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# PREDICTING ECONOMIC CHANGES IN OUR TIME

Some observers are surprised by the fact that economic phenomena occupy an increasing place in the average man's concerns. Has not economic life been the necessary basis for man's physical existence since the most distant times? Have not agriculture, industry, business and finance been in existence for thousands of years? Do not the nations' standards of living, and even their manner of life, depend necessarily on their production?

We all know, to be sure, that humanity took many centuries to become aware even of those realities which are most fundamental to its existence. All the sciences are recent; why should not this be true of economics as well? What is unique to economics, however, is not so much that the science is new; it is rather that the *need* for that science should be felt today by even the least citizen.

Progressively throughout the course of the nineteenth century, and bulking large in our own time, economic problems have encroached upon the thoughts of the governing classes, then upon those of the average citizen. We are now at a point where political problems, both foreign

and domestic, are dominated by such considerations as production levels, crises, unemployment, currency, foreign trade, purchasing power—all matters which formerly intruded upon history only episodically. Furthermore these problems often take a tragic aspect: interests clash, and each side advances a contradictory solution; governments turn to trial-and-error methods or to one of mutually opposing doctrines. The results of these interventions are often quite the opposite of what was expected: passions are aroused, battle-lines are formed; devaluations of the currency, political unrest, strikes, tariff barriers, wars, are the all-too-frequent result of disorders which were at first hardly noticeable but which, since they are often poorly understood and always inadequately resolved, break down into serious maladies. The life of such great nations as France and Italy is almost overwhelmed by such troubles; the growth of the underdeveloped countries is stifled by them; world social progress is paralysed; they shake the philosophic, political and social foundations of the liberal West. In no other field of action does science lag so far behind the needs of man.

This is not a chance result. Our need for knowledge and the difficulty of establishing our science spring from the same source. This source is the instability of economic conditions, that is, the excessively rapid change of the fundamental factors of economic life, as measured on the scale of human existence.

In the eighteenth century, and to a considerable extent still in the nineteenth, economic conditions were as imperious as they are now, but they were *stable*. The workday was long (from ten to fourteen hours), but it was constant. Purchasing power was low—a pound of bread cost a labourer one wage-hour—but it was about the same in 1800 as it had been in 1700. The crises themselves, dearths and famines, followed each other showing kindred characteristics; and the same sufferings resulted from the same causes. Above all, occupations were stable; entering his father's occupation, cultivating the same field, sowing the same seed, a man achieved, in good years and in bad, about the same living-standard as his forebears. This stability, or more exactly this slowness of transformation in the essential economic conditions, made it possible both for the average man to understand his own economic life intuitively, and for the expert to analyse it at ease in scientific terms: Vauban, Quesnay, Adam Smith, Lavoisier built an economic science which was valid for their own times.

With the coming of what has been for good reasons called the first

industrial revolution, however, *things began to change*. They moved more quickly still, and even more astonishingly, after 1900 and after 1930. The average man no longer understands what is happening to him. Even if he continues his ancestral occupation, he may be ruined; driven off the soil, uprooted, countryless, forced into the class without property, he ceases to perceive the concrete connexion between his production and his consumption. Instead, he now perceives only the wages-consumption relation, with the result that his aim in life is no longer to produce, but to earn money. The instability that drove him off the soil pursues him into the factory. He is faced by economic crises of a new kind—called crises of overproduction—and by unemployment, by the obligation to adapt himself constantly to new machines and new techniques, often to new lifeways; and above all looms the *necessity* of constant social strife, the feeling of frustration and injustice, strikes, factory shutdowns, and within forty years, ten years of war . . . . The average man no longer comprehends the rules of a game which he must play in spite of himself, and turns in anguish to the economist.

The economic doctors are, however, themselves the pawns of this fearful game. The statistician, bent over innumerable figures, drawing innumerable charts, does little more than record powerful, rapid, and disorganised movements. Bristling with peaks, summits, plateaus, precipices, valleys, and ravines, the learned empiricist's curves look like a transverse section of some fantastic road leading from Paris to Brisbane through the Alps, by way of the Himalayas and along the ocean's floor. The theoretician then seizes upon some of these many-horned graphs, schematises and rationalises them, 'fits' them as the dressmaker does our wives, and from them he then draws mighty theories wherein the observable world plays about the same part as does the furniture in a tragedy of Racine's. Neither the empiricist nor the theorist can disengage from the whirling mass of countless economic data those rules of the game so necessary to the average man, the distinguishing mark of which would be that they would *permit foreknowledge*.

Thus, when economic science was easy to construct, it was all but useless; today, when it is so necessary, it seems hopelessly buried in its own ruins. Economic happenings are moving too fast for us to get a mental grasp on their laws; no sooner have we brought an important phenomenon to notice than it is supplanted by another which was formerly quite negligible, much as a cyclonic depression forms within a few hours in a beautiful tropical sky. The economist today finds himself in a situation

comparable to what Newton's would have been, had he sought to discover his famous laws in a world where the gravitational constant was constantly changing.

Must we then conclude that economic science is not possible in our present world? By no means. We want to show, on the contrary, that if economic research is willing to restrict its ambitions, through a clear awareness of the conditions which are laid down for it by the reality of the observable world, it can achieve results which are not inconsiderable. Even in a rapidly changing universe, some predictions are possible.

A few figures will be useful to suggest concretely the possibility of such advance knowledge.

Those economists who have studied prices have studied the 'general movements' of prices. From these, they have drawn several thousands of those bristling curves I mentioned above, and some dozens of theories. But no prediction. To sum up, if the general index of prices, on a base of 1913 as 100, is found to be 14,230 in France today, this fact is connected with so many causes that no one could catalogue them, and still more certainly, no one could foresee their changes well enough to deduce a prediction from them concerning the index itself.

