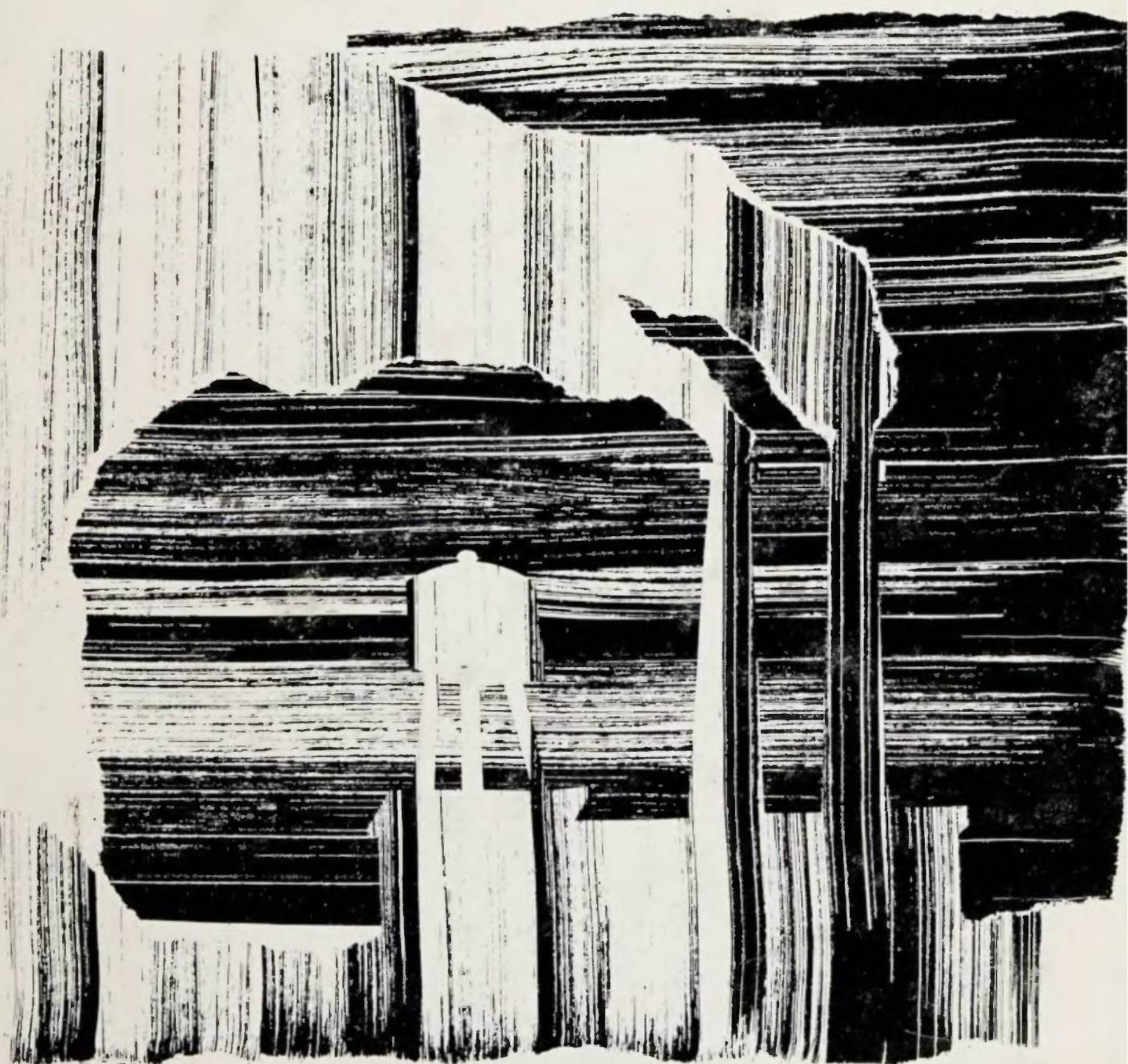


THE CASE OF THE UKRAINE

**LOCATION PROBLEMS
IN SOVIET INDUSTRY
BEFORE WORLD WAR II**

I. S. KOROPECKYJ



During the period of the First and Second Five-Year Plans, 1928-37, Soviet economic planners decided to de-emphasize the industrial growth of the Ukraine and other western regions in favor of the all-out industrialization of a few undeveloped areas in the east, beyond the Ural Mountains. The repercussions of this decision have strongly influenced the course of economic development in individual regions and in the USSR as a whole ever since, and will continue to influence it for decades to come.

In this study all relevant economic and noneconomic factors responsible for this decision are examined and the decision's consequences are analyzed. The Ukrainian SSR, one of the best developed of the western regions, serves as an example for the examination of Soviet location theory in regard to the entire industry as well as to its individual branches, and of location practice during this period. Using extensive data,

(continued on back flap)

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by I. S. Koropecykj

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To Roman and Sophia

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PART I

**LOCATION PROBLEMS
OF UKRAINIAN INDUSTRY**

1. INTRODUCTION

The economic development of the USSR, and its industry in particular, is considered to be one of the most rapid that history has known. Since this growth took place under conditions of central planning and public ownership of the means of production, it became a subject of numerous studies by Western economists. The studies were national in scope. It is important to realize, however, that the USSR, being a very large country, consists of many regions characterized by widely different economic and natural conditions. Moreover, these regions are inhabited by various nationalities, which differ in the levels of their economic, political, and cultural development. According to the official ideology, all these differences are to disappear under socialism and all nationalities are to achieve equality. Thus, only regional studies can demonstrate whether any progress has been made toward bringing about greater economic equality and, as a result, greater political and cultural equality among the nationalities of the USSR.

This study will deal with an analysis of the industrial growth of the Ukrainian Soviet Socialist Republic (subsequently called the Ukraine), one of the most important regions of the USSR. The Ukraine is well suited for this kind of study because it can be considered a separate

region according to all three criteria used in the field of regional economics:¹ (1) The Ukraine is a homogeneous entity in its ethnological, historical, and cultural aspects. Its population and natural resources facilitated an economic growth that was distinctly different from that of the rest of prerevolutionary Russia. Subsequently, however, this growth pattern tended to disappear under central planning. (2) Donbas, with its mineral resources, served as a center around which the bulk of Ukrainian industry was developed. This fact not only tended to determine the character of all its industry but also influenced the entire economy of the Ukraine. (3) The Ukraine is a constituent republic of the USSR, and as such it has always been treated as a unit for the purpose of economic planning. This has resulted in a supply of relevant statistics without which independent research into the Ukrainian economy would be impossible. Finally, although plans for the Ukraine are decided upon and prepared centrally in Moscow, their execution is supervised in its capital, Kiev.²

The focus of this analysis is on industrial development because of its importance for the growth of an entire economy.³ Industrialization means more than just the creation of new job opportunities with higher productivity for the rural population; it also strongly influences the growth of all economic sectors and contributes greatly to the power of the state. Furthermore, in the Soviet context, a high level of industrialization is a prerequisite for the attainment of communism. In turn, investment is of utmost importance for industrial growth because, in contrast to other economic sectors, "it is reasonable to think of the main requirement for an expansion of the output of many types of manufacturing as being the provision of capital to build factories and equip them with machinery and working capital."⁴ There-

1. Meyer, 1963, p. 22. (Sources will be listed in the abbreviated form, indicating only the surname of the author or the issuing organization and the year of publication. A full list of sources cited is provided at the end of this study.)

2. The geographic designations will be given in Ukrainian transliteration, except a few that are well known in the West in their Russian transliteration, Kiev being one example of the latter.

3. By Soviet definition, industry comprises manufacturing, mining, electric-power generation, forestry, and fishing.

4. Reddaway, 1962, p. 40. In some other cases—for example, housing or in-

fore, when the development of Ukrainian industry is studied, special attention must be paid to Soviet investment policy.⁵

In regard to investment policy, each national economy must solve the following three problems:⁶ (1) What share of the national income should be devoted to investment? (2) How should this investment be distributed among economic sectors and industrial branches? (3) In what proportion should capital be combined with other resources, notably with labor? To these problems another may be added: namely, if there is a choice of location, which alternative should be selected for a given economic activity? The efficiency of location decisions, i.e., the choice of the most appropriate region of a given industrial enterprise in relation to the location of inputs and to the markets for the products of this branch, has been especially vital in a country the size of the USSR, where for each economic activity many alternatives were, and are, available. The significance of proper location decisions lies also in the fact that, in contrast to the first three aspects of investment policy, which can be relatively easily changed even within a short time, location decisions cannot. Thus, location decisions once made remain influential for the future differential growth of individual regions and of the country as a whole. Furthermore, they also are important for the attainment of some noneconomic goals, such as strengthening the defense capacity of the country.⁷

ventories—investment is better regarded as a function of economic growth rather than a condition of it. See Bauer and Yamey, 1957, p. 128.

