

A Note on Farm Price Support Programs

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A close and candid study of federal subsidies and their effect upon agriculture.

RECENTLY PROFESSOR WILLARD COCHRANE boldly suggested that a combination of circumstances is pushing in the direction of a cartelization of agriculture. "I am convinced that society is eventually and inevitably going to grant monopoly powers to agriculture, via government, to permit and to enable the many producers in agriculture to act in concert."¹ In *Farm Prices, Myth and Reality*,² the main outlines of a monopolistic course of action for agriculture which seem to Cochrane to have more desirable than undesirable features are once again set forth; the monopolistic features, however, are cloaked in the guise of a "public-utility approach to the price-income problems of agriculture."³

The objective of the public utility approach does not differ from the objective of acreage limitations, export dumping, import restrictions, domestic multiple price plans, destruction of output, expansion of demand, storage, and direct payments which were designed to obtain for farmers a given price support; the difference lies

in the method suggested for obtaining the price support end, which is basically a comprehensive supply control program comparable to the fluid milk, tobacco, and sugar programs. Cochrane likens his public utility approach primarily to that of sugar.

The need for a cartelization of agriculture essentially rests on Cochrane's conviction that the technological forces shifting supply to the right will continue in the next decade to out-pace growth in demand; with both the elasticities of demand and supply with respect to price inelasticity, the net effect of a victory by supply will be to reduce agricultural income and add to the welfare disparity vis-a-vis agriculture and the rest of the economy unless society is prepared to underwrite a large price-income support program out of the treasury or grant agriculture more comprehensive control over supply. Since Cochrane doubts the willingness of society to continue underwriting an agricultural support program, he urges that increased attention be given to the latter alternative.

While it is a matter of conjecture and debate whether the technological shift in supply will continue indefinitely to out-pace demand,⁴ and while Cochrane's emphasis on short-run inelasticities of demand

and supply may create a misconception as to the nature of their respective long-run elasticities,⁵ his bold, if not courageous, suggestion to create via the political process a more comprehensive system of production and marketing controls in order that commercial farmers might enjoy "reasonably good and stable prices and incomes" raises the question, what have been the income effects of those programs to which his comprehensive proposal might be compared?

The Effects of Control Programs

Of the two sides to the income question, this note is directed towards summarizing information with respect to the apparent effect of control programs on the level of agricultural income rather than its stability. Have the fluid milk, tobacco and sugar programs raised the level of producer income relative to the incomes of agriculture as a whole and the non-farm sector? The word "level" is used to denote an average of several years as opposed to prices and incomes prevailing in any one year; where the data permit, a three year average level is used to iron out transitory fluctuations.

Selected for comparison are the periods 1947-49, in which farm operators received the highest net income ever recorded by the Department of Agriculture, and the most recent period for which data are available, 1954-56. Between these two periods prices received by farmers declined 11.2 per cent; prices paid by farmers, on the other hand, rose, thus accelerating the decline in the parity ratio which fell 21 per cent. During this period the average price received for sugar beets increased by one-half of one per cent; the price of sugar cane increased 10.4 per cent; flue-cured tobacco, 13 per cent; and burley tobacco, 12 per cent. Of the three commodities subject to the most stringent production controls, only fluid milk failed to increase in price; it declined, on the average, 8.1 per cent, somewhat less than the index of prices received by farmers. The price data support the hypothesis that commodity con-

trol programs have been more successful in maintaining, and in some instances raising, prices than farm support programs in general.

On the income side, level comparisons can be made easily only with respect to dairy and tobacco enterprises; see Table 1. These data indicate that all seven of the USDA's 28 commercial family-operated farms having dairy or tobacco enterprises rose in ranked income status (columns 4 and 5). Save for Wisconsin dairy farms, these enterprises were more successful in maintaining net income than farm operators in general whose income declined 10.4 per cent, and the USDA's 28 commercial farms whose income declined on the average 24.7 per cent.