Could we not, however, take up the study of prices from another of its aspects? About 1820, in France, one kilogram of linden (flowers for making infusions) exchanged for 0·6 kilograms of soda crystals; in 1950, for 20 kilograms of soda. Around 1750, eleven square metres of Gobelin tapestry were the exchange equivalent of a looking-glass of four square metres; in 1950, 0·1 square metres of tapestry would exchange for the same-sized mirror. Ten kilograms of potatoes were exchangeable for one kilogram of wheat in 1820; in 1950, only two kilos of potatoes. Are these merely anecdotal facts, as the few economists who have perceived them seem to believe, or are they rather examples which point to certain underlying structural movements, which would be generative of predictions, and which an analytical study could reveal?

In order to explore this possibility, we shall rapidly survey the domain where we may hope to find predictable facts in social and economic matters, and we shall then indicate the framework which, at present, seems to us to permit an access to substantial results, verified by daily observation.[1]

[1] Readers who are not interested in the problems of scientific methodology, but only in the concrete results of our studies, can dispense with the reading of the first part of what follows.

## I. *Efforts to Increase the Scope of the Predictable in Economic and Social Matters*

Classical economics and the social sciences in general have thus but rarely arrived at an explanation of facts which would be sufficiently exact to give rise to predictions. It will be useful to specify the causes which make economic events in particular, and human events in general, seem to be unpredictable, in order to find out whether we cannot eliminate them or at least reduce them in certain areas.

### *Why do human events seem to be unforeseeable?*

It is not hard to find the immediate causes of the unpredictability of economic happenings. Long ago, scientific methodology taught us that an event is predictable or determined when we can precisely know its laws, that is, its elements, conditions, or causes, then the changes in each of them. In all other cases, the event will remain unpredictable, either because its elements themselves remain unknown in whole or in part, or because the elementary factors, while all identified, are themselves subject to unpredictable change.

Sociologists, imitating the physical sciences, thus seek to identify the causes—all the causes—of the phenomena they study. They think that there is no science outside this search for unalloyed determinism, no middleground between darkness and light, no transition between certainty and ignorance. They exhaust themselves, accordingly, trying to encompass global problems, general movements of prices, crises, foreign trade, money, credit, monopoly, competition—and of course never succeed in even enumerating with precision the innumerable factors involved.

A fundamental fact is, however, beginning to come to light: this is that in social and economic matters, as in matters of physical science too, no doubt, there are stages between the determined and the indetermined; certain facts are aleatory[2], others are conditioned[3]. An immense domain is thus opened up to prediction, on the condition that man be satisfied with something less than a deterministic form of foreknowledge.

By being less ambitious, by not trying always and everywhere to find a rigorous determinism, and by not trying to bend nature to our requirements but on the contrary bending our conceptions to fit nature, we can extend the field of our knowledge and its efficiency. Let us then examine objectively, but without too much pessimism, the grave difficulties which are peculiar to the social sciences.

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[2] Pierre Vendryès, *Vie et Probabilité* (Albin Michel).
[3] Von Neuman and Morgenstern, *Theory of Games* (Princeton University Press).

*A. The Factors to be Considered Are Innumerable.* It is just as much of a delusion, in the present state of science, to expect to find all the factors that act on the general movement of prices or on economic crises, for example, as it would be to claim that we can find all the causes determining the behaviour of man during the course of a month or a day in his life. Actually, these causes are too numerous, too fluctuating, too ephemeral. The general movement of prices is influenced by political, social, psychological, financial, and statistical factors; by banking, by commerce, by technical considerations . . . Each of these covers a sea of component elements, all more or less active; for example (a commercial factor) the index will be lowered by 0·01 per cent at Paris because a merchant in Conakry (West Africa) sold a large part of his stock of bananas at once; in the same way (technical factor) the index will go up by 0·02 per cent because a drought went on for eight more days in the central Canadian plains.

The scientific problem which an economist must solve is exactly the same as an observer would encounter in foreseeing and explaining the use I shall make of these present morning hours. This observer would first have to know my biological, psychic, intellectual, and moral antecedents, and to know them in great detail (heredity, distinguishing characteristics, intellectual attainments . . .). He would have to catalogue the sensory and spiritual factors which lead me to spend my summers in this village in Quercy and the place that the village occupies in my mind. It would be necessary to reconstruct conversations I have had with M. Caillois and Mr. Nef; to note the influence upon me of my wife, children, friends, and of my reading; and to be aware of my health, the atmospheric temperature, whether the day is cloudy or clear. Is there any ink remaining in my pen? That would have to be known, and in addition a mass of social, political, scientific, and technical factors would need to be inventoried. For example, it would be necessary to know whether the order to return to work issued by certain trade unions will permit me to receive this morning some mail from the General Planning Commission which has been held up by a strike for fifteen days now.

*B. Factors Become Modified During the Time Required to Verify Them.* We have here a difficult assignment for the human mind. And what is more: it is an impossible one, in the present state of our techniques of gathering information. One fact is sufficient to prove this; and I ask the reader to reflect upon it, since it is, to my mind, the heart of the problem: *the time required to gather information exceeds the duration of the action being studied.*

This means that, even in a case where an inventory of causes can be drawn up, such an inventory would not be finished until long after the maturation of the event to be foreseen; so that it would not be the future that was forecast, but the past. It is, for example, conceivable that a statistical institute could inform itself with precision on all the factors which have acted on prices before August 21, 1953, and which would be likely to act on August 22. However, since the facts involved are worldwide and complex and since most of them cannot be known except by means of analyses which would be equally on a world scale and equally complicated, it is apparent that the information could not all be brought together between 11 and 12 p.m. on August 21. In practice, it would take months, if not years, to bring together all the data relating to this day of August 21; and yet all of them are really necessary to a scientific foreknowledge of just what will happen on the 22nd. Accordingly the prediction of prices relating to the twenty-second day of August in 1953 could not be published until some hypothetical date in 1975.

Even if I admit that it is scientifically possible to make an exact, complete inventory of the causes which are impelling me to write this morning, why I am doing the present article and this very phrase which I am in the process of drafting, I have to take account of the fact that such an inventory would require a long-term labour of experts, of such a duration that they would not be in a position to forecast how this article will end until some time so far in the future that not only would I already have written it, but what is more, unfortunately, I would no longer be in the least capable of writing it . . . Time thus undermines prediction in scholarship.