5. Here, as throughout this entire study, the term “investment” refers to investment in fixed capital only.

6. Dobb, 1955, p. 260.

7. The importance of this problem was always realized and appreciated by Soviet leaders and economists. For example, in 1930 Stalin expressed it in the following way: “However much we may develop our national economy, we cannot avoid the question of how properly to distribute [geographically] industry.” See Stalin, 1955, p. 334. A Soviet authority on location theory and practice writes as follows: “In our country many hundreds of enterprises, factories, electricity plants, and new transport lines are built every year. The effectiveness of investment depends largely on how they are distributed in economic regions and republics. Therefore, the construction of each enterprise is preceded by considerable planning, and, among other aspects, the choice of the most convenient region and site for a project is considered on the basis of the socialist principles of distribution of productive resources.” See Feigin, 1958, p. 204.

Although the first three problems listed above exert an influence on the growth of Ukrainian industry indirectly, the choice of location — whether a given industrial branch should be developed in the Ukraine or in some other region of the USSR — affects it, of course, directly. Because the location problem is of basic importance for the differential development of Ukrainian industry, the theory and practice of industrial location in the USSR must be analyzed here. Obviously, all aspects of investment policy are interrelated and should therefore be solved simultaneously.⁸ For the purpose at hand, however, it can be realistically assumed that the distribution of national income between consumption and investment, the allocation of investment among various economic sectors and industrial branches, and the proportion between capital and labor have already been decided upon centrally for the whole USSR. It is of interest then to establish the criteria that were applied by the central planners to the distribution of investment between the Ukraine and the rest of the USSR. If these criteria were purely economic—if the output were to be maximized—their application should have resulted in the production of each commodity at the site and in the region where the combined costs of production and transportation are the least for the national economy. Specifically, the available funds were to be invested in the Ukraine only if the desired commodity or a group of commodities could be produced more cheaply there than in any other region of the USSR and vice versa.

To test this proposition, one might hope to utilize an important tool of regional studies—comparative cost analysis.⁹ This approach is not feasible in practice, however. The newly constructed plants were producing thousands of different commodities, and in order to apply this method, it would be necessary to compare the production costs of each or at least of the most important ones in the Ukraine with those in other regions of the USSR or the USSR as a whole. Moreover, without extensive adjustments, the nature of the Soviet price system would make the comparative cost analysis meaningless.

8. Cf. Dobb, 1955, p. 261.

9. Meyer, 1963, p. 31. For a discussion of the application of this method, see Isard, 1960, pp. 233 ff.

Instead, under the assumption that capital was the limiting factor of the expansion of industrial output in the USSR in the early stages of industrialization¹⁰ and that the supply of other resources could have been easily adjusted to the increases of capital, the question may be asked whether available investment was allocated to those regions in which the resulting increase in output was the highest. Furthermore, a purely economic rationale would require that capital be directed to such regions until, as a result of diminishing returns, their output increases per unit of capital become equal to those in other regions. A policy designed to equalize the marginal productivity of capital by regions would maximize the total output of the USSR.

In order to test whether the output-maximizing approach was actually applied to the distribution of investment between the Ukraine and the rest of the USSR, a comparison of incremental capital-output ratios (ICOR) between the industries of the Ukraine and the USSR will be undertaken.¹¹ It is of interest to do the same on the disaggregated level because the relationship between investment and the increase in output of industry as a whole conceals many diverse changes, adjustments, and adaptations for individual industrial branches.¹² The analysis of individual branches in the case of the USSR is not only interesting but is also mandatory in view of the fact that the objective of Soviet investment policy is not the maximization of national income in general—here, of industrial output in general—but the maximization of output of a certain desired structure.¹³ Therefore, the over-all efficiency of investment, as measured by the ratio of the increase in fixed capital to the output increase will here be determined (as a weighted average) by the efficiency of investment in different branches. It may be stated at this

10. Kaplan, 1953, p. 67. It should be noted that some skills were as scarce as was capital during this period.

11. Subsequently, many comparisons between the Ukraine and the USSR as a whole will be undertaken. If not explicitly specified, the USSR data always include the data for the Ukraine. Consequently, the difference between the two in any comparison is always to some extent blunted. The comparison is further complicated by the wide variation in the importance of the Ukraine to the USSR, depending upon the particular comparison under investigation.

12. Bauer and Yamey, 1957, p. 131.

13. United Nations, 1965, chap. iv, p. 36.

point that the makers of Soviet location policy had to meet not only economic but also certain noneconomic goals, which require careful analysis as well.

To sum up, the purpose of this study is to analyze the differential development of Ukrainian industry as a whole and of its individual branches. Since this development depended to a great degree on the allocated investment by central planners in Moscow, it is necessary to devote much attention to the theory and practice of industrial locations in the USSR. As is well known, the Ukraine was more industrialized than most regions of the country in the years before World War II. The lessons learned from its development are useful for understanding how Soviet planners approached the industrial development of other advanced regions and perhaps also for understanding Soviet attitudes toward regional development in general. Finally, it is hoped that this study will contribute to the clarification of regional problems in other developing countries as well.

Among the problems outlined above, only Soviet location theory and its application to certain economic sectors has received attention in the West recently.¹⁴ In the USSR, with the revival of economics in the fifties, a considerable number of works appeared on location theory and practice in regard to the problems of the economy as a whole and of individual industrial branches. Several of these works are identified in the course of the present discussion. None of them, however, deal explicitly with the application of location theory to the differential development of Ukrainian industry.¹⁵ It is true that many studies have been published in the USSR on the development of Ukrainian industry; but none of them treat explicitly and critically the basic problem of this study: the efficiency of geographic allocation of investment in regard to Ukrainian industry.

This study covers the period of the First and Second Five-Year

14. Soviet location theory was analyzed in Chambre, 1959; Wiles, 1962, chap. viii; and Koropecj, 1967. It was also discussed with specific reference to the iron-and-steel industry, transportation policy, the construction of the Ural-Kuznetsk Combine, and the cement industry, respectively, in Clark, 1956; Hunter, 1957; Holzman, 1957; and Abouchar, 1967.

15. Of related interest are two works: Frank, 1957, which deals with changes in the productivity of Ukrainian industry and agriculture, and Melnyk, 1965, which analyzes capital formation in the Ukraine during the First Five-Year Plan.

Plans. Because 1928 and 1937, the initial and terminal years of this period, are the years for which the data are most complete and comparable, they will serve as benchmark years.¹⁶ It can be assumed that these years are representative, at least in regard to industrial development, of the period, and the time span is long enough to preclude the possibility that random variations in the growth of fixed capital in the Ukraine and the USSR during the period discussed could obscure the real trend.¹⁷

Several factors were responsible for the selection of this period, the decisive one being its historical importance for the economic development of the Ukraine and the USSR. The period 1928–37 was characterized by tremendous investment activity and a corresponding expansion of industrial output. The repercussions of geographic investment allocation made then were of utmost importance during World War II, have strongly influenced the course of economic development of individual regions and of the USSR as a whole since then, and will continue to influence it for decades to come. In fact, although this period appears to be relatively short, the groundwork for the present geographic distribution of industry in the USSR was laid then. Furthermore, the period between 1928 and 1937 fostered the economic dynamism associated with the socialist system in the early stages of its development and thus deserves a thorough analysis. Finally, despite its remoteness in time, it seems that the study of location problems during the First and Second Five-Year Plans still has some predictive value for the USSR, particularly in view of the continuity of basically centralized decision-making and, surprisingly enough, unchanged objectives,¹⁸ even though the techniques of planning and its implementations have become more sophisticated.

Nearly all the statistical data used in this study are taken from Soviet sources, such as statistical yearbooks, books, monographs,

16. These two years are used as benchmark years in the most basic works on Soviet economy; cf. Bergson, 1961.

17. The 1928 calendar year is used in official statistics interchangeably with the 1927/28 fiscal year. In this study the year will be consistently referred to as 1928.

18. Most of the location problems in the USSR, as discussed in this study for the prewar period, still remain unsolved at the present time. See, for example, Pervukhin, 1967.

and articles. The more recent publications are presumably more reliable than the earlier ones. All of them suffer from certain shortcomings, which have been widely discussed in the Western literature. There is a consensus that data expressed in physical terms are preferable to those in value terms. Both kinds are used in this study. In the case of the latter, attempts have been made in many instances to support them with information in physical terms, as is officially recommended in the USSR.¹⁹ In some other cases, it was possible to substitute adjusted estimates for official data. When unadjusted ruble data had to be used, however, it was not because of interest in their intrinsic value but because they enable the comparison of certain aggregates between the Ukraine and the USSR. For this reason, a crucial assumption must be made and consistently kept in mind that if these data are deficient or biased in any respect, both the Ukraine and the USSR are affected equally.