Only one of the seven enterprises had a better than average net income during the 1954-56 period; and only three of the seven had incomes which ranked better than the average for all 28 enterprises considered. While the control programs were relatively successful at preserving net income during the recent decline, they did not induce adjustments necessary to create "good" incomes. Even the three enterprises which had an increase in net income between 1947-49 and 1954-56 lost ground relative to the 31.9 per cent increase in net income enjoyed by non-farm families between 1947-54.⁶

Turning to a different set of data, it does not appear that sugar producers were much better off than other farms in 1949, the only year for which data are available. See Tables 2 and 3 for comparisons. Those instances in which sugar producing counties or parishes have higher net incomes than the average for their respective states are about offset by areas which have lower incomes. In connection with sugar, it should be pointed out that the data are not inconsistent with the hypothesis that the gains from the control program have been capitalized into land values. With respect to Louisiana sugar producing parishes, one notes that the value of land and buildings per acre in farms in 1950 is higher in all

TABLE 1

Net Farm Income per Farm, Commercial Family-Operated Farms, by Type, Averages 1947-1949 and 1954-1956, and Their Rank.¹

	Average net income per farm (dollars)		Percentage change — columns (1) + (2) (3)	Rank 1947-49 (4)	Rank 1954-56 (5)
	1947-49 (1)	1954-56 (2)			
Dairy farms					
Central Northeast	3,892	4,077	4.8	20	12
Eastern Wisconsin	4,366	3,133	-28.2	18	16
Western Wisconsin	3,284	2,607	-20.6	23	22
Corn Belt farms					
Hog-dairy	5,639	5,281	-6.4	15	6
Tobacco farms					
Tobacco-livestock (Kentucky)	3,334	3,163	-5.1	22	15
Small tobacco farms (N. Car.)	2,354	2,697	14.6	25	21
Large tobacco-cotton farms (N. Car.)	3,923	4,142	5.6	19	11
Average 28 enterprises	6,370	4,798	-24.7	—	—

cases than the state average (column 3, Table 2), and that in all save three of the 12 cases the average size of farm is greater (column 4), negating the alternative hypothesis that sugar land is inherently more productive. An investigation of the determinants of irrigated land values supports the same hypothesis;⁸ according to Johnson, a premium must be paid to obtain land with tobacco quotas.⁹ The capitalization of gain, which Cochrane chooses to call "cost of doing business in a stabilized agriculture,"¹⁰ whether it be into land values or, as he would advocate, marketing certificates, bears careful scrutiny.

The paradox of Cochrane's suggestion to cartelize agriculture is the presumption that farmers can be made significantly better off by increasing the cost of doing business. Admittedly, the farmers who own the land or obtain the marketing certificates would stand to benefit from this plan via the capitalization process, but this is a once and for all benefit unless agriculture is unexpectedly restabilized at higher price levels in future periods. The young farmer trying to enter the business and the farmer struggling to expand his unit of operation would not benefit from an increase in the cost of

doing business. That is, unless the windfall accruing to farmers in general ironed out imperfections in the capital market, such that ease of financing scale adjustments outweighed the increased cost. At this juncture, the effect of support programs on the capital market is still a matter of conjecture and, in any event, the effect should be compared to alternative ways of obtaining the same end at less cost to the taxpayer and to the consumer.

The objections one is forced to raise against any program designed to raise prices above long run free market equilibrium levels are that it may impede adjustments¹¹ which are not only desirable but inevitable, and that it will not distribute benefits in a manner consistent with the ideal of a more nearly equal distribution of income.

The Need for Adjustment

While Cochrane performs a service by pointing out the existence of a myth which holds that agriculture is just a little out of adjustment, that it can be made to adjust easily by tinkering with the price mechanism, he may be performing a disservice to agriculture in the long run by emphasizing

TABLE 2
*Farm Income and Related Parish and State Data, Louisiana
Sugar Producing Areas*

Parish	Sugar acreage as a Per Cent of Cropland Harvested, 1949 ¹²	Median Farm Income 1949 ¹³	Value of Land and Buildings in Farms, 1950 ¹⁴	Average Farm Size (acres) ¹⁴
	(1)	(2)	(3)	(4)
Ascension	45.6	\$1,402	\$107.81	77.5
Assumption	72.1	1,062	86.08	249.0
Iberia	45.5	1,067	116.74	125.6
Iberville	48.0	1,576	99.21	164.4
La Fayette	42.0	1,392	187.75	44.3
Pointe Coupee	17.1	978	87.18	104.9
St. James	63.5	980	85.14	171.2
St. John the Baptist	59.6	1,154	89.42	245.1
St. Martin	23.9	1,167	100.38	55.4
St. Mary	66.1	1,125	89.44	410.9
Terrebonne	58.5	1,240	117.06	160.3
West Baton Rouge	53.6	924	124.86	125.7
Weighted average, 12 parishes		1,174		
State	9.0	1,106	82.21	90.2

ing the need for adjustment on the output side to maintain aggregate agricultural income as opposed to a more difficult course of adjustment on the input side designed to bring about factor price equalization both within agriculture and between agriculture and the rest of our economy.

