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SOME ECONOMIC ASPECTS OF THE WORLD WAR¹

ECONOMIC CONDITIONS BEFORE THE WAR²

Our Resources

THE United States is a nation of unmatched natural resources. It is a young nation. Its people have not yet multiplied so that they even approximate the potential possibilities of production. In consequence of this happy situation the United States, antecedent to the war, easily produced a sufficient amount of almost every essential commodity to meet our wants and in addition a large surplus. The production in the United States of the cereals—wheat, oats, rye, corn, and barley—was enormous. Whether the year was favorable or unfavorable, enough of each was produced not only for our own needs, but these commodities could be shipped abroad to any extent that the market demanded.

The situation in regard to meats and fats was like that which obtained for the cereals.

The only fundamental food of which we did not produce vastly more than we needed was sugar; and an adequate supply of this commodity was easily furnished by our insular possessions and by our immediately adjacent neighbor Cuba.

The two great textiles of the world are cotton and wool; and of these "cotton is king." Of the latter commodity the out-

¹ Address of Charles R. Van Hise as retiring president of the American Association for the Advancement of Science, Pittsburgh, Pennsylvania, December 28, 1917.

² For a much fuller presentation of the facts herein summarized see "Conservation and Regulation in the United States during the World War," by Charles R. Van Hise, published by the Food Administration.

put of the United States was more than twice that of the rest of the world; and wool was also produced in large quantities; but for this textile, we were both exporters and importers.

Of the most essential mineral products, we were leaders of the world. More iron ore and its products, iron and steel, were produced in the United States than by our two chief competitors combined—Great Britain and Germany.

Similarly the production of copper was more than half that of the world. For lead and zinc we led the world. The petroleum production again was more than half that of the world.

Fundamental to all industry is power; and power is mainly produced by coal and falling water. The coal production of the United States previous to the war was greater than that of Great Britain, Germany and France combined; and water power was developed on a more extensive scale than in any other country.

Also the forests of the United States originally surpassed those of any other country; indeed wood was so abundant that except in the cities we are a nation of wooden houses.

Finally the transportation system of the United States has developed far beyond that of any other country. The railroad mileage of the United States for 100,000,000 people is 40,000 miles greater than for Europe with 450,000,000 people; and, aside from Europe, is much greater than for the more than 1,000,000,000 people inhabiting all the rest of the world. Our transportation system furnished rapid movement of commodities at a lower rate than that of any other nation.

It is not so many years ago that the American people thought that all of their natural resources would last forever. It was frequently said that the deposits of

iron ore, copper and petroleum are inexhaustible. While, before the war, we had developed beyond this simple primitive faith in our bigness, at least so far as scientific men were concerned, we still took it as a matter of course that each year there would be enough of every essential commodity—food, clothing, metals, oil, fuel—to meet without limitation any demands that might be made. While there might be local want in the cities, this was not due to lack of an insufficient quantity of essentials in the country, but to our imperfect economic system. Famine was unknown. From childhood the great majority of our people regarded an abundance of essential commodities as the natural order of our planet; whereas, those who consider the globe as a whole know that a considerable fraction of the people of the world go to bed each night, if not absolutely hungry, at least insufficiently nourished. From time to time, since the dawn of history and doubtless millenniums before, famine has swept over the densely populated portions of the earth carrying away the people by hundreds of thousands or by millions.

Control by Supply and Demand

Under the conditions of abundance in this country, we depended upon the law of supply and demand and competition to control the prices and distribution of commodities. Indeed these doctrines were a faith with both the great political parties, and without being formulated have been unquestioningly accepted by the people for a hundred years.

The Antitrust Laws.—When the period of concentration in industry came with modern transportation, and it became possible by combination and cooperation to control the market and thus unduly enhance prices, a remedy for the trusts was demanded by the people. Congress decided upon prohibition with penalties.