Statistical data in physical terms refer most often to the total industry (large- and small-scale industries combined), while value data refer to large-scale industry only.²⁰ The following percentages indicate that the importance of large-scale production in total industry was so large, with perhaps the exception of consumer industries, that the drawing of inferences on the basis of the large-scale for the total industry is completely justified.²¹

	<i>Ukraine</i>	<i>USSR</i>
1927/28	84.8	85.0
1939	92.2	93.7

Moreover, as can be seen, the percentages are almost identical for

19. "Recommendations," 1959, p. 87.

20. According to the official definition (TsUNKhU, 1936, p. 394), large-scale industry is understood to include all enterprises employing fifteen persons (including workers, apprentices, and minor service personnel) and using mechanized equipment. In the absence of mechanized equipment, the employment of thirty persons is required for inclusion in this category. These qualifications are modified in the case of power stations, brick kilns, glass factories, printing plants, tanneries, flour and grain mills, breweries, and soft-drink plants. Included without regard to the number of employed are all mining and metallurgical enterprises and also all enterprises formerly subject to the excise tax.

21. Vorob'ev, 1965, p. 140.

the Ukraine and the USSR in both years, thus enabling a comparison between the two on the basis of large-scale industry only. Although these percentages refer only to output, it could be assumed that a similar relationship between large-scale and all industries existed also in the case of the other two important variables: employment and fixed capital. In order to avoid unexplained changes in definitions and methods in official statistics, an attempt was made to present data from the same source for comparisons between the Ukraine and the USSR, or between different years for either of the two in the hope that at least an author or an editor would be consistent in his handling of the statistics.²²

One more factor in regard to statistical data should be mentioned. The territorial coverage of data used here refers to the prewar boundaries of the Ukrainian SSR and of the USSR, which remained unchanged during the period under discussion. However, the sources published before World War II include in the Ukrainian data the data for the Moldavian ASSR, which during this period was for planning and administrative purposes a component part of Ukraine. On the other hand, the sources published after 1954, the year of incorporation of the Crimean *oblast* in the Ukraine, cite the Ukrainian data inclusive of this *oblast* but exclusive of Moldavia for the prewar period as well. Since in both Moldavia and Crimea industry was for practical purposes nonexistent during this period, it is believed that this inconsistency does not obscure the real picture of Ukrainian industry.²³

Finally, there has been a common complaint among students of the USSR economy about the insufficiency of statistical data. This complaint applies *a fortiori* to the Ukrainian economy. Although the economic development of the period under discussion is usually considered to be relatively well documented, I had great difficulty in

22. For the Ukraine this method was more feasible because most of the Soviet authors who discuss this period refer to *Narodne hospodarstvo URSR, Statystychnyi dovidnyk*, Kiev, 1940. All my attempts to obtain this yearbook were unsuccessful.

23. For example, in 1934 Moldavia accounted for 0.4 per cent of fixed capital, 0.6 per cent of workers, and 0.6 per cent of gross output of total large-scale industry in the Ukraine, without Moldavia and the Crimea, in the prewar borders. The respective percentages for the Crimea were: 3.0, 3.3, and 3.1. See TsUNKhU, 1936, pp. 58–59.

compiling the statistics used here. Many limitations of this study may be ascribed to the lack of necessary information, and for the same reason many interesting possibilities remained unexplored.

The study consists of two parts and two appendixes. In addition to this introduction, the five chapters of Part I deal with industry as a whole. An analysis of the Ukrainian share of industrial investment in the USSR is made in Chapter 2. The conclusion is reached that the resulting structural changes in Ukrainian industry relative to industry in the USSR can be accounted for by the planners' preferences for locations in other regions of the USSR over locations in the Ukraine. The economic rationality of these decisions is investigated in Chapter 3 with the help of a comparison of ICORs for the entire industry and for the weighted average of individual industrial branches between the Ukraine and the USSR. There is no doubt that the ICOR was lower in the Ukraine, and the rest of Chapter 3 is devoted to the analysis of reasons for this phenomenon. The explanation of why the Ukraine did not receive its economically justifiable share of the total industrial investment of the USSR must be sought in Soviet location theory, which is discussed in Chapter 4. The analysis of Soviet location policy in the next chapter shows defense considerations to be of decisive importance. Mainly in the light of these considerations can the shift of the center of gravity of Soviet industry from the west to the east be understood. The summary and conclusions for Part I are presented in Chapter 6.

All eight chapters of Part II are devoted to an analysis of the most important branches of industry. For each, the specific location theory is discussed, and the respective ICORs of the Ukraine and the USSR are compared. On this basis, a conclusion may be drawn concerning whether the geographic distribution of investment for each branch was economically justified during the period under discussion.

Appendix A presents a calculation of the output index of Ukrainian industry, which is needed for an estimation of the ICOR, and Appendix B summarizes the controversy of the late 1920's of whether to expand Donbas further or to construct the Ural-Kuznetsk Combine.

2. STRUCTURAL CHANGES IN UKRAINIAN INDUSTRY

In December, 1922, the Ukraine was formally incorporated into the newly created Union of Soviet Socialist Republics as a union republic. Its government had extensive power in all the internal affairs of national life. These powers have since, however, been gradually centralized in the hands of the all-union government. By the end of the 1920's the Ukrainian government became no more than an administrative arm of the central government, unable to formulate its own policies and engaged in the execution of orders issued from above. A similar situation existed in its economic life. Although the Ukraine organized its own Supreme Soviet of National Economy, a Central Planning Committee, and various economic ministries in the early 1920's, all these agencies were already at the time of the First Five-Year Plan in fact only loyal branches of their respective central organs.

At the time of incorporation the Ukraine was, and remains today in terms of population, the largest republic next to the Russian SFSR; the Ukraine contains slightly less than one-fifth of the total population of the USSR. Before the Revolution the Ukraine produced about one-fifth of the industrial output of Russia in the pre-World War II borders of the USSR, specializing in such branches of heavy

industry as coal mining and ferrous metallurgy and some food-processing branches, notably sugar refining.¹ Its agricultural output accounted for a little less than one-third of the total output of Czarist Russia, mainly because of the renowned fertility of the Ukrainian soil. During the Revolution and the following Civil War, the Ukrainian economy, and its industry, in particular, were destroyed to a much greater extent than those of other regions of the USSR. For example, in 1921 the industrial output of the USSR was equal to 31 per cent of its 1913 output,² while in 1921/22 the Ukraine produced only 12.9 per cent of its 1912 industrial output.³ In 1928, however, when the First Five-Year Plan was launched, both outputs already exceeded their 1913 level, the USSR by 32 per cent and the Ukraine by 19 per cent.⁴ The growth of Ukrainian industry was impeded by the slow recovery of its iron-and-steel industry and some branches of its light industry. This period of reconstruction, referred to in the literature as the New Economic Policy, ostensibly placed equal emphasis upon the development of both producers' and consumers' goods industries. In the Ukraine, however, it was already the tendency in the second part of this period to devote more attention to producers' goods industries, industrial Group A in Soviet nomenclature. As a result, the producers' goods share in the total output of Ukrainian industry increased from 36 to 42 per cent between 1913 and 1928, while the share of consumers' goods (Group B) declined, correspondingly, from 64 to 58 per cent.⁵

In the middle and toward the end of the 1920's, Soviet economists were engaged in a lively debate over the future of the economy of the USSR.⁶ Despite their lack of agreement as to the means and the tempo of the desired economic growth, they were in complete agreement regarding the goal of Soviet economic development. All of them were unanimous in the opinion that the USSR had to industrialize in order to create the material base for socialism and eventually

1. Virnyk, 1967, pp. 40-41.

2. TsSU, 1964, p. 32.

3. Nesterenko, 1966, p. 62.

4. TsSU, 1964, p. 32; TsSU-Ukraine, 1957, p. 22.

5. TsSU-Ukraine, 1965, p. 54.

6. See Erlich, 1960.

communism. Industrialization was also necessary for a more practical reason: to strengthen the defense capacity of the country in order to counteract what the Soviet leaders believed to be a hostile capitalist encirclement. The importance of the Ukraine in these plans was very great, indeed, as can be seen in the following passage from the First Five-Year Plan:

Three reasons in the final analysis are at present responsible for determining the character of the development of the Ukrainian economy: the presence of rich resources of coal and high-grade iron and manganese ores, situated relatively close to each other, the existence of developed industry based on these minerals, which possesses substantial fixed capital and labor force, and, finally, market-type agriculture, which serves as a basis for the processing industry and, as a result, makes the Ukraine an export region Considering the above favorable conditions for the development of heavy industry, the Ukraine shall be a crucially important base for our industrial policy in the near future.⁷

The last sentence, to put it simply, indicates that Ukrainian heavy industry was expected to supply the necessary inputs for industrial investment projects to be constructed all over the USSR.⁸

Therefore, in order to facilitate the attainment of these goals, the planners allocated to the Ukraine slightly more than one-fifth of the total investment in USSR industry, as is shown in Table 2.1. This was two percentage points higher than its share during the period between the Revolution and the introduction of the First Five-Year Plan.⁹ Also, the Ukraine's share in USSR investment was higher in industry than in the national economy as a whole. As a result, investment in industry accounted for a higher share of all investment in

7. Gosplan, 1930, p. 119.

8. Stalin expressed this in his speech at the Sixteenth Party Congress in the following way: "At the present time the situation is such that our industry and the whole national economy as well depend on the Ukrainian coal and iron-and-steel base. Of course, without such a base, the industrialization of the country would be unthinkable." *Kommunisticheskaia Partia*, 1930, p. 42.