Even if the price of agricultural products were held at parity, there would exist a need for revolutionary adjustments on the input side to attain and maintain factor price equalization in the wake of general economic growth which continually increases the marginal product of labor and its price relative to most other inputs.

Holding both agricultural prices and the state of the arts constant, a large movement of labor out of agriculture and a recombination of agricultural resources would still be necessary to bring about a more nearly equal distribution of income, since the variance in farm operator income both within agriculture and between agricultural regions is about as great as the variance between farm and non-farm family in-

comes. In 1954, for instance, the coefficient of mean variation between farm and non-farm income was 46 per cent; coefficient of the mean variation between the USDA's 28 commercial farms and non-farm income was 13 per cent. On the other hand, the coefficient of variation with the USDA's group of 28 commercial farms was 87 per cent; between the USDA's six geographical regions, 38 per cent; and within the Department of Commerce's distribution of farm operator incomes, 43 per cent. In general too little attention has been paid by agricultural economists to the factors responsible for income variation. While the USDA's income statistics for commercial family operated farms may not be representative of all families that consider themselves commercial farmers, they do serve to emphasize an important point, notably that the information available is not complete and detailed enough that legitimate comparisons can be made between farm and non-farm income. If one were to include the non-commercial farmer, who

TABLE 3

*Farm Income and Related County and State Data, Western
Sugar Beet Producing Areas*

County or State	Beets as a Per Cent of Irrigated Cropland Harvested	Median Farm Income
	(1)	(2)
Alameda	15	\$2,542
Sacramento	14	2,272
San Benito	14	2,211
Yolo	25	2,089
California		2,323
Morgan	15	2,194
Weld	17	2,499
Colorado		2,182
Keith	14	2,575
Morrill	10	2,353
Scotts Bluff	13	2,284
Nebraska		2,182
Canyon	12	2,445
Franklin	13	2,448
Minidoka	10	2,390
Idaho		2,394

lowers the average income of all farmers, in the non-farm class, as has been suggested might be done by Warburton and individuals in charge of constructing the Department of Commerce's non-farm income distribution, since many of these families obtain most of their cash income from non-farm sources, much of the income disparity between the two sectors would disappear. If further adjustments in the data were made to allow for transitory factors such as weather, for differences in inherited and acquired wealth, for differences in income due to age, sex, race, population concentration, regional growth, capital invested in education professional training, a valuation of farm products consumed at retail rather than at the farm, and for differences in ability and specialized talents, it might well turn out that commercial farmers are in general financially better off than their appropriate city counterpart, that they are, in fact, paying no special price for the benefit alleged to be associated with an agrarian way of life. Viewed from this perspective,

the farm problem might well collapse into more general problems of economic and social adjustment immune to correction by farm price manipulation.

The impact of technological advance on different enterprise types and different geographical regions makes the adjustment problem even more difficult in a dynamic sense, since the various enterprises and regions are affected differently. One has merely to observe the behavior of the input per unit of output series developed by the Department of Agriculture for their commercial, family-operated farms to note the differential impact. The trend in input per unit of output has been markedly downward since 1930 in the Corn Belt, the Kentucky Bluegrass, and the Mississippi Delta. On the other hand, the Southern Piedmont, the Black Prairie of Texas, and the Inter-mountain regions show no discernable trend in input per unit of output. In a dynamic economy even with stable agricultural prices some areas will be forced to recombine inputs in a more dramatic fashion

than other areas in order to attain income parity vis-a-vis agriculture as a whole and the non-farm sector.

The Distributive Effects of Price-Support Programs

While it is common knowledge that price-support programs do not distribute income equally and hence serve to increase the absolute if not the relative income disparity between farmers, this fact is usually lost sight of by both policy makers and agricultural economists when it comes time to suggest solutions to the farm problem. Cochrane essentially begs the plight of the subsistence farmer who would not stand to benefit materially from a cartelization of agriculture by confining his remarks to the plight of the commercial farmer. On pages 23-24 he compares the average income of commercial farm operators with non-farm families. Other than for D. Gale Johnson's paper on the effects of high level support prices on Corn Belt agriculture,¹⁵ little attention has been paid to the inconsistency between these programs and the equalitarian ideal of a more nearly equal distribution of income. Yet it may be this inconsistency which makes a few farmers wealthy without materially helping the poor farmer that is responsible for increasing resistance on the part of the general taxpayer to the present farm program.

