0 constant prices are as follows. In case (a) we may choose between the index for V and an index obtained by chaining the N index with the V index. If the chaining option is preferred, one must then make the further choice of the year in which to perform it (which may be any year between α and $t - 1$). In case (b), only a chained index can be used, but the choice of year is still open. In case (c), the use of a price index is precluded and some other expedient is required: this I discuss later.

I now critically examine the results obtained when the deflation is performed using the V index or, alternatively, the chained index. I hypothesise that the calculation is performed on a set of products of the same denomination, but which comprise a component V and a component N . The operations are formalized respectively in [1] and in [2] below. The symbols have already been defined - with the exception of symbol β which denotes the year of concatenation.

$$[1] \quad (q_t^V \cdot p_t^V + q_t^N \cdot p_t^N) \cdot \frac{p_0^V}{p_t^V} = q_t^V \cdot p_0^V + q_t^N \cdot p_0^V \cdot \frac{p_t^N}{p_t^V}$$

$$[2] \quad (q_t^V \cdot p_t^V + q_t^N \cdot p_t^N) \cdot \frac{p_0^V}{p_\beta^V} \cdot \frac{p_\beta^N}{p_t^N} = q_t^V \cdot p_0^V \cdot \frac{p_t^V}{p_\beta^V} \cdot \frac{p_\beta^N}{p_t^N} + q_t^N \cdot p_0^V \cdot \frac{p_\beta^N}{p_\beta^V} \cdot \frac{p_t^N}{p_t^N}$$

Examination of the formulae prompts the following considerations. If we use formula [1], the estimation of component V is obviously correct. Since the zero-year price is applied to it whatever year is examined, the rate of variation at constant prices of this component in any time span is accurately measured. Component N , however, is valued at a price which varies according to the year examined. Remembering the "empirical observation" mentioned above, we may presume that throughout the new product's first years of life, the price which formula [1] applies to N tends to decrease as the year examined, t , shifts forward in time. Hence it follows that when this formula is used,

the rate of variation of component N over time is underestimated compared with the rate obtained from correct estimation at constant prices. If we then also consider the "subjective valuation" described above, we find that according to this valuation the price attributed by formula [1] to N is too high (compared with an imaginary zero-year price) for the values of t in the new product's first years of life. Therefore, still on the basis of the "subjective valuation", formula [1] overvalues the rate of variation at constant prices of the set of products $V + N$ in the year when the new product is introduced compared with the previous year.

If we instead use formula [2], a price is attributed to component V which varies with t and which presumably (according to the above-mentioned "empirical observation") tends to increase as t is shifted forward in time during the first years of the new product's life-span. By contrast, with formula [2] the price attributed to N remains constant whatever year t is considered.

Of course, this does not answer the question whether the constant price of N resulting from the formula is acceptable, subjectively, as an imaginary price of N in year zero. I stress that the prices attributed by [2] to V and N are functions of the relative price p_t^N / p_0^V ; consequently, the results of the formula may change to a considerable extent according to the year chosen for chaining.

The foregoing discussion points to the general conclusion that the technique based on the price indices of similar products is open to serious criticism, at both the formal and practical levels. The technique is formally flawed in that it deviates, for N in formula [1] and for V in formula [2], from the logic of calculation at constant prices. In practice, it may give sharply divergent results depending on which similar product is chosen as reference and, in the case of formula [2], which year is chosen for chaining. And these are two choices which are inevitably affected by random and subjective factors.

Other expedients

That discussed above is not the only technique used by

statistical offices to handle the problem of estimation at constant prices of products of new type or quality.

First of all, there are cases in which statistical offices neglect the qualitative differences between the product present in the year examined and that which existed in the base year. In these cases, the offices improperly treat p_t^N / p_0^V as if it were the price index of the type of good examined and the product $q_t^N \cdot p_0^V$ as if it were the value at constant prices of the quantity of that good in year t .

Passing to less hit-or-miss procedures, we find one which consists in the construction of a fictitious price of N for the year zero by making the hypothetical calculation of how much it would have cost in that year to produce or import a good with identical characteristics. On this procedure see UN [1979: 29].

There is a further expedient available in the specific case where the new and the old product both possess a particular characteristic or property but in different measure, and where this different measure is deemed in all practical respects to be the only significant difference between them. I give two examples. It has been suggested that if a new model of a refrigerator comes onto the market which differs from its predecessor only because it has greater capacity (expressed in litres), the unit price of refrigerators should be measured by litre rather than by item in order to render the valuations of the two models homogeneous. Similarly, if table wine is appreciated mainly for its alcohol content, and if this varies from one vintage to the next, a homogeneous historical series of the price of wine can be obtained by measuring the price per gramme of alcohol content rather than the price per litre of wine. Other examples are given in UN [1979:29-30].

The "hedonic" method

Matters become more complex, however, when the products possess more than one significant feature in common. A case in point is the automobile, where an old model and a new one differ in a wide range of features like horsepower, acceleration, petrol consumption, durability, top speed, etc.

The so-called hedonic method is designed to handle these cases.

It treats goods as though they consist of a "package" of measurable types of performance. For example, a certain model of car can be seen as a package comprising a certain number of Hp plus a certain acceleration rate plus a certain amount of miles per gallon of petrol, and so on.

Suppose that various models of car are present in the base year and that the price as well as the performance package of each model is known. Using multiple regression analysis we can estimate what was (probabilistically) the unit price that the market of that year tended to pay for the various types of performance. We find, in short, the hypothetical table of prices per unit of performance (so many lire for each horsepower, so many lire for each mile/gallon, etc.) which gives the best approximation to the prices effectively paid for the various models of car sold in the base year. Hence it is sufficient to know the performance packages of the new models sold in that year and to value them by applying the table of prices per unit of performance. This operation will give the values of the new models at base-year prices.

Then, if we calculate the ratio between the value at current prices of car production in this year and the value of the same production calculated at constant prices as explained above, we have an accurate index of car prices which takes account of qualitative changes.

The hedonic method has been studied for more than fifty years and boasts a considerable literature.⁴ To date it has been applied mainly to car and computer prices. However, its undoubted merits in terms of formal elegance are counterbalanced by certain deficiencies at the practical level. First of all, the range of products to which it can be applied is rather limited. Secondly, the results obtained from its application may differ markedly according to how the significant features are selected and measured, and according to how the sample of models to subject to multiple regression analysis is chosen.

⁴ See Triplett [1986] and UN [1979: 30-1], both of which contain further bibliographical references.

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