What is even more serious is that the work accomplished in order to foresee how I use my time on August 21, or the level of the general price index on August 22, will be only partially worth while for predictions relating to later days: for the list of determining factors varies with the date, and above all, their relationships vary. A factor which plays no role in predictions for the 22nd becomes of essential importance on August 23; others which were conspicuous are obliterated; none (or only an exceptional one) keeps the same degree of influence: the oil market is thrown into turmoil by the arrest of Prime Minister Mossadegh, I shall be called to leave for Italy . . .

Time thus plays a crucial part in the philosophy of science. The period necessary for gathering information separates the experimental sciences from those of simple observation, and does so more effectively than the

students in our classes are usually told that it does. The impossibility of experimenting is not simply the loss of a precious method for discovering causes; *it is the telltale sign of the heterogeneity of time.*

*C. Time, in the Social Sciences, is not Homogeneous.* The kind of time found in the human and social sciences is heterogeneous, that is, it does not admit of definite periods at the end of which phenomena repeat themselves identically. In these fields, phenomena never again pass through identical states. None of the sequences whose duration forms social time is, then, homogeneous.

*D. Phenomena in This Field are Distinct and Autonomous.* Still more, each phenomenon is, if not independent of the others, at least distinct and autonomous, that is, it has some distinguishing characteristics of its own; it shows an evolution, a behaviour which is *sui generis.* Just as I cannot identify any one of my mornings with any other morning, and I cannot identify myself with any other living being, in the same way the general index of prices in France, the economic crash of 1929 in the United States, the market quotation of the pound sterling on the Exchange, the sale of grapes this morning on the Moissac market—all are unique phenomena which are produced but once and have no counterpart either in time or in space. Even more precisely, these phenomena are only some aggregates and resultants, mostly artificially defined by experts or jurists, of a greater or smaller number of autonomous and independent facts. The general index of prices, for example, includes at one sweep the price of wheat, of potatoes, of iron, etc. Now each of these prices has a different development and depends on different factors. There is no correlation among them. They differ as much as one living being does from another living being. It follows that the index can be understood only by understanding its make-up, and by the study of each of its components considered by itself.

Do the characteristics of human and economic facts prevent us from knowing them in a scientific way? Is prediction objectively impossible? Must economic science stagnate in fruitless theories and out-of-date descriptions?

We do not think this need be the case. First, because we believe that great progress is possible by just such an increased awareness of the real nature of the situation as we have been suggesting. And second, because we believe that a science which will be useful to man can develop abundantly, outside the really somewhat elementary requirements of classical determinism.

We must first look for determinism where it really exists. This is not in synthetic compositions, aggregates, general assortments, or mixtures. It is in *autonomy*. So long as chemistry attempted to study mixtures, it went astray. By identifying the substances of unvarying chemical make-up, which were pure of admixture, then the simple substances or elements, Lavoissier created a fruitful science. We must identify the *pure substances* in the economy. These are not Prices, Crises, Competition, Production . . . (with capital letters, that is, in the abstract). No, the autonomous fact is the price of such-and-such a product, the amount of such-and-such a product that goes unsold, the way this or that merchandise is made. It is the price of wheat on the market at Rozay in Brie, the price of linden in the purchases of the Commissary at Paris, the price of fencing foils, Model No. 13 from the Armament Factory at St. Etienne . . . the technique of manufacture and the sales of Shoe Factory 'X' in Fougères or in Denver, for such a model, on such a day. We shall observe, after having isolated these relatively unmixed materials, the behaviour proper to each; we shall then, but only then, be able to group them into classes showing comparable behaviours.

The second rule is to forgo our claim to a precision which in the nature of things is at present outside man's mental capacity. Precision is outside our kind of time. Certainty is beyond our grasp. We shall then be approximatists or probabilists. This means that instead of trying to draw predictions which are verified every time, and within an accuracy of 1/00, we shall be looking for[4] predictions which are verified seven, eight, or nine times out of ten—and within one, five, ten or even twenty per cent of accuracy (per cent in this case, and not 0/00).

Then the problem of prediction becomes soluble in the province of the sciences of man, for, if put in this way, it authorises us to seek no longer for all the factors or phenomena, but only to seek out the *preponderant* among these.

### *Pursuit of Autonomous and Preponderant Phenomena*

The essential thing about Galileo's discovery was not his having calculated the gravitational constant within an accuracy of one per thousand (it was only later that men succeeded in doing that) but in his identifying a common and preponderant factor in phenomena which were *a priori* distinct and had actually been considered distinct until then (the leaf

[4] I do not say, 'we shall content ourselves with . . .', because to hope for more in economic matters would be to fail to recognise objective realities and to pursue phantoms.

falling from a tree and floating on the wind, the billiard ball passing down an inclined plane, water running in rivers).

So long as it had not been detected, men did not know about this factor, or they considered it an idle detail of no importance; as soon as it was identified, its existence seemed obvious and fundamental. Our effort is to identify the autonomous and preponderant factors in economic matters, and then to discern, in composite perceptions, in a mass of accessory differentiated phenomena, that permanent factor or those permanent factors without which nothing else would be as it is.

Without gravitation, even though there would be water and river beds, there would be no current; even if there were leaves and trees, the leaves would not fall to earth. It matters little, then, whether Galileo's discovery did not make it immediately possible to calculate precisely the rate of the current in the river Arno; or whether it still does not permit us precisely to calculate the time that this leaf now detaching itself from this poplar tree will spend in settling to the ground. The essential part of the scientific result is obtained as soon as the essential cause is made plain, for knowledge of this factor is on the one hand already productive of fruitful predictions for the ordinary run of men, and on the other hand generative of further progress in research.

I cannot here sketch a general method of research for finding the preponderant factors. I will only say that this method seems to me to stem from the two essential traits of these phenomena: they are common to a large number of complex phenomena; and they are cumulative, that is, they exercise effects which are added together despite variable circumstances of time and place.