In January 1947 the BAE conducted a nationwide field survey to obtain a size distribution of farm operators' income.¹⁶ The results of this survey give one of the best pictures that may be obtained as to what would be the impact of a general price support program on farms with different cash incomes. Since as a first approximation the effect of a price support program is to benefit farmers in proportion to their sales of supported farm products, a rough measure of the potential differential impact of these programs can be obtained for each income class by computing the percentage ratio of gross cash income

to the number of farms; see Table 4, columns (3) and (6). This ratio essentially expresses the gain to each income class as a per cent of an equalitarian change. A ratio of .50 indicates that the farmers in the income class under consideration obtain only half the benefit that would be obtained if the change in aggregate farm income were distributed equally among all farmers; a ratio of 2.00 indicates that the income class under consideration obtains twice the equalitarian share. The unadjusted survey ratios for different income classes in 1946 ranged from zero, for 7.4 per cent of all farm operators reporting zero income, to 13.87, for 1.6 per cent of the farm operators reporting 20,000 dollars worth of sales or more. Thirty per cent of all farm operators would have received more than eighty per cent of the benefits from a general price support program.

While the exit of proportionately more small farmers from agriculture, enlargement of farm units, and a decline in agricultural prices may have done much in the last eleven years to bring about greater income equality, it is safe to infer that the redistributive effects of price support programs are still far from equal. It is this factor, it seems to me, that makes many economists favor adjustment programs to encourage the movement of labor out of agriculture and to permit a consolidation of the smaller, less efficient farm units; it is this factor which leads the welfare economists to favor a compensatory income payment program, since payments could be related to variables other than output and price. T. W. Schultz has suggested in a speech before the National Farm Institute, Des Moines, Iowa, February 14, 1958, that income payments might be related to the time and effort farm people devote to farming and that they might be offered as an inducement to increase the rate of occupational migration.

Utopian and politically unreal as programs designed to ease and facilitate the

TABLE 4
Gross Cash Farm Income, Adjusted and Unadjusted Distributions
by Gross Income Classes, 1946^a

Gross Income Class	Unadjusted Survey Data			Survey Data Adjusted for Under-reporting		
	No. of farms (1)	Percentage of farms Income (2)	Ratio of (2) to (1) (3)	No. of farms (4)	Percentage of farms Income (5)	Ratio of (5) to (4) (6)
0	7.4	.0	.00	7.4	.0	.00
\$1— 249	15.5	.6	.04	10.5	.3	.03
250— 499	9.8	1.2	.12	11.4	1.0	.09
500— 749	7.7	1.6	.21	9.7	1.4	.14
750— 999	6.0	1.7	.28	5.2	1.1	.21
1,000— 1,499	9.1	3.7	.41	8.1	2.3	.28
1,500— 1,999	6.7	3.8	.57	6.2	2.6	.42
2,000— 2,499	5.2	3.8	.73	4.9	2.6	.53
2,500— 2,999	4.5	4.0	.89	5.1	3.3	.65
3,000— 3,999	6.2	7.1	1.14	5.0	4.1	.82
4,000— 4,999	5.0	7.3	1.46	3.7	3.9	1.05
5,000— 5,999	3.6	6.5	1.80	3.3	4.3	1.30
6,000— 7,499	4.1	8.9	2.17	6.3	10.0	1.58
7,500— 9,999	3.4	9.5	2.79	5.0	10.1	2.02
10,000—19,999	4.2	18.1	4.30	4.7	15.1	3.21
20,000 & over	1.6	22.2	13.87	3.5	37.9	10.82
Totals	100	100		100	100	

adjustments brought about by the technological revolution in agriculture are,¹⁸ they have their appeal.¹⁹ The discouraging thing about them is that by the time Congress and the public are thoroughly educated as to the nature of the adjustment problem facing agriculture, many if not most of the necessary adjustments will have been made.

If the farm population were to continue to decline at the same rate in the next twenty years as it has in the last ten to fifteen years, one can infer that there would be no farm problem, for the simple reason that there would be no farm population. With our eyes glued to the short run, it is easy to lose sight of how rapidly the problem of "too many farmers" is resolving itself apparently without government intervention designed to encourage such adjustment.