The Sherman antitrust law was enacted, which forbids all combinations and contracts in restraint of trade and monopoly. Similar laws were enacted by the states. Notwithstanding these laws, combination and cooperation continued; and a long series of suits have been brought by the Attorney General of the United States to enforce the Sherman law and dissolve unlawful trusts. But still cooperation existed everywhere, not by definite contracts, but by mutual understanding, so that in any given community the price for each standard commodity was the same. However, the representatives of the people did not surrender their faith that the remedy was to restore the freedom of trade; and in 1915 the Clayton antitrust act was passed, which attempted to bolster up the Sherman act by introducing the new restrictive principle that any combination which resulted in substantial lessening of competition was unlawful.

Thus antecedent to the war, so far as the control of production and distribution of commodities were concerned, we were mainly dependent upon the law of supply and demand with competition and upon repressive laws which should prevent co-operation and allow a free flow of trade.

Regulation Before the War

Regulation, however, had begun. It had become recognized that the public utilities occupied an exceptional position.

The Public Utilities.—All business and industry are so dependent upon transportation, and the public convenience was so interested in having good service without discrimination that, for the railroads and other public utilities, regulation had been adopted as a national policy through the enactment of the Interstate Commerce law and the various state public utilities laws. It is difficult to recall the bitter opposition

which the proposal to regulate the public utilities aroused when it was first made. The owners of the stocks and bonds said the railroads were private property, in the control of which the public should have no part. These ideas bring a smile now; but the older men among us remember the fierce contest running through years, before it was established that the public had such an interest in the utilities as to require their regulation.

The Pure Food and Drug Acts.—At another point, it appeared that the laws of supply and demand and competition were not adequate to control commerce. It was the theory of those who held these doctrines in an extreme form that supply and demand and competition would result in securing quality, because poor goods or spurious goods could not compete with good materials. But, after the period of concentration came on, it was found as a matter of fact that food and drugs were extensively sold of inferior quality and even dangerous character under false names. After a prolonged contest, the pure food and drug laws were enacted by Congress and by the several states. The manufacturers of food and drugs denounced these regulatory measures as an interference with private business. It seems odd to us now that any one should consider it a right to sell a food or a drug under a false name. It seems even more strange that the right to sell diseased meats should be regarded as sacred. But this is so recent that probably all here remember the severe struggle to establish the principle that meat should be inspected and found wholesome before being placed upon the market.

During the contest for public control, those who advocated the regulation of the public utilities and foods and drugs were often denounced as socialists and were held up for opprobrium as being in favor of the

subversion of the fundamental principles of our government.

The Administrative Commissions.—As a necessary concomitant of these regulatory movements, commissions or other public agents were created whose duty it was to enforce the public utilities and pure food laws. At first the commissions had small authority; but as necessity arose their powers were expanded. When the present powers of these commissions and agents were worked out, it was found that they were a combination of executive, legislative and judicial; and, thus, instead of keeping these functions separate, they were combined. Regulatory commissions have now become recognized as essential under modern conditions as the executives, legislatures or courts. The development of the administrative commissions is probably the most fundamental change which has taken place in our government since the adoption of the Constitution. Therefore it is not at all surprising that the development of these commissions has been looked upon with suspicion and doubt by the people, in consequence of which it is only slowly and, as proven necessary by irresistible facts, that they have increased in numbers and expanded in functions.

The above is a wholly inadequate, because necessarily all too brief, summary of economic conditions which existed antecedent to the war.

THE EFFECT OF THE WORLD WAR

When the World War broke out in August, 1914, the immediate economic effect was to create almost a panic in this country. The stock exchanges in the chief commercial countries of the world were successively closed. Prices of many commodities fell. But it was not long before the permanent economic effect of the war began to appear.

The Greatly Increased Demand for Commodities

There were withdrawn from productive work by the allies alone 15,000,000 to 20,000,000 of men; and behind the lines as many more were ere long diverted to war manufactories. In consequence of the colossal transfer of the ranks of industry, there was a great decline in the agricultural and ordinary manufacturing production of Europe. Yet, the many millions of men in the field required more than the usual amounts of food and great quantities of clothing. The demand for ships, guns and munitions was insatiable. The result was an extraordinary call for essential commodities from the United States.

Increase in Exports

The amount of wheat which was exported in the fiscal year 1914-15 was more than double that of any previous year. The exportation of meats and fats rapidly increased until it became threefold.