9. TsSU, 1961a, pp. 60, 82.

TABLE 2.1. Investment in All National Economy and Industry of State and Cooperative Enterprises (without Kolkhoz) in the Ukraine and the USSR During the First and Second Five-Year Plans (1955 prices)

	Ukraine		USSR		Ukraine as Percentage of USSR
	Millions of Rubles	Index	Millions of Rubles	Index	
A. Entire national economy					
First Five-Year Plan	1243.1	100.0	6716	100.0	18.5
Second Five-Year Plan	2521.3	202.8	15170	225.9	16.6
B. Industry					
First Five-Year Plan	596.0	100.0	2897	100.0	20.6
Second Five-Year Plan	1178.4	197.7	6377	220.1	18.5
C. Industry as percentage of entire national economy					
First Five-Year Plan	47.9		43.1		
Second Five-Year Plan	46.7		42.0		

Sources: TsSU, 1961a, pp. 60, 82.

the Ukraine than in the USSR, as can be seen in Panel C of this table. During the Second Five-Year Plan, however, investment in the entire economy of the Ukraine as well as in its industry grew at a slower rate than in the USSR, with the result that the Ukrainian shares declined in both by two percentage points, as compared with the First Five-Year Plan. Despite the roughness of the underlying data, the somewhat declining attention to the Ukraine in the prewar industrialization of the USSR is thus evident.

These investments resulted in considerable increases in fixed capital in industries of the Ukraine and the USSR. According to the official statistics, the fixed capital increased in both more than 5.5 times during the First and Second Five-Year Plans (Table 2.2). It is important to note that the declining Ukrainian share in USSR investment during the Second Five-Year Plan did not result in any noticeable change in the Ukrainian share in fixed capital; the latter was equal to 21.1 on October 1, 1928, and to 20.7 on January 1, 1938. This fact implies a higher ratio between the fixed capital introduced into

operation and investment outlays in the Ukraine than in the USSR during this period. It could have resulted from such factors as better planning of investment, higher productivity of construction enterprises, more advanced economic development, and milder climate in the former. Despite the almost identical growth of fixed capital in the industries of the Ukraine and the USSR, it is of interest to inquire whether any structural changes took place in Ukrainian industry. An analysis of these changes will help to determine the factors responsible for the investment policy of the USSR in regard to the Ukraine and will also help in the investigation of the economic rationale of this policy.

The structural changes in the industry of a region relative to the industry of the entire country can be shown through the changed share of individual industrial branches of this region in the respective branches of the entire country. The structural change can be demonstrated not only in terms of fixed capital, but, most desirably, also in terms of other main variables: output and employment. In regard to output, the data expressed in current prices would be conceptually most appropriate for the analysis of structural changes. For the period under discussion, such data for individual branches of industry are not available either for the USSR or the Ukraine. In this particular case, however, even if they were available, they could not be used for a meaningful comparison of the value of output at the beginning and at the end of this period because of differential price increases, resulting from the then-existing inflation, and the changing rate of turnover taxes and subsidies for various products. In addition, these prices do not include payments for such factors of production as capital and land. Finally, the profit rate that is included was determined arbitrarily. The available data expressed in constant 1926/27 prices also cannot be used for this study. Because of changes in scarcity relations that took place during this period of extraordinarily rapid industrialization, these prices fail to reflect adequately the changes in output. As such, they contain an upward bias, but to a different degree, on the growth rate of industries in the Ukraine and the USSR, primarily because of their changing product mix.¹⁰ Also,

10. For more on this, see Appendix A.

these data refer to the gross output, and as such they can be affected by changes in the vertical integration of industry.

The available employment data for individual branches of industry, which are comparable for the Ukraine and the USSR, are also not useful for the analysis of structural changes. They cover the period between January 1, 1929, and January 1, 1936, which is only a part of the period under discussion.¹¹ In addition, they comprise only the workers in large-scale industry,¹² and, moreover, only about two-thirds of them, namely, those who were registered by the labor division of the contemporary Central Statistical Administration.¹³

Of necessity, the present analysis must rest on the data for so-called productive fixed capital. October 1, 1928, and January 1, 1938—the beginning and end dates of the period under discussion—have been chosen as benchmark dates. According to the Soviet definition, productive fixed capital means the capital participating directly in material production.¹⁴ During the period under discussion, it was usually subdivided into the following three broad groups: (1) buildings and structures; (2) means of transportation; and (3) equipment and machinery.¹⁵ The valuation of productive fixed capital in the USSR, however, presents a number of difficulties. In order to understand them, it is necessary first to describe briefly the Soviet practice of fixed capital accounting during this period.

Because of differential price changes, the decline in the real cost of production of the same assets, or of their close substitutes, resulting from technological progress, technological obsolescence, and physical wear and tear, Soviet planners periodically undertake an inventory

11. TsUNKhU, 1934, pp. 327–31; TsUNKhU, 1936, pp. 520–22.

12. In addition to workers, who accounted, for example, for 79.9 per cent of all employed in industry in the Ukraine and 78.8 per cent of the USSR on January 1, 1936 (*ibid.*, pp. 518–19), there were the following categories of employed: apprentices, engineers, technical personnel, administrative personnel, and minor service personnel.

13. It is reported that the number of workers in large-scale industry registered with the industrial division of TsUNKhU was 48 per cent larger than the number registered with the labor division. See Hodgman, 1954, p. 37. For the discussion of differences between labor and industrial division classification, see *ibid.*, pp. 35–36.

14. Bunich, 1960, p. 12.

15. *Ibid.*, p. 23.

of existing assets. Knowledge of the value of these assets is of obvious importance for making day-to-day economic decisions. Such a revaluation, pertinent to the period discussed, took place in 1925. The value of machinery, equipment, and means of transportation was estimated on the basis of the market prices for the same assets or for their close substitutes in this year, while the value of buildings and structures was appraised on the basis of the current cost of construction. The wear and tear, in turn, were estimated by experts taking into account the actual condition of each asset, its length of use, its life expectancy, etc.¹⁶ Following this revaluation, the value of fixed assets in all industry or in one of its subdivisions at any given point of time during the period under discussion was equal to: (1) initial net value in 1925 prices plus (2) the value of introduced assets at current prices and minus (3) retired assets at original prices, between 1925 and the point of time under investigation.¹⁷

Such an accounting practice was obviously applied in the Ukraine as well. The value of Ukrainian fixed assets in industry, as shown by official statistics, is thus formally comparable to the value of corresponding assets in the USSR as a whole. To repeat the basic assumption, if these data suffer from certain deficiencies and biases, and they most probably do, both the Ukraine and the USSR are equally affected. Keeping this in mind, the official data have to be accepted as reliable indicators for the purpose of an analysis of changes in the structure of Ukrainian industry relative to USSR industry between 1928 and 1937.

Table 2.2 presents the value of fixed assets of large-scale industry by branches in the Ukraine and the USSR for the benchmark dates, their index numbers, their percentage distributions, and the Ukrainian shares. In addition, Columns 8 and 9 give the values of location quotients on these two dates. Their meaning and importance will be discussed shortly. On the initial date the quotients are listed in

16. Bunich, 1963, pp. 15-16. For the criticism of this revaluation, see *ibid.*, pp. 16-17; Ostroumov and Shevchuk, 1963, pp. 79-81.

17. Arakelian, 1938, p. 19. During the First and Second Five-Year Plans, capital repairs were not distinguished from investment, in contrast to the subsequent practice. See Bergson, 1961, p. 379. Thus, it could be assumed that they were included in the value of introduced assets.

descending order, while the numbers in parentheses, next to the last column, indicate their changed order on the terminal date. The breakdown of the total is limited to only fifteen branches and the residual, because of the lack of more comparable data. In the residual, called "Other," the most important branches are probably mineral-building materials and mining and smelting of nonferrous metals. The oil industry, important in the USSR, was nonexistent in the Ukraine during this period.