While a case might be made to the effect that agriculture has contributed substantially to the general increase in productiv-

ity;²⁰ that it, more than other sectors contributing to the efficiency with which we produce the gross national product, has been forced to make difficult adjustments on the labor input side, and, owing to the competitive nature of the industry and the inelasticity of demand and supply, has captured a smaller fraction of the benefits accruing from increased efficiency, still it is not all clear that the solution to this inequity is increased government intervention. The demand effects, the quality effects, and the substitution effects, which (according to T. W. Schultz) explain in large measure "the nature and severity of the U. S. farm problem,"²¹ and are responsible for a decline in the relative importance of agriculture in an economic sense, are bound to be responsible for a decline in the relative importance of agriculture in a political sense. In 1956 agriculture engaged six per cent of our labor forces, used only twelve per cent of our tangible assets, and contributed only four per cent

to the gross national product.²² With these percentages declining with respect to time, is it in the best interest of agriculture in the long run to look toward increased government intervention in the market rather than to face realistically adjustments which are inevitable, if the goal of income parity is ever to be obtained by farmers generally?

Concluding Remarks

My purpose in writing this review has not been to quarrel with Cochrane's prophecy of a cartelized agriculture, but to reiterate the rather obvious conclusion that price support programs generally are poor tools for redressing agricultural incomes. At a speculative level, it may turn out that recent technological developments in nutrition will tend to create a more monopolistic type agriculture than can be created by government intervention. Nearly all the graduates in animal nutrition are hired by major feed companies at the present time. Spectacular advances in poultry nutrition, for instance, have revolutionized that industry, have dramatically changed its location in a few short years, and have brought into being a new system of contract broiler raising controlled primarily by the large feed companies and cooperatives rather than by the independent decisions of several million individual farmers. It is currently suggested that nutritional advances in the feeding of hogs will bring about similar changes. Assuming that the large feed companies are able to maintain control over feed technology and through nutritional advances obtain control over livestock production and marketing, it would only be a matter of time until they would be able to control the production of feed grains in the manner analogous to the way in which canneries are able to control the supply of produce. Cochrane's prediction that circumstances are pushing in the direction of a cartelization of agriculture may turn out to be a valid prediction, but for unanticipated reasons. In either event, the input adjustment problem, which lies at the heart of the so-called "farm prob-

lem" should not be minimized or overlooked.

¹Willard W. Cochrane, "Agricultural Policy — Recent Changes and Future Implications," *Journal of Farm Economics*, May 1957, pp. 296-97.

²Minneapolis: University of Minnesota Press, 1958.

³*Ibid.*, p. 172.

⁴According to Bressler, (R. G. Bressler, "Farm Technology and the Race with Population," *Journal of Farm Economics*, November 1957, pp. 860-61). "We can recognize that weather, economic conditions and the backlog of technology are non-repetitive factors that contributed to the 1935-55 increase in farm production and that cannot be expected to make similar contributions in 1955-75 . . . these factors may have accounted for ten points of the 1935-55 increase.

"In summary, then it would appear that the real job ahead for American agriculture is not simply equivalent to the remarkable increases achieved during the past 20 years but forty per cent higher than those record rates."

⁵Essentially it takes time for either consumers or producers to respond to price changes; the adjustment process may be so slow as to bias empirical estimates of the relevant elasticities. Nerlove's work indicates that estimated elasticities of the supply of selected agricultural commodities are more elastic if the adjustment process is taken into account. See, "Estimates of the Elasticities of Supply of Selected Agricultural Commodities," *Jour. Farm Economics* 38 (1956), pp. 496-509. Schultz's discussion of price stability in the *Economic Organization of Agriculture* (New York: McGraw-Hill Book Co., 1953) also infers that this is the case.

⁶*Income Distribution in the United States, by Size, 1944-50*, a Supplement to the *Survey of Current Business*, 1953, p. 84; *Survey of Current Business*, June, 1956, pp. 13-15.

⁷United States Department of Agriculture.

⁸A correlation between Census land values in 1950 and acreage percentages devoted to various crops is not inconsistent with the hypothesis that the production of sugar beets causes land values to be higher than they would otherwise have been, assuming forage and cereals are the closest substitutes for sugar beet production.