The exports of iron and steel gradually increased until they became fourfold.

The exportation of copper increased twofold. Many other commodities were exported in proportion to those mentioned.

Thus while, from the outbreak of the war, the central powers were in a great measure cut off as export markets for the United States, the needs of the allies were so greatly enhanced as to vastly more than counteract the partial loss of the export market for the central powers.

Increase in Home Demands

Finally in April, 1917, we entered the war; and in consequence there were at once great governmental demands for materials to build ships, for munitions, for food, and for textiles. To meet these needs it was necessary greatly to extend our manufacturing, transportation, mining and

constructional facilities. Thus there arose a greatly increased home call for foods, for textiles, for metals, and for wood. Fundamental to all industry is energy. The energy derived from water can not be readily increased suddenly; and therefore the increased requirements must be met by coal. This particular demand came rather slowly; and it was not until the middle of the summer of 1916 that a shortage of coal appeared probable. From the middle of that year, the demand has exceeded the supply, and exerting every effort, for 1917-18, it is estimated that the supply will be 50,000,000 tons short of the needs, although the production has been largely increased.

Mounting Prices

It thus appears that, in consequence of the World War, we have an absolutely new situation in this country—one in which there is demanded more of every essential commodity than the country is able to supply. Because of this radically changed situation prices began to mount, rather slowly for most commodities until about July, 1915; but since that time for two years rapidly and at an accelerating rate. Prices at about the middle of 1917, as compared with those three years earlier, just before the outbreak of the war, for a number of the most important commodities, were roughly as follows:

Meat animals and meats, 25 to 75 per cent. higher.

Wheat and flour, two and one fourth times as much.

Corn and cornmeal, an increase of 80 per cent.

Potatoes, an increase of about 60 per cent.

Sugar, an increase of 75 per cent.

Cotton and cotton yarns, an increase of 75 per cent.

Wool and worsted, two and one third fold.

Bituminous coal, from two to threefold.

Copper, about two and one half fold.

Pig lead, about threefold.

Pig iron, about three and two thirds times as much.

Steel billets, more than fivefold.

Spelter, nearly double.

Petroleum, an increase of about 75 per cent.

The Causes of Mounting Prices.—The fundamental cause of the mounting prices is that which has already been explained, an unusual and extraordinary demand at first abroad and later at home for all essential commodities; but this has been only one factor in the process.

When it was generally appreciated that there was likely to be a shortage of the essential commodities, the home purchasers, instead of buying ordinary amounts, purchased in advance of their needs. Thus the family, instead of buying flour by the sack, bought a number of barrels; or, in some instances, bought flour for years ahead. The same was true for sugar. Similarly during the spring and summer of 1917, when it was appreciated that there was a shortage in coal, many manufacturers tried to protect their business by accumulating reserves to carry them through the winter. Many of those who required coal for heat did likewise.

The consequence of the unusual buying campaign was that the demands of purchasers were far beyond what would have been necessary to meet actual needs, had the ordinary procedure been followed. This frenzy of excessive buying greatly aggravated the situation.

Another important cause of the rising prices was that a time when there is an extraordinary demand is especially advantageous for speculators to accumulate larger stores of goods of various kinds and hold them for advances in prices. This

was done on a great scale throughout the country for every essential commodity.

Finally, when the conditions are set forth, it is especially easy for those in a given line of business to cooperate to push prices upward and thus greatly increase their profits. This also was done extensively for many commodities.

Based upon the first factor, the second, third and fourth factors have come in to accelerate advancing prices, each with reinforcing power. The tendencies above described, once started, are cumulative, and the enhancement of prices goes on with increasing velocity. The prices of foods are advanced; the employees must have higher pay because of the increased cost of food; the raw materials for manufactured articles are advanced; the manufacturer charges a higher price for his articles because he must pay more for his labor and an increased price for his raw materials. The jobber and the retailer did likewise. At each successive stage the advance of prices is made sufficient to cover the increased cost and an additional increment is placed on top. The cycle thus completed, is begun again with food, and the circle once more gone around. The second cycle completed, the conditions are right for a third cycle, and so on indefinitely, with the result that prices rose beyond all reason, like a spiral ascending to the sky.