Given the fact we have stated above, namely, that time is not homogeneous for the social sciences, we must expect that the preponderant factors will not be uniform in time. This amounts to saying that when they are of a very long-term nature (one hundred years, for example, in economic matters), they will generally be quite negligible in the short term (six months) and only slightly perceptible in the middle term (five years).

To identify the preponderant phenomena, then, we must select a time span, and seek out the deep-lying differences which distinguish the beginning of the period from its end. Multiplying our soundings in time and space, we bring to light *what falls and what does not fall*, what stirs and what does not stir, what is very much transformed and what changes little or not at all. These confrontations will make it apparent

which factors are acting strongly at one point, and, at another, are showing little activity or none at all.

I think that in these studies of what is decisive in economic matters, we must begin with the long term. Actually, just as it would be absurd to hope to understand and treat the troubles of puberty in a young girl without being aware of the role of mother which she will normally assume, so it seems to me absurd to try to understand England's economic crises or her present difficulties in foreign trade (for example) without having first taken into account her fundamental evolution. Research directed toward finding the preponderant factors is easier, moreover, in material that stretches out over a very long term, because in this domain we have at our disposal, in larger amounts than we would have in the short or medium term, that factor which is so grievously lacking, generally speaking, in social science: time. If our studies cover one hundred or one hundred and fifty years, we have at least a chance that action will not subject our research to a sort of statute of limitations. Time then operates for us like a kind of magnifying mirror. In studying phenomena whose transformation is slow relative to the length of human life, we approach the position which our colleagues in the physical sciences already occupy without being aware of it: every phenomenon which is long-lasting with respect to us, will be for us a source of determinism.

## II. *The General Range of Long-Term Prediction in Economic Matters*

Among economic phenomena, some of those which have most struck our contemporaries are the depopulation of the countryside, the fluctuations of employment, and economic crises. Looking at it another way, facts relating to the standard of living, to the purchasing power of wages, and consequently to prices, are those which often open the door to social conflicts. And finally, the differences which exist at the present time among rich nations, less rich nations, and underdeveloped regions, are the principal cause of international tensions.[5]

### *The Distribution of the Active Population*

For a hundred years, men have been struck by the depopulation of the countryside. Around 1800, in all the world's countries, 80 to 90 per cent of human beings were peasants. France in 1780 had twenty million inhabitants; eighteen million were peasants. These proportions were common at

[5] It is obvious that we can give only a short sketch of our method here. This method, however, does not assume its full value unless it is applied to the concrete, detailed study of real situations. For this, we would refer our readers to our principal works as enumerated on p. 114.

the time, and were to be found in England, the Netherlands, Italy, Spain, Turkey; in India, in China. The world of that time was homogeneous. The United Kingdom itself had 80 per cent of its workers engaged in agriculture; in 1820, the United States still had 73 per cent so occupied.

The nineteenth century saw the countryside of many nations empty itself of men. In the United States, the agricultural population was reduced from 73 per cent in 1820 to 17 per cent in 1950. In France, the figure dropped from 80 per cent to 30 per cent. The movement was general, but quite irregular among the nations; thus, more than half the citizens of the Soviet Union are still engaged in agriculture, and nearly 80 per cent of those of India.

This phenomenon has been studied chiefly from a social and ethical viewpoint, and has only recently begun to figure in economic science. Mr. Colin Clark, notably, has brought to light the relationship between a high standard of living in a nation and the small size of its agricultural population. But obviously, reducing the number of peasants is not, of itself, going to make a country rich. What then is the cause of the migrations? Why are they becoming both possible and necessary? Only a knowledge of the cause of this transformation, or at least of the preponderant factors in it, will enable us to understand the phenomenon, appraise its human consequences correctly, and predict its future course.

What, then, are the factors in the depopulation of the countryside? What transformation has brought about the vast differences between the United States and India? What powerful phenomenon was able to change the homogeneous world of 1800 into our heterogeneous world of 1950?

### *Technical Progress, a Preponderant Factor*

Do we not, by putting the question in this way, suggest the answer? Technical progress has transformed our world. A vague and general answer, however, does not suffice; a scientific answer is needed. Magnitudes must therefore be taken into account which are not only measurable, but have been measured.

If technical progress is a preponderant factor in our problem, it must be measured. We shall therefore be going back again and again to that measure of technical progress which is to be found in *productivity* (productivity: ratio of the physical volume of production to the total number of hours of direct or indirect labour necessary to obtain this volume of production, starting from pristine nature).

The physical volume of production attained by one agricultural worker

in one year has risen from 1, in the United States in about 1750, to 10, in about 1950; in France, from 1 to 6. We have here a key to our problem: progress, very irregular from one country to the other, may have given rise to the differences we observe today. India, whose productivity has progressed little, is found to have nearly the same proportion of persons in agriculture in 1950 as in 1800.

*The Structure of Consumption, Another Preponderant Factor*

But we lack another key: The agricultural population could not have decreased, not even in the United States, if the level of consumption had not risen in the same proportion as that of production; in other words, if the population had not raised the volume of its consumption from 1 to 10.

The average man was badly fed in 1750; the average American of today eats much better. He eats twice as much; but not ten times as much, for he has only one mouth, one stomach. If 80 out of 100 had remained on the soil, they would be producing $80 \times 10 = 800$, while consumption absorbs but 160 (twice what it absorbed in 1750, that is, $2 \times 80$). It was necessary, then, for 64 out of 80 of the agricultural workers ($640 = 800 - 160$) to leave the soil. They did so as they were squeezed and compelled by crises: they were *driven from the soil* by technical progress, because, as production increased, their products became useless to the feeding of the population. The 16 who remained were enough to feed the entire population.[6]

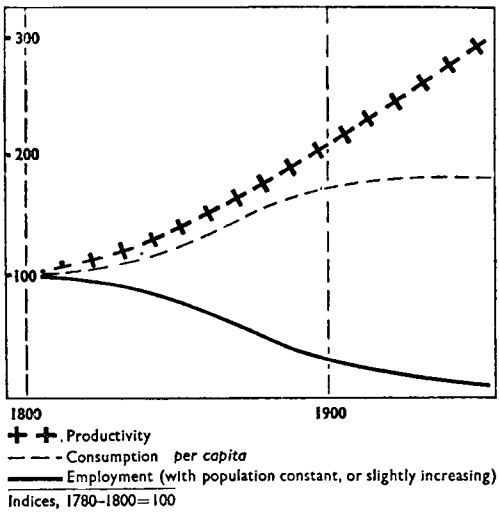
We can see here how the phenomenon of economic crises, which has been so poorly understood up until now, is linked with the distribution of the active population according to occupations. It also becomes apparent how technical progress, on the one hand, and consumption, on the other, are the two preponderant factors that govern employment in agricultural occupations.