Where:

X_1 = Estimated per acre value of irrigated land without buildings, 43 counties, 1950

X_2 = Acreage percentage devoted to cereals

X_3 = Acreage percentage devoted to sugar beets

X_4 = Acreage percentage devoted to seeds, truck, vegetables, and miscellaneous crops

X_2 = Acreage percentage devoted to fruit and nuts

$$X_1 = -10.8 + .197X_2 + 1.064X_3 +$$

(.38) (.73)

$$.747X_4 + 1.665X_5$$

(.34) (.34)

The negative constant term and the statistical insignificance at the .05 level of the cereals variable and the sugar beet variable can probably be attributed to the fact that observations are taken all over the 17 western states with no attempt being made to hold constant climatic, soil, water right, rainfall, or other variables which affect yields geographically. A discussion of the theory underlying the above model can be found in one of my papers: Ed Renshaw, "Cross-Sectional Pricing in the Market for Irrigated Land," *Agricultural Economics Research*, January 1958, pp. 14-19.

⁹D. Gale Johnson, "Agricultural Policy," Univ. of Chicago Office of Agricultural Economics Research Paper No. 5412, May 14, 1954, p. 5.

¹⁰Cochrane, *op. cit.*, p. 173.

¹¹Taking as an index of adjustment the change in average farm size occurring between 1950 and 1955, one finds practically no change in the average size of tobacco farms. Average farm size as measured by acres in farms generally increased during this period. Only one-fourth of the sugar producing parishes listed in Table 2 had percentage increases in average farm size equalling or exceeding the state average for all parishes.

¹²Census of Agriculture.

¹³Census of Population, county estimates are obtained by linearly interpolating within the median income class.

¹⁴Census of Agriculture.

¹⁵D. Gale Johnson, "High Level Support Prices and Corn Belt Agriculture," *Journal of Farm Economics*, August 1949, pp. 509-19.

¹⁶Nathan M. Koffsky and Jeanne E. Lear, "Size Distribution of Farm Operators' Income in 1946," *Studies in Income and Wealth* (New York: National Bureau of Economic Research, Inc., 1951), Vol. 13, pp. 221-64.

¹⁷Koffsky, *et al.*, *op. cit.*, p. 233.

¹⁸This point is brought out by John D. Black in discussing Lauren Soth's book, *Farm Trouble* (Princeton: Princeton University Press, 1957). See "Dear Lauren Soth: Must We So Nearly Despair," *Journal of Farm Economics*, November 1957, pp. 894-913.

¹⁹This is a course of action repeatedly endorsed by such economists as T. W. Schultz and D. Gale Johnson in their numerous discussions of the farm problem.

²⁰For one of the best discussions of changes in productivity and its relation to agriculture, see: T. W. Schultz, "The U.S. Farm Problem in Relation to the Growth and Development of the U.S. Economy," The University of Chicago Office of Agricultural Economics Research Paper No. 5710, October 12, 1957 (prepared for the Joint Economic Committee of the Congress of the United States).

²¹*Loc cit.*

²²John D. Black, "Agriculture in the Nation's Economy," *American Economic Review*, p. 21.

The Esthetics of the Streamline

Is the streamline a natural and promising development in the art of our time?

HELMUT SCHOECK

CAN NEW FORMS AND BODIES, brought before our eyes by technological development, change our conception of beauty? Years ago a historian and I discussed whether the "technization" of our world could change human sensory experience.

The historian was concerned by the "loss of cultural values," as he and another historian, the late Johan Huizinga, called it. Today, he said, few things come out of the hands of craftsmen. Industrial production rarely tries to combine genuine beauty and technical purpose. The historian went on to praise the simple and true beauty of handmade tools, containers, furniture, and the like, which, he thought, originates from an ancient human sense of measure and finality. The centuries of individual craftsmanship had closed a circle between usefulness and beauty.

I was tempted to accept the challenging statement of this historian who looked at the realities of our age so mournfully. Of course, technological progress meant not always pleasant consequences. Yet is it legitimate to ask whether our world has

become more or less beautiful under the impact of technology and science?

There can be little doubt as to the humble origins of technological production and design. They were awkward and ghastly. The shape of the first locomotives and automobiles, the first steamers and steel bridges offends our esthetic sense. People designing those new means of moving, crossing, and producing evidently did not care about a new age of forms. They simply set forth in their old ways, blueprinting for bare technical ends.

And engineers in those days probably never had a course in art appreciation. They did not care for the pragmatic values of eyecatching forms and surfaces. It took a long time before engineers acquired esthetic ambition. I think they would have developed a higher standard of esthetic design much later if the very nature of matter itself, the necessities of technological materials, had not forced them to consider streamlines and smooth, shining surfaces.

This leads to my thesis. It is man's desire to thrust across land, sea, and through the air with a minimum of resistance—in other words, man's longing for the utmost speed—that caused decisive changes in our system of esthetic values in engineering. We entered the age of stream-