Failure of Control by Supply and Demand

Under pre-war conditions, when the supply was equal to and often greater than the demand, the prices, if not adequately controlled, had been largely controlled by competition, except where there had been cooperation of purchasers or manipulators, or both, to control the market; but the facts presented show that under the war conditions the laws of supply and demand and competition adequately to control

prices have broken down, for the simple reason that for every staple commodity the demand is ever greater than the supply.

It is not possible to give percentages of the extent to which the demand exceeds the supply for each commodity; but it is safe to say that the percentages upon the average are not large, probably not more than 20 per cent., and for scarcely any commodity more than 30 to 40 per cent. Thus for coal the demand for the current year over that of last year is 20 per cent., and the excess demand for this year over the production not to exceed 10 per cent.

However, the moderate excess demand, taken in connection with buying in advance of needs, of forestalling by speculators, and combination to control the market, has been sufficient to increase the prices of many essential commodities by 100, 200, 300, and even 400 per cent., and for certain articles greater amounts. It is therefore clear that there is no relation whatever between the excess demand and the increase of prices under the competitive system. An increase demand of one tenth or one fifth may increase prices two, four, or even five fold.

There is no reason to suppose that the excess demand will decrease in the near future; indeed it is probable that next year the demand for commodities will be greater than this year; and this situation of excess demand over the possible supply will almost certainly continue to the end of the war and possibly even longer. So long as the excess demand exists, if supply and demand are allowed to have full play, prices will continue to climb.

The situation above described in regard to an inadequate supply of essential commodities and their ever-increasing prices demonstrate that, under the war conditions, the laws of supply and demand and competition are insufficient to secure the neces-

sary increase in production, to control distribution, and to hold prices at proper levels. If the war is to be carried to a successful conclusion the production of the United States must be enormously increased. The distribution of the essential commodities must be such as to meet the various needs in proportion to their importance. The prices to the people of the United States and the Allies must be reasonable else extortion will continue on a vast scale both from ourselves and our associates; but the law of supply and demand and competition did none of these things—even the increase in production was inadequate.

REGULATORY MEASURES NECESSARY

To remedy the situation the President asked Congress for one regulatory measure after another. The crisis was such that these requests have all been met. The result is a most amazing series of regulatory enactments. These are as follows: The food and fuel administration act, the shipping act, the espionage act, the trading with the enemy act, and the priority act. Also the War Industries Board and the Federal Court have instituted regulatory measures without congressional action.

It is my purpose very briefly and inadequately to summarize some of the things which have been done under these regulatory measures and, following such summary, to discuss the principles involved. All of the measures enacted by Congress grant the powers to the President. These he has in some cases at first exercised, but later delegated them to agencies created as authorized by the acts. After such agents have been created, the President has issued proclamations from time to time in accordance with the recommendations of the several agencies. In the succeeding pages, for the sake of brevity, no discrim-

ination is made between the exercise of the powers by the President directly and their exercise by his agents.

The Food Administration Act

Under the Food Administration Act, the President appointed Herbert Hoover, Food Administrator. The latter organized the Food Administration. A licensing system has been introduced for all essential food commodities. Manufacturers, wholesalers, and other distributors are required to take out a license in order to conduct their business. Under the terms of these licenses, hoarding and speculation are to be eliminated and only fair and reasonable profits or charges are to be made for services rendered. Thus the charge which the miller may make for the manufacture of flour and the margin which the jobber may take for its distribution is definitely limited.

The law confines the control of the Food Administration to the zone between the original producers, that is, the farmers and the farmers' associations and the retailers with a business less than \$100,000 per annum. The manufacturers and the wholesalers are directly reached by regulation; the farmers and retailers only indirectly. While the base price of the producer is not controlled, intermediate additions are, so that the product reaches the retailer with only a fair increment added to the price of the producer. The public is informed in regard to the price which the retailer pays and what would be a fair price which he should charge.