As a consequence, we can explain the past, and predict the fundamental tendencies of the future. If in France, for example, technical progress increases without an increase in the consumption of food, we shall have by degrees the same evolution as the United States. But if, as in India for example, demographic growth should inflate consumption unremittingly and absorb the growing production, we shall have a different type of evolution, with a stationary standard of living and an agricultural population of stable proportions.

[6] It goes without saying that we are carrying this calculation out here only in very rough terms. To bring it closer to reality, we would have to introduce the figure of over-all population, because its proportion has varied in relation to the active population. But this does not change the order of magnitude of the figures.

We thus have one type of curve for countries where the phenomenon of production gets the better of that of consumption (this is the type of curve shown in Figure 1, below); and another type for countries where technical progress is powerless to raise the increasing production above the level of the increasing consumption.

FIG. 1. *Productivity, Consumption, and Employment for a Product of the Primary Type.*




The curve of total national consumption obviously has the same shape as that of *per capita* consumption, when the population is constant or only slightly increasing. This is what gives the employment curve its descending slant to the asymptote O. The equation of employment, $e^{-t}$, thus stands against the equation of productivity, $e^{t}$.

On the other hand, if the demographic factor is powerful, it becomes preponderant, and will then govern employment, which however cannot rise above its traditional value. If the increase in production is less than that in population, there may be a falling-off of *per capita* consumption.

### *Primary, Secondary, Tertiary*

Two phenomena have thus come into our view as preponderant in the prediction of agricultural and alimentary facts:

a. *The increase of production*, under the influence of technical progress, measured by productivity.

b. *The increase of consumption*, under the influence of increased production; this increase in production is measured by the statistics of consumption.

But could we not carry out just as well, for all production and all consumption, the procedure we have just sketched out for agriculture and food products?

*A.* Let us first notice that, in the above, we have considered all agriculture together and all food-products together. Now, even a very cursory study is enough to convince us that technical progress has not had the same effects on data about cereals and data on potatoes, for example, and similarly the behaviour of consumption has not been at all the same as concerns milk and as concerns bread.

If we want to come out with precise predictions, we must thus study in isolation the production and the consumption *of each product*.

*B.* For it is not because wages are paid to the workers who make umbrellas that those umbrellas find customers. The Keynesians' error is to reason as if only two groups could be distinguished in production: consumption goods and investment goods. In reality, it is for each product that supply and demand must be in equilibrium, if we are not to have crisis or unemployment: wheat, potatoes, umbrellas, underclothing-buttons . . . .

*C.* Now, each of these products has its own behaviour; it is as inaccurate to think that wheat and umbrellas react the same way economically as it would be to imagine that soda reacts chemically in the same way as does sugar.

In particular, each product shows a behaviour which is *sui generis* with respect to our two key phenomena: technical progress and consumption. For example, wheat is strongly influenced by technical progress, fountain pens even more, umbrellas much less, potatoes still less. In the United States, average productivity, from 1800 to 1950, was multiplied eighteen times for wheat and only two or two-and-a-half times for potatoes. This derives from the fact that the technique of planting potatoes has made much less progress than that of sowing wheat, and that the extraction of tubers has shown much less progress than the reaping and threshing of grain. In the same way, the demand for wheat and for potatoes for consumption is not in the least identical, and this demand differs still more for umbrellas and for fountain pens.

We are thus in the presence of an almost unlimited number of *products* each having *its own* behaviour. Unmindfulness of this *autonomy* of

economic facts leads to frustrations as complete as the study of mixtures brought to chemistry before Lavoisier: no man can find simple laws in variable mixtures.

In order to let a little light into this forest of objectively heterogeneous and autonomous data, I therefore propose that we do as is done in chemistry: first, distinguish the unmixed substances of unvarying composition (whether they be elements or compounds) from variable mixtures; then, just as acids, bases, salts, metalloids, etc., are distinguished in chemistry, array these products into classes showing roughly comparable behaviours.[7]

For example, we call those products 'primary' which have this triple 'property' (as do potatoes): (1) they are agricultural products; (2) they have profited from a perceptible technical progress, which is, however, clearly less important than is the case for most industrial products; (3) they have a consumption-*per-capita* curve which has already passed its maximum in rich countries. We call those products 'secondary' which, like looking-glass mirrors and most industrial products, have the following characteristics: (1) they have undergone very great technical progress; (2) the consumers' demand for them remains on the increase. Finally, we call those products or services 'tertiary' which, like art tapestries, the administration of justice, teaching, and men's hairdressing, have this double property: (1) they have been the beneficiaries of only minor technical progress; (2) they have a strongly ascending demand curve by consumers, without signs of exhaustion in any country.

It is understood, of course, that I do not assign any rigidity at all to these type-classifications. In practice, if most products enter neatly into one of the three sectors, many remain refractory; some, although agricultural in nature, have undergone great technical progress (rye, oats); others, although they are industrial, are marked by practically non-existent technical progress (bell foundries); still others, such as all manufactured goods on their first appearance on the market, display a very strong technical progress and, at the same time, a very markedly rising demand. However, the distinction of the three typical behaviours is no less useful to economic science than that of acids, bases, and salts was for chemistry, for the differences in behaviour which are in question are extreme. But, just as strong acids and weak acids are distinguished, and as some

[7] Each class may be characterised by a typical product, which serves as a point of reference and as an example. It is for this reason that the method whose introduction into economic science we are recommending, is sometimes designated in other sciences as 'typology'.

substances have both acid functions and basic functions, in the same way we shall say without the slightest sense of uneasiness that rye behaves very much like a product of the primary type in its consumption but so far as its production is concerned, it is close to secondary behaviour; similarly, television sets have, at the moment, a secondary type of production and a tertiary type of consumption. Finally, it may be said that the production of aluminium remained typically tertiary until 1886, and that it has become typically secondary since that date.