As can be seen, the fixed capital increased at almost the same rate in the total industry in the Ukraine as it did in the total industry of the USSR; individual branches in most cases displayed different growth rates, however. For example, coal, iron ore, or the iron-and-steel branches experienced substantially higher growth in the USSR than in the Ukraine. Other branches showed less pronounced changes in favor of either the USSR or the Ukraine. This development found its expression in changed distributions of both industries at the end as compared with the beginning of the period discussed. The faster growth of the above-mentioned branches in the USSR, in which the Ukraine was already particularly well-developed, suggests that Ukrainian industry was becoming less specialized relative to USSR industry.

The change in specialization can be expressed numerically for individual branches as well as for the distribution of the entire industry. In regard to the former, the location quotient is used. This indicator is defined as follows: "Since the localization in a given industry may be considered to occur when a particular industry deviates from a common pattern, a measure may be obtained for a specific area by dividing the share of the national total for a given manufacturing industry in the area by its share of all manufacturing. . . . The higher the localization quotient in any instance, the greater the degree of localization of that particular industry as compared to all manufacturing."¹⁸ Column 8 in Table 2.2 shows that at the beginning of the period under discussion the quotients for seven branches had values higher than unity. In other words, the Ukraine was specialized in these branches compared with the USSR. In six cases the quotient

18. See U.S. NRPB, 1943, p. 107.

decreased during this period, and for such branches as coal, iron ore, food, quite substantially; in one case it dropped below unity (Column 9). Of the remaining nine branches, which initially had values less than one, the quotient in 1938 increased in six cases but continued to stay below unity. Obviously, this tendency of quotients to move toward the unitary value from both directions indicates a definite decrease in the specialization of Ukrainian industry.

For the purpose of establishing the degree of decline in the specialization of total Ukrainian industry relative to total USSR industry, the coefficient of specialization and specialization curves are used. The former is obtained in the following manner. The share of each individual branch in the industrial distribution of a region is subtracted from the corresponding shares of the distribution of industry for the whole country; then the sum of all plus (or minus) differences is divided by 100.¹⁹ The coefficient thus obtained may vary between 1 and 0. The lower the value of the coefficient, the more similar is the branch distribution of industry in this region to the branch distribution of industry in the whole country. Applying this procedure to the problem at hand gives a coefficient value of 0.43 for October 1, 1928, and of 0.25 for January 1, 1938. The decrease in the specialization of Ukrainian industry during this period is clearly evident.

This trend can also be observed with the help of specialization curves. In contrast to the coefficients of specialization, these curves aid in the identification of contributions of particular branches to the trend for the entire industry.²⁰ The curves are obtained by plotting the cumulative percentage distribution of Ukrainian fixed capital by industrial branches on the vertical axis and of the USSR branches on the horizontal axis. They are ordered according to the size of the location quotient, from the largest to the smallest, as shown in Table 2.2. The further the specialization curve lies from the diagonal, the more specialized is a given distribution relative to its base. The figure below shows that the curve for the terminal date of the period is much closer to the diagonal than the curve for the initial date. This, of course, confirms the result obtained with the help of the coefficient of specialization.

19. Isard, 1960, pp. 270–71.

20. *Ibid.*, p. 273.

TABLE 2.2 Productive Fixed Capital of Large-Scale Industry by Branches in the Ukraine and the USSR on Benchmark Dates

Branch of Industry	Ukraine					Ukraine as Percentage of USSR		Location Quotients	
	Oct. 1, 1928		Jan. 1, 1938		Jan. 1, 1938 (Oct. 1, 1928 = 100)	Oct. 1, 1928	Jan. 1, 1938	Oct. 1, 1928	Jan. 1, 1938
	Millions of Rubles at Original Cost—Gross Depreciation Allowances	Percentage of Total	Millions of Rubles at Original Cost—Gross Depreciation Allowances	Percentage of Total					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Total	2,163	100.0	11,968	100.0	553.3	21.1	20.7	4.41	2.39 (3)
1. Coal	359	16.6	1,139	9.5	317.3	93.1	49.5	3.81	3.30 (1)
2. Sugar	335	15.5	613	5.1	183.0	80.3	68.4	3.37	1.91 (4)
3. Iron ore	27	1.2	162	1.4	600.0	71.2	39.6	2.87	2.44 (2)
4. Iron and steel	415	19.2	2,681	22.3	646.0	60.5	50.6	1.82	1.54 (5)
5. Chemical	154	7.1	1,270	10.6	824.7	38.4	31.8		
6. Glass, china, and pottery	30	1.4	141	1.2	470.0	25.7	28.5	1.22	1.38 (6)
7. Food other than sugar	247	11.4	787	6.6	318.6	22.2	15.2	1.10	0.73 (10)
8. Apparel	8	0.4	37	0.3	462.5	20.6	15.9	0.98	0.77 (9)
9. Metalworking and machine building	293	13.6	2,419	20.2	825.6	15.4	16.5	0.73	0.80 (8)
10. Electric power	107	4.9	1,097	9.2	1,025.2	15.1	19.3	0.72	0.93 (7)
11. Leather, fur, boot and shoe	26	1.2	66	0.6	253.9	13.4	10.1	0.64	0.49 (12)
12. Paper	17	0.8	25	0.2	147.1	10.5	3.8	0.50	0.19 (15)
13. Woodworking	15	0.7	105	0.9	700.0	6.4	7.4	0.30	0.36 (13)
14. Other	100	4.6	1,227	10.3	1,227.0	5.6	10.7	0.27	0.52 (11)
15. Textile	29	1.3	182	1.5	627.6	1.4	4.8	0.07	0.23 (14)
16. Peat	1	0.1	17	0.1	1,700.0	1.3	2.1	0.06	0.10 (16)

	(1)	(2)	(3)	(4)	(5)
<i>Total</i>	10,262	100.0	57,935	100.0	564.6
1. Coal	385.5	3.8	2,301.8	4.0	597.1
2. Sugar	417.0	4.1	896.0	1.5	214.9
3. Iron ore	37.9	0.4	409.0	0.7	1,079.2
4. Iron and steel	685.7	6.7	5,298.9	9.2	772.8
5. Chemical	401.3	3.9	3,991.7	6.9	994.7
6. Glass, china, and pottery	116.7	1.1	494.0	0.9	423.3
7. Food other than sugar	1,114.0	10.8	5,189.0	9.0	465.8
8. Apparel	38.8	0.4	233.0	0.4	600.5
9. Metalworking and machine building	1,905.9	18.6	14,664.2	25.3	769.4
10. Electric power	706.7	6.9	5,696.6	9.8	806.1
11. Leather, fur, boot and shoe	194.2	1.9	651.2	1.1	335.3
12. Paper	161.3	1.6	650.0	1.1	403.0
13. Woodworking	236.1	2.3	1,412.0	2.4	598.1
14. Other	1,777.7	17.3	11,430.0	19.7	643.0
15. Textile	2,006.4	19.5	3,793.4	6.6	189.1
16. Peat	77.1	0.7	824.0	1.4	1,068.7

Sources: Ukraine: All data are from Khromov, 1945, pp. 35, 37, except for the following branches: sugar; glass, china, and pottery; food other than sugar; apparel; and leather, fur, boot and shoe, which are from Kukhareno, 1959, pp. 110, 112.

Branch "Other" was obtained as a difference between the sum of the listed branches and the total.

USSR: All data are from Kaplan, 1951, Appendix Table II.

For the following branches the data are unavailable for January 1, 1938, but are available for January 1, 1937: leather, fur, boot and shoe; paper; and peat. They were extrapolated for one year on the basis of the average rate of growth for a given branch during four years of the Second Five-Year Plan (January 1, 1933, and January 1, 1937).