Scarcely less important than the regulation of prices is the control of distribution. The Food Administration decides upon the amount of the essential commodities which go abroad and to what country they are to go. Not only so, but he controls the home distribution, and if advisable, even to the extent of the purposes for

which the commodities are used and the amount.

The situation is well illustrated by the staples—sugar and wheat and its products.

Sugar.—For sugar the Food Administration has made agreements with the producers in regard to the prices which they are to receive; with the refiners concerning the prices they are to charge for their services; has limited the margins of the jobbers and wholesalers; and thus has controlled the price at which the commodity should be sold to the retailer. Also the Food Administration has indicated what would be a fair margin for the retailer. Thus the public knows precisely what it should pay for sugar in any locality. Further, the Food Administration has very sharply controlled the distribution of sugar, deciding absolutely the amount which is to go abroad, and has limited the amount of sugar to be used in certain industries, such as the bakers and the confectioners.

Wheat and Its Products.—For wheat the control has gone even farther. The price of wheat has been fixed for each grade at the primary central markets. To handle wheat a grain corporation has been formed, which organization has actually bought and sold wheat to the extent necessary to reach the required results. While only a small part of the wheat crop has been bought and sold by the grain corporation, the other larger part has been controlled as completely as if it were bought and sold; that is, the grain seller and the miller and exporter have been brought into direct relations. The wheat remains at home or is sent to our associates in war in accordance with the directions of the Food Administration. With few exceptions sales have been carried on at the prices fixed by the Food Administration, and thus the dealing in wheat is practically a government-controlled monopoly.

By limiting the charges of the miller, the price of flour at the mills is as definitely controlled as the price of wheat. The jobbers' margins are fixed and the freight rates are known. The bakers have been brought under licenses, which provide for a standard loaf, both in regard to its constituents and its weight. The price of this standard loaf is therefore definitely determined for the bakers in different parts of the country; and this gives a basis upon which to announce a fair charge by the retailers. This for a pound loaf is from 7 to 9 cents. Thus the price of bread, the staff of life, is brought under control.

In distributing the wheat, its main routes of travel have been very greatly changed. Under pre-war conditions the wheat very largely went to the great central markets and especially Chicago and St. Louis. The price of the wheat of the country was controlled by Chicago quotations; and this market, and to a lesser extent St. Louis, served as magnets which drew the wheat to these centers. From these centers it was redistributed. Under the Food Administration the importance of these centers has diminished; cross and return freights have been avoided. The wheat for export has very largely gone directly south to the Gulf ports and there found an outlet instead of East to the Atlantic ports. The wheat not exported has gone directly to the milling centers, in proportion to their capacity, there to be converted into flour.

Other Foods.—Other essential foods have been placed under the licensing system and thus to a large extent controlled, although as yet regulation has not gone to the extent of that for wheat and its products and sugar, but the Food Administration is moving from one essential commodity to another. Thus the first step in the control of the price of meat—the limitation

of the profits of the packers—has been taken.

As a result of the work of the Food Administration the skyward movement of prices has been checked, and for some of the most essential commodities such as wheat, the product of wheat flour, and bread, there have been actual reductions in price. Also prices have been stabilized. Dealing in futures for the most essential products has been prohibited and hoarding and speculation prevented.

The Fuel Administration Law

One section of the Food Administration act authorized the control of fuel. Under this section the President appointed H. A. Garfield Fuel Administrator. The maximum price of each kind of coal and coke at its source has been fixed. Moreover, the margins which are allowed to the jobbers and to the retailers have been limited, and thus the price of coal to the consumer has been controlled. Therefore for coal, the price control occupies the full field rather than the zone between the producer and the retailer as in the case of wheat.

The Fuel Administration has also controlled wage contracts with the miners. When a considerable advance of wages was approved, it was made a part of the contract that the miners should be penalized \$1 a day if they declined to work or ceased to work during the time the contracts into which they had entered remained in force.

The distribution of coal and coke has been controlled as completely as the price. The coal has gone for the purposes and to the various districts in accordance with the decisions of the Fuel Administration. The amount of coal which goes abroad is also controlled. Thus the amount assigned to Canada is the quantity received last year plus the same percentage of increase as that obtained by the United States.