These three adjectives, primary, secondary, and tertiary, will serve us, then, definitively to designate the *typical behaviours* with respect to the two key phenomena: technique of production, and consumption requirements.

We have already started a widespread inquiry in order to sketch the classification of the principal products. But much remains to be done. On the one hand, investigations into increasing consumption are few and very incomplete. Above all, apart from the highly spectacular special cases like aluminium, steel, electricity, and automobiles, the intensity of technical progress has remained very little understood; there are such watertight bulwarks between the engineer and the economist that the work of the one remains unknown to the other. With the small means at our disposal, we have, at the École Pratique des Hautes Études, studied about two hundred products from these points of view. It is as a result of this study that we can cite among the most *tertiary* of productive activities such items as tobacco-raising, the production of hunting weapons, repairs in general; and among the most *secondary*, the production of gas, of electricity, and of tyres. But taken altogether, it is in industry that one finds the most striking progress, in administration and in trade the least.

The distinction of these three grand types of behaviour with respect to technical progress and to consumption is of a surpassing scientific importance. Production and consumption are the two key phenomena of economy, and all the others are, if not determined, at least conditioned by them. They are the two arms of strong pincers, and whoever dispenses with these pincers, runs the risk of not being able to pull out a good many nails. Each type of behaviour, primary, secondary, tertiary, thus entails highly important consequences for the life of man. Each type supports a well defined group of characteristic properties, permitting the explanation of the past and, in a certain degree, the prediction of the future. These properties relate not only to purchases and to sales, but to foreign trade, to exchange rates, to prices, to purchasing power, to crises, and to employment. Gradually, the facts of productivity and of consumption thus rule

all the problems of economic and social life, or at least exercise a preponderant influence upon them.

We shall restrict ourselves here to reproducing the typical curves of employment in the three sectors, and to suggesting some ideas relative to prices and to purchasing power.

*Typical Evolution of Employment According to the Sectors*

Figure 1 (above, page 27) traces the fundamental tendencies of productivity, consumption, and employment for a product of the primary type, in the Western world.

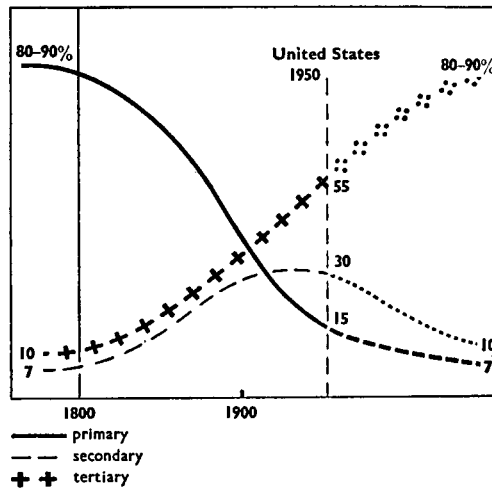
Productivity, which is substantially increasing, and consumption per head, which is very rapidly levelling off, bring with them the decrease of employment. This decrease in employment necessarily implies a reduction of prices, for, income *per capita* being taken as the unit of measurement, the price is the quotient obtained when employment is divided by the volume of production; now, in this case employment (the numerator) decreases and production (the denominator) increases. The fundamental falling off of agricultural prices will, in addition, be verified below for certain typical products.

It follows from this that food products are expensive in poor countries and cheap in rich countries, in proportion to the average wage. Exchange rates in part correct this disequilibrium by giving wages in poor countries a lower international value than the wages of rich countries. For example, wheat is worth eight wage-hours to a workman in New York, and twenty-four in Paris; but, according to the official rate of exchange, the hourly wage at New York (one dollar) equals 350 francs, while the French workman only earns 130 francs. Thus, the spread in international prices, instead of being 8 : 24 now appears to be only $8 : \frac{24 \times 130}{350} = 8 : 9{\cdot}5$.

Figure 2[8] traces the typical tendencies of employment in the three sectors. The preceding explanations are sufficient to clarify the meaning of these curves. Employment for tertiary goods, not being limited by the demand of consumers, which remains unremittingly active, is limited only by employment in the first two sectors. Thus the tertiary trades slowly absorb the working force which is set at liberty in other fields. This sector, in which demand is increasing more markedly than production, will continue to persist for a long time, even in the most advanced countries. This implies the persistence, so far as human beings can foresee, of an

[8] Taken from *Le grand espoir du XXe siècle*, p. 88.

FIG. 2. *Fundamental Tendencies of Employment in the Three Typical Sectors.*




This figure represents the fundamental tendencies in the distribution of the active population according to the three types of activity.

Before 1800 and for centuries, out of 100 active persons, 80 to 90 were in agriculture (primary), about 7 in the secondary types of employment (industry, manufactures, handicrafts), around 10 in employment of the tertiary type (government, clergy, trade).

These proportions have been impressively transformed under the effects of technical progress; as of the present, the United States has only 15 men in agriculture and 30 in secondary activities, for 55 who are in the tertiary occupations.

The presumed continuance of the present manifestations of technical progress and of consumers' wants makes it possible to predict, for all countries with a modest birthrate, an analogous tendency having as asymptotes values such as 7·10 and 85.

Toward the end of this transformation, men employed in secondary activity will thus not be much more numerous than they were in 1750, while the tertiaries will have taken over the numerical position of the primaries.

economy of scarcity, and consequently of an economy based on wages, whether we are looking at an order of things along soviet lines or at the liberal world. For wages are the only practical system of rationing in an economy of even the slightest degree of complexity.