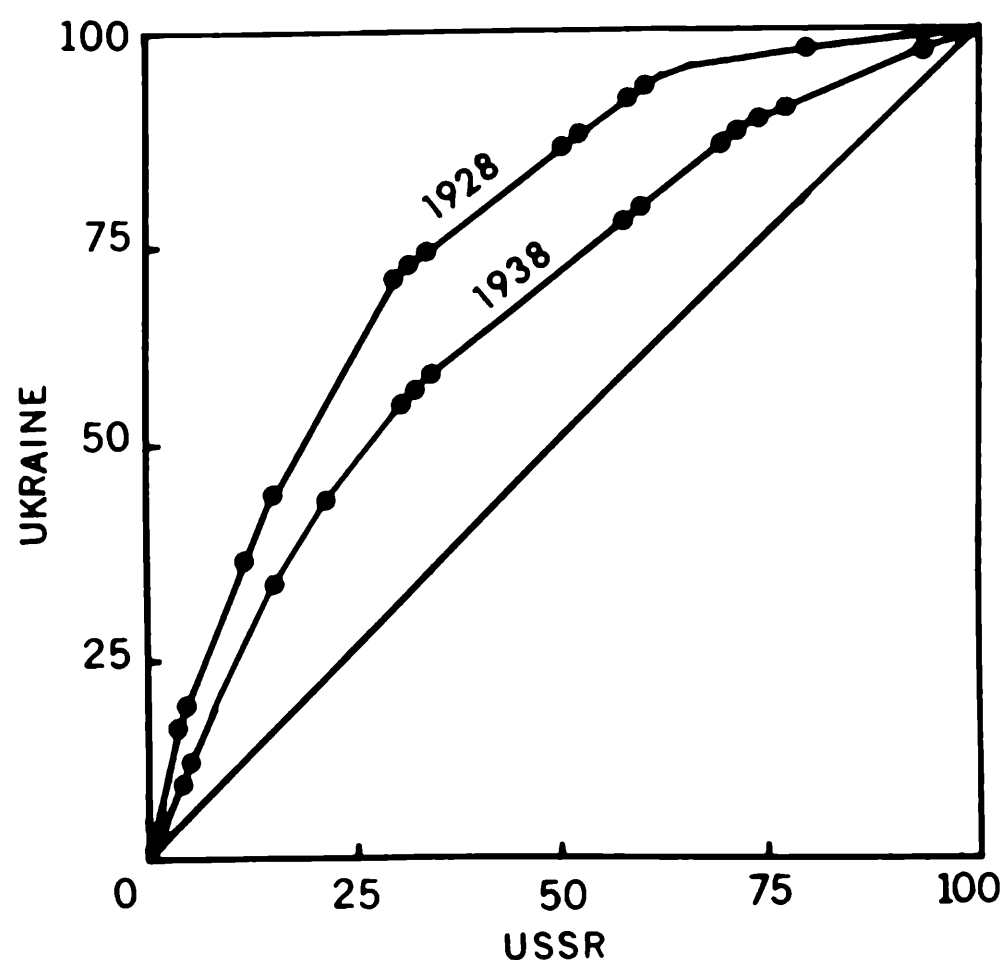
For the explanation of the derivation of data for sugar and other than sugar food industries, see Table 12.2, n. 4.

The data for chemical and petroleum-refining branches are combined in order to make the derived branch comparable to Ukrainian data, which in addition to the chemical branch proper includes also the coke and petroleum-refining branches. In view of the lack of necessary data, the adjustment for the coke industry is not possible.

The data for glass, china, and pottery are obtained through the subtraction of mineral building materials from the branch called stone, clay, and glass products.

The branch "Other" derived in the same way as for the Ukraine.

Specialization Curves of the Distributions of Fixed Capital in Large-Scale Industry of the Ukraine Relative to the USSR for Benchmark Dates



Source: Table 2.2.

It must be emphasized that the decrease in specialization of Ukrainian industry, as discussed here, does not mean that this industry, in terms of branch distribution of fixed capital, increased its ability to satisfy the needs of the Ukraine. In fact, Ukrainian industry became even more specialized in heavy industry branches. On October 1, 1928, such branches as coal, iron and steel, iron ore, chemicals, machine building and metalworking, and electric power accounted for 62.7 per cent of all fixed capital, while on January 1, 1938, they accounted for 73.3 per cent of the total Ukrainian industry. What this discussion is concerned with is the changing relationship of individual branches of Ukrainian industry to the corresponding branches of USSR industry.

The measures of the structural changes of Ukrainian industry discussed above suffer from a basic deficiency, namely, that the absolute level of the coefficient of specialization and the shape of the specialization curve depend on the degree of branch classification of

the total industry.²¹ The observed tendency, however, seems to be strong enough to remain in any classification, although the level of these measures will obviously change. A much more important deficiency lies in their lack of any analytical value. These measures represent instantaneous pictures at two points of time, but they cannot indicate the causes responsible for the changes, as disclosed by the comparison of these pictures.

Some quantitative indications concerning the reasons for the change in the structure of fixed capital in Ukrainian industry relative to the USSR for the period under consideration can be obtained with the help of the "shift" technique.²² Before this method is applied to the problem under analysis, two basic reasons must first be identified that may be responsible for the particular growth of a region and the accompanying structural changes within its economy or, in this case, for the particular growth of the industry of a region and the accompanying changes in industrial branches. One reason may be the concentration in a given region of branches that are expanding nationwide at a faster rate than that of industry as a whole. The resulting shift in the growth variable — in the present case, in fixed capital — is called "proportional." Another reason for the faster regional growth and the resulting structural changes is the improvement of over-all access to inputs and/or markets of outputs of some branches, regardless of whether the nationwide growth rate of these branches is faster or slower than that of the entire industry. The shift in the analyzed variable is then called the "differential."²³ In the case of a planned economy, it is conceivable that the planners' location decisions, affecting differential shift, can be motivated not only by purely economic factors but also by noneconomic factors, such as defense considerations and the need to develop backward regions. Proportional and differential shifts add to the total net shift in a given variable of a region relative to the entire country. It will now be of interest to determine to what extent each of the two contributed to the total shift in the fixed capital of Ukrainian industry during the period discussed.

21. Cf. *ibid.*, pp. 262 ff.

22. Developed by Daniel Creamer in U.S. NRPB, 1943. For the simplified approach used in this study, see Perloff, 1960, pp. 70–74.

23. *Ibid.*, p. 71.

Since the differential shift is comparatively easier to obtain, its calculation will be undertaken first. Then this result will be subtracted from the net total shift in Ukrainian assets, and the difference will represent the proportional shift in these assets. The differential shift is calculated in the following manner. Fixed capital of an individual branch at the initial date is multiplied by the relative increase in fixed capital of this branch for the USSR as a whole during this period. The figure obtained is then subtracted from the actual value of fixed capital in this Ukrainian branch at the terminal date. If the latter figure is greater (the difference in the footnote below is indicated by a plus sign), the fixed capital growth in this particular branch has been greater in the Ukraine than for the entire USSR because of existing locational advantages in the Ukraine.²⁴ When relative growth was lower in the Ukraine, the locations for the development of this branch in other parts of the USSR have been regarded as more advantageous. By adding the results for individual branches, the negative total differential shift in the amount of 1,350.0 million rubles is obtained. Adverse differential shifts for the Ukraine are quite pronounced in such branches as coal, food, and iron and steel. The positive differential shifts in "Other," electric power, metalworking and machine building, and some other branches were too small to offset the negative shifts.²⁵

After the sum of differential shifts by branches is obtained, the following calculation can be undertaken:

Net shift in total fixed capital	—244.3 million rubles
Differential shift in total fixed capital	—1,350.0 million rubles
Proportional shift in total fixed capital	+1,105.7 million rubles

The first figure above shows the net shift for Ukrainian industry as a whole. It is derived by multiplying Ukrainian fixed capital on October

24. The results for individual branches are as follows (in millions of rubles): coal, —1004.6; sugar, —106.9; iron ore, —129.4; iron and steel, —526.1; chemical, —261.8; glass, china, and pottery, —14.0; foods other than sugar, —363.5; apparel, —11.0; metalworking and machine building, +164.7; electric power, +234.4; leather, fur, boot and shoe, —21.2; paper, —43.5; woodworking, +15.3; other, +584.0; textile, +127.2; peat, +6.3. Source: Table 2.2.

25. As was indicated above, the total differential shift depends on the degree of branch classification. For example, if the leather, fur, boot and shoe, paper, and peat branches (these are the USSR branches for which the value for the ter-

1, 1928, by the index for USSR fixed capital on January 1, 1938, and subtracting the result from the actual value of Ukrainian fixed capital on the same date.²⁶ As was explained above, the net shift for the entire industry consists of differential and proportional shifts. The proportional shift, equal to +1,105.7 million rubles, is obtained by subtracting the former from the net total shift.

The preceding analysis warrants the following conclusions. The difference between the Ukraine and the USSR was negligible in regard to the growth rate in industrial fixed capital. Under the surface, however, two distinct trends can be discerned. First, the locations for the development of some branches of heavy industry such as coal, iron and steel, or iron ore, which were particularly favored during the period discussed, have been considered by the planners to be more advantageous in other regions of the USSR than in the Ukraine. Since the trend in other branches was mixed, the total differential shift was negative for the Ukraine. Second, that the total fixed capital in the Ukraine did not decline relative to the USSR correspondingly, but only insignificantly, is due to the fact that the Ukraine specialized in these favored branches. Because the weights of these branches in the distribution of Ukrainian industry were high, even their relatively slower growth in the Ukraine was almost sufficient to offset their higher growth in the USSR, where the weights of these fast-growing branches were relatively low, as well as the higher growth of some slow-growing branches, notably other than sugar food processing. In other words, a large positive proportional shift in the Ukrainian industry during the period under analysis is found to correspond to a negative differential shift of almost equal magnitude.

The discussion of structural changes and the reasons for these changes in Ukrainian industry relative to the USSR was based on the value data of fixed capital, which, as was explained above, was the summation of initial values at 1925 prices and subsequent additions

minal data was obtained through the extrapolation for one year; see source to Table 2.2) were not treated separately but included in "Other," and sugar and food industries other than sugar were combined, the total differential shift would be increased to 1,820.0 million rubles. Despite this numerical difference in result, the trend is clearly seen.