The prices have not been fixed exclusively upon the basis of the heating power and the location of the coal, but in part upon the basis of the cost of production. In many instances this gives the poorer mine which is unfavorably located a higher price per thermal unit than the rich mine favorably located. This practise is in complete contravention to economic theories accepted before the war. The owner of a better property gained all the advantages of cheapness of operation and convenience of transportation.

Had the Fuel Administration so decided, it would have been possible under the law for the government to become the exclusive buyer and seller of the coal for the country. Had this method been used, the coal mined would have been sold to the Fuel Administrator by the operator at a fair profit. The coal then his property would have been pooled and sold at prices dependent upon its value, taking into account its thermal power and other qualities and its position in the country in regard to freight. The prices fixed would have been sufficient to cover its cost, including that of administration.

The Shipping Board and Emergency Fleet Corporation Boards

The United States Shipping Board has requisitioned all cargo ships and tankers registered under the laws of the United States of not less than 2,500 tons total dead weight capacity, and all passenger steamers of not less than 2,500 tons gross register. These vessels, thus requisitioned, have in general been leased to the companies which before have been operating them, the companies receiving a definite compensation based, for freight boats, upon dead weight ton capacity, and for passenger vessels upon the number of passengers which they can carry. The vesesls are to sail on routes and

carry goods as determined by the Shipping Board.

The Shipping Board also exercises the control of interstate commerce by water, its powers being analogous for water transportation to those which have been exercised by the Interstate Commerce Commission in regard to railroads. However, the powers of the Shipping Board extend beyond those of the Interstate Commerce Commission in that the board is allowed to approve any agreement between common carriers by water concerning rates, accommodations, pooling, limited sailings, and other arrangements; and all agreements thus approved by the board are exempt from the Sherman antitrust law and its amendments.

Under the Shipping Board, there has been organized the Emergency Fleet Corporation with a capital stock of \$50,000,000. This corporation has requisitioned all the shipyards of the United States and all the ships under construction. The ships will be completed in accordance with the directions of the Fleet Corporation. The actual operation of the yards and the finishing of the ships remain with the corporations and persons who previously had them in charge, but the compensation which they are to receive is upon the basis of a fair profit, which is decided by the Fleet Corporation.

The Fleet Corporation is also engaged on a gigantic scale in the construction of additional ship-building plants and in the construction of new ships. This work is largely done not by the Fleet Corporation itself, but under contract. The Emergency Fleet Corporation has announced that the actual building program under contract embraces more than 8,000,000 tons, dead weight capacity.

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(To be continued)

THE NOMENCLATURE USED IN COLLOID CHEMISTRY. A PLEA FOR REFORM

COLLOID chemistry is no longer considered as a mere collection of mysterious substances and "abnormal" reactions. It is an important branch of chemical and physical science possessing a fairly well established working basis and is rapidly acquiring new students.

It suffers, however, like all virgin sciences, the affliction of superfluity of terms used to describe essentially the same things, careless and loose use of some expressions, and confusion of nomenclature in general. This condition results in a great handicap to new students. It is very difficult for them to acquire clear conceptions from their first readings of the various works on the subject.

It is time that this matter be taken in hand by some committee of our Chemical Society for the purpose of removing this needless handicap and confusion by defining the various terms used in colloid science, eliminating unnecessary ones and by standardization of the terminology in general, just as was done with the terminology of the proteins by the biological chemists some years ago.

The paragraphs which follow attempt to point out some of the cases of malusage of terms.

No objection can be raised against the word "colloid." It is distinctive, but the use of the expression "colloidal *solution*" is to be strongly condemned, since it is so evident that substances in the colloidal condition are not dissolved, in the strict sense of the term. Colloidal particles are in a condition midway between solution and mechanical suspension, and they are held in this peculiar state of *dispersion* by virtue of their surface energy, electrical charge, their kinetic energy as manifested by the Brownian movement, and the adsorbed ions of electrolytes which are essential to the stability of all colloids.

The general term "dispersion," as suggested by Wo. Ostwald, is to be preferred to the special term "solution." *E.g.*,

"Mechanical suspen-	
sions" are	Coarse dispersions,