These three curves are valid both for the totality of the economy divided into three sectors which are respectively predominately primary,

secondary, and tertiary; and for a given industry, according to whether it is in a primary, secondary or tertiary stage. The curve relating to the secondary sector is in short a synthesis of the two others. If we want to follow this curve through from beginning to end we would have to start from the moment when a new product has been introduced on the market. Demand is increasing rapidly, and employment rises at the same time that productivity does. From a certain point in time on, however, the increase in productivity gains on that of consumption; employment levels off, then decreases. The discovery of a new technique can subsequently kill off completely the old activity (example: stage-coaches drawn by horses) or reduce it notably (example: village wheelwrights, the moving picture industry).

The three curves in Figure 2 are based on experience, up to the vertical line which corresponds to the present situation in the United States (where 55 per cent are in a tertiary activity).[9] What follows from there is conjectural and would require for its realisation the continuance of the preponderant causes which have shaped the past (persistence of the same type of technical progress and of the same tendencies in consumption).

*Typical Evolution of Prices and of Purchasing-Power*

In order to follow the profound tendencies of change in prices and in the purchasing-power of wages, we must first compare prices, not in terms of the monetary unit, which is always changing, but in terms of other prices, chosen as the unit according to the study which we want to carry out. In the three simple examples that follow, we shall take as our base unit the hourly wage of a very characteristic type of worker, the unskilled workman in industry, in cities of from 50,000 to 100,000 inhabitants.

The relation between current price and current salary is called the *real price*. The current price gives us a series of incoherent figures, whose incoherence grows further if we take into account the influence of exchange rates and other financial correctives. The real price, on the contrary, is both comprehensible and predictable.

For example, the going price of a haircut has gone up in France from 0·10 francs in 1780 to 150 francs in 1953. What can we deduce from that, other than that the currency has 'softened'? What can we deduce for the future? The same haircut nowadays costs, according to the country considered, 0·9 Canadian dollars, three Swedish crowns, two and a half

[9] Tertiary activity is an abbreviated expression for: activity devoted to the elaboration of a product or a service of the tertiary type.

shillings, 200 lire, 9 pesetas, 4 annas . . . . It will not help much, but rather increase the confusion, if I write that according to the current exchange rates, this gives the following sums in French francs: 300 frs., 210 frs., 150 frs., 36 frs., 25 frs. The only conclusion that could be drawn from these figures is that it costs less to have one's hair cut in Karachi than it does in Montreal or New York. Unfortunately, one cannot stock up on haircuts, and the difference in price on one haircut still does not repay the cost of a trip!

All this seems trivial but becomes scientific if we observe (see Figure 3) that these current prices, divergent as they are, in every case stand for one wage-hour: one wage-hour in France in 1780, one wage-hour in 1910, one in 1953; and not only in Paris, but in Montreal, New York, Stockholm, Madrid, Rome, Karachi, and even at Wellington, Djagarta, Moscow, Budapest. Before we had complete incoherence, now we are in the presence of utter determinism. Is this merely a curious coincidence? A strange caprice of figures which take on some pattern for a moment, in their disordered dance?

Not at all. It is the obvious and simple consequence of the tertiary character of haircuts. Little influenced by technical progress, the barber's work always takes more than 10 minutes per customer, despite the use of certain instruments such as electric clippers. The proportion of clients who are bald or shorn does not increase. The productive activity in this case remains 'artistic' and of a handicraft nature; haircuts are still awaiting for their Henry Ford and his assembly line. Productivity and a production-period which are fixed (or very slightly decreasing) carry with them a ratio which is also fixed (or very slowly falling) between wages and prices. Here, we have taken for a comparative salary base that of an ordinary workman; it would have been better to have taken that of the apprentice barber; the correlation would have been still better if we had taken the average hourly income of the master barber, whether worker or owner of his shop.

Such are the distinguishing marks of tertiary prices: levelling-off in time, identity in space; only the rates of exchange, by disequilibrating the values of salaries, disequilibrate the price of tertiary goods as well, and make the tertiary products seem expensive in rich countries and cheap in poor lands.

The prices of primary and secondary products obviously behave quite differently. The figures shown herewith illustrate their movement by examples. Variations here are by no means small-scale. A thousand per

cent, ten thousand per cent, twenty thousand per cent, are the usual figures in data of this kind. Whoever overlooks them, loses sight of one of the major phenomena of the contemporary world and deprives himself of one of the essential factors in the *explanation of our time.*

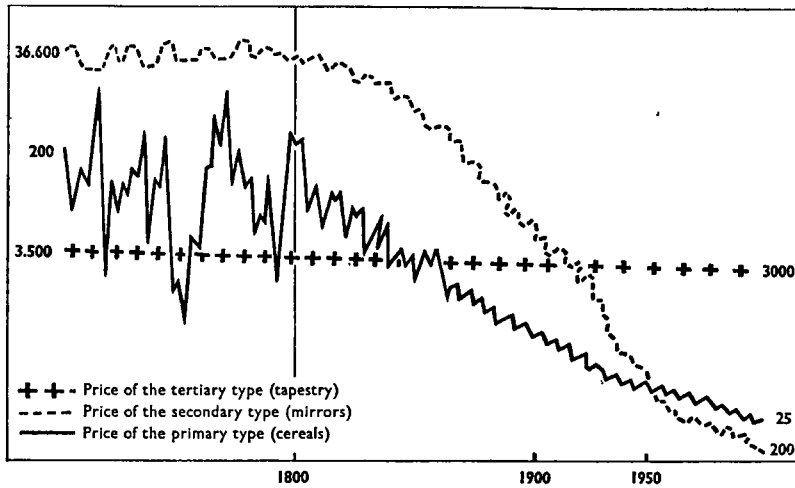
For a hundred years, men have known how to calculate within ten seconds the occultation of Jupiter by its fourth satellite; we know how to weigh the stars and measure the distance of the nebulae; but we know no better than our ancestors how to regulate questions of interest, avoid a strike, effect accords among personalities, conduct negotiations, sign a treaty. On the contrary, the power which technology has put in the hands of a few men causes what were formerly merely local squabbles and neighbourhood irritations to degenerate into world-wide suffering. Humanity suffers gravely from the fact that the physical sciences have run ahead of the social sciences.