26. $11,968 \text{ million rubles} - (2,163 \text{ million rubles} \times 564.6) = -244.3 \text{ million rubles}$ (Table 2.2).

at current prices. Because of then-existing inflationary tendencies, a possible argument that the results are influenced considerably by the unevenness of these tendencies for individual branches can be rejected on the following grounds. (1) As can be seen from the data below, showing the price indexes of Soviet gross national product and of some of its components for 1937 (1928-100), the inflation was much less pronounced in investment than in noninvestment components of the gross national product.²⁷

	<i>1928 Weights</i>	<i>1937 Weights</i>
Gross national product	425	265
Gross investment	173	136
Construction	205	199
Equipment	143	71
Noninvestment components of GNP	489	353

If the unevenness of inflation affected the comparability between the Ukraine and the USSR at all, it affected it only to a very small degree. (2) The Ukrainian shares for individual branches were in almost all cases substantially high, say, over 5 per cent. Therefore, a small increase in fixed capital in any particular branch in the Ukraine, without any change in the corresponding branch in the rest of the USSR, even in view of these inflationary tendencies, would not seriously affect the relationship between the Ukraine and the USSR. Of course, the same will be true in the converse case. Moreover, as Column 3 of Table 2.2 indicates, there were no instances of increases only in the Ukraine or only in the rest of the USSR; all branches showed a growth in the Ukraine as well as in other regions of the USSR, albeit at different rates. It seems, therefore, that the results previously obtained should be accepted as indicating the actual trend.

27. Moorsteen and Powell, 1966, p. 226, Table 8-1.

3. EFFICIENCY OF INVESTMENT DISTRIBUTION

The negative differential shift of industry in the Ukraine relative to other regions of the USSR means that during the period under discussion the planners regarded investment in the latter as more advantageous, on the average. The advantages could have been economic, noneconomic, or both. In purely economic terms, as far as the geographical distribution of investment is concerned, an efficient policy should result in the highest increase in total output in each branch of industry for the investment allocated to it. Specifically, a region should receive an increasing share of investment as long as capital is more productive there than in other regions of the country. Such allocation should continue, without regard to the region's share in the total population, employment, fixed capital, or any other consideration, until its marginal productivity of capital becomes equal to that in other regions.

In this chapter an attempt will be made to answer the question whether the capital was, in fact, becoming less productive in the Ukraine and, thus, whether the emphasis on the development in other regions of the USSR of certain branches of industry, for which appropriate conditions existed in the Ukraine, was economically sound.

There are several methods that can be used for testing the economic

efficiency of investment decisions. A Soviet authority in this field lists the following: net output per ruble of fixed capital, increase in output per ruble of investment, profitability, the decrease in cost of production, or the increase in output in physical units per investment.¹ The choice of method depends on the purpose at hand. It often depends on the availability, or rather the unavailability, of data, however. Precisely because of the latter situation, the comparison of ICORs is the only feasible method for use in this study. Most generally, the ICOR is defined as the ratio between the increase in capital and the increase in output during a certain period, under the assumption that the length of the production process remains unchanged and the technological progress is neutral.² This means that the lower (greater) the ratio, the greater (lower) the increase in output per given increase in capital. It should be pointed out that in rigorous terms the ICOR is not a reciprocal of marginal productivity of capital, because it postulates that all other factors of production can be varied, while in the case of marginal productivity of capital, they are assumed to remain unchanged when the capital is increased.³ As was already noted, however, it is realistic to assume that, during the period under analysis, other factors of production could have been easily adjusted to the increasing levels of capital in the Ukraine and the USSR.⁴

The capital-output ratio is accepted by Soviet economists as an important method of determining capital productivity.⁵ It is used for

1. Khachaturov, 1964, p. 48.

2. Harrod, 1948, pp. 82–83. In other words, it is neither labor nor capital saving.

3. Bator, 1957, p. 89.

4. One has to remember the unexploited and often unexplored rich natural resources scattered throughout the USSR. In regard to labor, even disregarding the huge rural overpopulation, unemployment existed among industrial workers at the beginning of the period under discussion. *Visti VTsVK* reported on September 30, 1928, that in the Ukraine 136,000 union members were unemployed. They represented more than one-fifth of all workers employed in large-scale industry in this year. For data on USSR unemployment, see Baykov, 1947, p. 213.

5. For example, "Recommendations," 1959, pp. 87–88; "Tipovaia metodika," 1960, pp. 56–57; Krasovskii, 1962, p. 59; Terekhov and Shastitko, 1961, p. 80; Khachaturov, 1962, p. 17; Khachaturov, 1964, chap. iii; Bunich, 1962, p. 62; Probst, 1962, p. 25; Akademia nauk, 1966, pp. 11–13. Soviet authors often fail to make explicit the difference between the productivity of capital and the capital-output ratio and between average and marginal concepts of these ratios. The

the analysis of capital productivity in various aspects, namely, for historical analysis, international comparisons, and comparisons among individual economic sectors and branches of industry. Also, since geographic location has a great influence on capital productivity, the capital-output ratios are extensively used for the aggregate interregional comparisons or comparisons between individual enterprises or complexes of enterprises within an industrial branch located in different regions. Ideally the ratio (R) for a certain period of time should be calculated according to the formula⁶

$$R = \frac{I + K_f - K_u + I_e - I_s}{O},$$

where I is investment; K_f is the value of unfinished projects at the beginning of the period; K_u is the value of unfinished projects at the end of the period; I_e is the investment for the support of the existing capacities; I_s is the investment in related supporting projects; and O is the increase in the gross output during this period. All authors emphasize the necessity of using comparable data for the calculation of this ratio as far as prices and definitions are concerned. In case the output is homogeneous (coal, oil, paper, etc.), the calculation of two ratios is recommended, using the output data in value terms and physical units.⁷

Unfortunately, the Soviet data for the period under discussion cannot be used for the calculation of a meaningful ICOR for the in-

superiority of marginal capital-output ratio to the average ratio is generally accepted in western economic literature, and its significance is described in the following terms: "One of the critical elements for economic growth in an area is new investment, and decisions on new investment are determined by relations at margin — that is, by small increments of change rather than by average relationships. Thus, it is quite possible that an area might have, on the average, favorable conditions for the production of a given commodity and not grow simply because the opportunities for new investment are unfavorable in this area relative to other areas." See Perloff, 1960, p. 88.

6. Krasovskii, 1962, pp. 65-66.

7. Kantor, 1962, pp. 54-55. The recent official document recommends to use for the measurement of differential productivity of investment by regions the ratio of increase in the net output to investment. See Akademia nauk, 1966, p. 13. However, see the preceding remarks about the difference between the marginal productivity of capital and the ICOR.

dustrial sector as a whole.⁸ As was previously discussed, both output and fixed capital data suffer from various deficiencies. In order to obtain an acceptable answer to the basic question of this study — where investment or the increases in fixed capital caused relatively higher output increases, in the Ukraine or in the USSR — it is necessary to adjust both variables to factor cost, i.e., to deduct turnover taxes from and to add subsidies to official data, and their changes must be calculated in constant prices.

In view of the paucity of data on fixed capital in Ukrainian industry, the following method was used to estimate its values in constant prices for benchmark years. There are estimates for the gross fixed capital (equipment and structures) of the USSR in 1928, 1937, and 1950 prices, adjusted for the above deficiencies.⁹ Those prices in 1950 have been chosen for use in this study because, as will be shown below in this chapter, the output index has also been calculated on the basis of this year's prices. To these data for 1928 and 1937 are applied official shares of the Ukraine in the fixed capital of the large-scale industry in the USSR on October 1, 1928, and January 1, 1938 (Table 2.2). Subtracting the data for 1928 from the data for 1937 gives an increase of 28,860 million 1950 rubles for Ukrainian industry.

	<i>USSR</i> (billions of rubles)		<i>Official</i> <i>Ukrainian Share</i>	<i>Ukraine</i> (millions of rubles)	
		<i>Index</i>			<i>Index</i>
1928	45.4	100.0	21.1	9,580	100.0
1937	185.7	409.0	20.7	38,440	401.3

The increase for USSR industry amounts to 140.3 billion rubles. In this procedure, one must assume that the Ukrainian shares in the large-scale industry of the USSR on October 1, 1928, and January 1, 1938, are representative of the shares in all industry on the average, during the years 1928 and 1937, respectively.