A disequilibrium is thus brought about between our means of action and our knowledge of the consequences of action. We know how to act upon nature better than we know how to predict what will result for men from this action. And often sufferings are the result, when we were hoping for happiness. The fundamental task of our times is thus to make up for the lagging of the sciences of man relative to the physical sciences, on pain of seeing a wider and wider gap appear between our actions and their results.

In fact, it seems likely that this task will be accomplished. Long paralysed by their servile imitation of the physical sciences, the sciences of man are beginning to forge their own weapons. There has not been a month, in recent years, during which important results were not achieved, either in medicine, in psychology, in sociology or even in economics.

We hope that these few reflections, on the value of time in sociology, on the autonomy of phenomena, on the necessity for detailed analyses, on the convenience of typological classifications, and on the role of technical progress in economic life, will be of assistance for a better understanding of the present world. We hope above all that studies of this kind will be able to show the richness of new methods and the fulness of that harvest which remains to be gathered, and to arouse the interest of young people, inspire them to take up careers, so that our twentieth century will evoke in the memory of man less the birth of atomic energy than the adolescence of the sciences of man.

FIG. 3. *Fundamental Tendencies of Real Prices in the Long Term*




The scale of prices is given by the inscribed numerical figures; it thus differs for each of the three curves. These curves, moreover, are not exact in detail but only serve to indicate the types of behaviour.

It will be recalled that the real price is the current price divided by the current hourly wage. For example, in 1702, a mirror of 4 by 2 metres, cost 2,750 *livres* in Paris, and the hourly wage of unskilled workmen was one *sou* and a half; the real price of the mirror was, then, $\frac{2{,}750}{0{\cdot}075}$ = 36,600 wage-hours. In 1953, the current prices had become respectively 30,000 *francs* and 150 *francs*, and the real price was therefore $\frac{30{,}000}{150}$ = 200 wage-hours.

*Prices of the primary type* were, before 1800, very variable in the short term but very stable in the long term. Since 1800, they have tended to become stable in the short term and slowly falling in the long term. From one country to the other they were little different in 1800, but are notably divergent today (example: potatoes, fruits, cereals, green vegetables. . .).

*Prices of the secondary type* were, before 1800–1830, only slightly variable in the short term, and stable in the long term. They became, under the influence of technical progress, more variable in the short term (crises) and markedly decreasing in the long term. From one country to the other, they were formerly very little different, but today they differ among nations in an extreme fashion, as a consequence of the difference which exists in the rate of progress in different countries. Examples: iron, steel, aluminium, electricity, etc.

And lastly, *prices of the tertiary type* vary little in the short term, just as they vary little in the long term. They have been only slightly influenced by technical progress; and as a result, have maintained, up to our own time, the same behaviour as before 1800. Not having varied in time, they are also found to be identical in space, being little different in the Indies and in the United States of America. Examples: art tapestry, barbers, theatres, etc.

*A Price of Primary-Type Behaviour (Wheat) and a Price of Tertiary-Type Behaviour (the Price of a Haircut)*

| France | Current hourly wage | Current price of a quintal of wheat | Current price of a haircut | Real price of a quintal of wheat | Real price of a haircut |
|---|---|---|---|---|---|
| 1750–1785 | 0·10 | 20 | 0·10 | 200 | 1 |
| 1876–1885 | 0·23 | 23 | 0·25 | 100 | 1 |
| 1906–1910 | 0·32 | 20 | 0·30 | 65 | 1 |
| 1930–1935 | 3·2 | 82 | 3 | 26 | 1 |
| 1951–1953 | 150 | 3,600 | 150 | 24 | 1 |
| *Nations which are ahead of France* | | | | | |
| Canada 1951–52 | $1·00 | $6·00 | $0·90 | 6 | 0·9 |
| U.S.A. 1951–52 | $1·15 | $9·00 | $1·00 | 8 | 0·9 |
| Sweden 1951–52 | 2·8 crowns | 30 crowns | 3 crowns | 11 | 1 |
| England 1951–52 | 2·5 shill. | £2·15 | 2·5 shill. | 22 | 1 |
| *Nations which are backward compared with France* | | | | | |
| Italy 1951–52 | 200 lire | 7,800 lire | 200 lire | 36 | 1 |
| Spain 1951–52 | 4 pesetas | 320 pesetas | 4 pesetas | 80 | 1 |
| Pakistan 1951–52 | 4 annas | 26 rupees | 5 annas | 120 | 1·2 |

The above tables of values have been used to construct Fig. 4.



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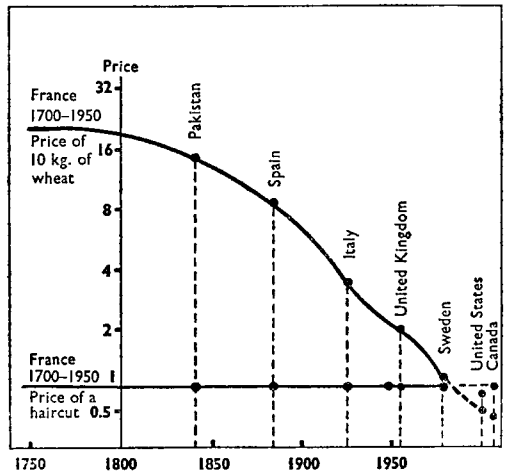
FIG. 4. *Changes in the Price of Wheat (Primary Product) and of Haircuts (Tertiary) in Time and in Space, since 1750.*




Prices are indicated in average wage-hours of unskilled workers. Logarithmic scale: figures are taken from the preceding table.

The curve shows the development of prices in France, from 1700–1750, and its foreseeable continuation (dotted line). The actual price level in other countries is marked on this curve. Certain nations thus appear retarded in their development in comparison with France, others (on dotted line) seem farther ahead.

It will be seen, however, that this retardation, so important and so consequential in the case of wheat (primary product), is without any noticeable influence in the case of haircuts (tertiary), their curve being practically a horizontal. *Tertiary prices do not vary in time, and they are constant in space as well.*