The output increase in Ukrainian industry is estimated somewhat

8. Cf. the comments of Thad P. Alton on Erlich's paper, Erlich, 1959, p. 131.
9. Powell, 1963, Table IV.12, p. 191.

differently. As a starting point, an estimate of gross value added to USSR industry in 1928, equal to 74.4 billion 1950 rubles, is taken.¹⁰ Of this, 17.4 per cent is considered to be the share for the Ukraine. This percentage was derived on the basis of official data for gross output of large-scale industry in 1928 in 1926/27 prices.¹¹ As before, it must be assumed that the share of the Ukraine in the output of large-scale industry of the USSR is representative of its share in all industry. Furthermore, it must be assumed that the prices in this year were not yet sufficiently distorted to deprive this share of its meaningfulness.¹² Because of subsequent inflation coupled with considerable structural changes in Ukrainian industry relative to the USSR, however, this output of Ukrainian industry in 1937 cannot be calculated in the same way.

The procedure used is as follows. The previously derived figure for 1928 is multiplied by an index, calculated in Appendix A, and, for comparability, the 1928 data for the USSR are multiplied by the Kaplan and Moorsteen index, on which the derivation of the Ukrainian index was based.¹³ As can be seen from the following figures, the output increase amounted to 110.6 billion rubles for the USSR and 31,614 million rubles for the Ukraine.

	<i>USSR</i>		<i>Ukraine</i>	
	<i>(billions of rubles)</i>	<i>Index</i>	<i>(millions of rubles)</i>	<i>Index</i>
1928	74.4	100.0	12,946	100.0
1937	185.0	248.7	44,560	344.2

It must be added that the figure for 1928 includes the value added in the production of munitions,¹⁴ while the indexes intend to show

10. *Ibid.*, Table IV.10, p. 187. The concept of gross value added, as used by Powell, means that the estimate in addition to net value added in industry contains also the value of inputs from other economic sectors as well as profits and depreciation.

11. Table A.3.

12. According to Hoeffding, 1954, p. 48: "The Soviet economy in 1928 was more of a 'market economy' than it became in the Five-Year Plan era . . . its price system was more 'meaningful' in the sense of being less remote from such an ideal as a system resulting from perfect competition."

13. Table A.6.

14. The munitions sector is retained in these calculations because it is included in fixed capital data.

the increase in the output of civilian goods. In view of the complete lack of information on this point for the Ukraine, it must be assumed that munitions production accounted for the same percentage in USSR and Ukrainian industries in benchmark years. This assumption seems to be plausible because the share of the Ukraine in the output of the USSR metalworking and machine-building branch, which was the main supplier of munitions, remained almost the same in both years, 17.5 and 17.8 per cent in 1928 and 1937, respectively.¹⁵

Dividing the increase in fixed capital of 28,860 million rubles by the increase in output of 31,614 million rubles, the ICOR of 0.913 for Ukrainian industry for the period under discussion is obtained. The corresponding ratio for the USSR is larger and amounts to 1.269. Thus, the Ukrainian ratio is 72.0 percent of that for the USSR. Both ratios are very low as compared with other countries,¹⁶ because in this study, as was just pointed out, the concept of gross value added is used, while the ICORs for other countries are usually calculated on the basis of net value added in industry alone.

Since the objective of Soviet investment policy is not to maximize the industrial output in general but to optimize the product mix, which is determined by planners, it is necessary to support the previous calculation by aggregating the ICORs for individual branches. These ICORs are estimated in Part II for fifteen branches, for which the data were available. In all cases the official data were used to obtain the increase in fixed capital. The output increases, on the other hand, were expressed in either 1926/27 or 1950 prices. The resulting ICORs are obviously not comparable among themselves, but in each case the ICOR for the Ukraine and the ICOR for the USSR were calculated on the basis of data expressed in the same prices. Thus the two are comparable, and the percentage of each Ukrainian ICOR in the corresponding USSR ICOR can be calculated. These percentages, listed in the first column of Table 3.1, are then aggregated with the

15. Table A.3.

16. Kuznets studied the ICOR in manufacturing and mining for seven selected countries for various periods; it was below 2.0 for one, between 2.0 and 3.0 for three, and over 3.0 for the remaining three countries. See Kuznets, 1961, pp. 46-47. According to Martin, 1957, p. 29, it was below 2.0 for India and Italy between 1950 and 1954, and 2.6 for the Indian Third Five-Year Plan, according to Reddaway, 1962, p. 211.

TABLE 3.1. Aggregation of Percentages of the Ukraine's Capital-Output Ratios of USSR Ratios by Industrial Branches

Branches of Industry	Ukrainian Capital-Output Ratio as Percentage of USSR Ratio	Percentage Distribution of Increase in Fixed Capital of Ukrainian Industry by Branches
<i>Total</i>	83.3	100.0
1. Iron and steel	97.3	26.0
2. Metalworking and machine building	93.7	24.5
3. Chemical	47.4	12.9
4. Electric power	75.6	11.4
5. Coal	85.1	9.0
6. Food other than sugar	54.8	6.2
7. Sugar	90.5	3.2
8. Textile	116.8	1.8
9. Iron ore	63.2	1.6
10. Glass, china, and pottery	61.2	1.3
11. Woodworking	163.4	1.0
12. Leather, fur, boot and shoe	85.1	0.5
13. Apparel	95.5	0.3
14. Peat	27.9	0.2
15. Paper	53.0	0.1

Sources: Capital-output ratios: pp. 99, 108, 109, 123, 130, 140, 151, 164, 170, 171, 172.
 Distribution of fixed capital: Table 2.2.

help of increases in Ukrainian fixed capital as weights. Conceptually preferable output increases, being heterogeneous, cannot, of course, be used for this purpose. The result of this calculation shows that the ICOR in Ukrainian industry amounted to 83.3 per cent of the USSR ICOR, i.e., the increases in output per increase in fixed capital were on the average almost one-fifth higher in the former.

As can be seen, both calculations prove that the ICOR was lower in the Ukraine than in the USSR, but they diverge as to the degree; in the first the advantage of the former over the latter is equal to more than one-fourth and in the second to a little less than one-fifth. Were

the data complete, then as a matter of arithmetic, both results should be equal.¹⁷ The obvious reason for this divergence is the inadequacy of the data and, consequently, of calculations based on these data. Specifically, in the case of the over-all ICOR, it is very probable that, because of its patchiness, the independent index overstated the growth of Ukrainian industry and thus understated the Ukrainian ICOR relative to the USSR. On the other hand, it is possible that the branch-aggregated ICOR for the Ukraine was overstated. In view of this, it may be suggested that these two results represent limits — one fourth and one-fifth of how much the Ukrainian ICOR was lower relative to the USSR between 1928 and 1937.

There are several factors that may be responsible for the differential ICOR in Ukrainian industry relative to the USSR during the period under discussion. The most important of these are the introduction of advanced technology, the level of capital utilization, the degree of modernization of production, the supply and skill of labor, the availability and quality of mineral resources, the level of economic development, the distribution of investment in new construction or the extension of existing plants, the size of enterprises, and the change in branch structure.¹⁸ In view of the lack of data, primarily for the Ukraine, it has to be assumed that some of these factors affected the Ukraine and the USSR equally. For example, there is no evidence that the individual regions were discriminated against in regard to the introduction of new technology. This was embodied in the equipment introduced into operation, and, therefore, the matter of whether a new technology was introduced depended solely on the increase in fixed capital in a given region. Also, nothing is known about the difference in the utilization of capital between the Ukraine and the USSR. The modernization (reconstruction in Soviet terminology) of capital proceeded during this period almost at the same rate in both cases.¹⁹ In 1940 over 92 per cent of all industrial output in the Ukraine was produced in new or entirely reconstructed plants, while in the USSR

17. *Ibid.*, p. 209.

18. Leibenstein, 1957, chap. ii; Meier, 1964, p. 104.

19. The plant was considered reconstructed if at least 50 per cent of its capital was recently put into operation.

this percentage was about 90.²⁰ The difference seems to be too small to explain the ICOR in the Ukraine and in the USSR.

In discussing the effect of labor supply on the ICOR in the Ukraine and the USSR, it is meaningless to treat all regions of the USSR outside the Ukraine as homogeneous. Instead, it is necessary to make a distinction between those located in the European and the Asiatic parts of the country. In the former, industry grew rapidly in the Moscow and Leningrad regions and also in some areas along the Volga River. These are the old historical provinces of Russia proper, settled long ago, and as such they were always relatively densely populated. Since the population was primarily engaged in agriculture and the ratio of population to land (not very fertile at that) was high in comparison with other parts of the country, these areas had at their disposal a large pool of underemployed manpower. The appropriate institutional change and economic policy could easily transform it into an effective industrial labour force, as was the case during the First and Second Five-Year Plans. In this respect, these areas were in a more favorable position than the main industrial region of the Ukraine, Donbas, the settlement of which began as recently as the eighteenth century and which remained still sparsely populated during the period under discussion. The necessary labour force for Donbas factories and mines had to come either from adjacent Russian areas in the east or from other Ukrainian regions, mainly those west of the Dnieper River. Nevertheless the inflow of labour force was never sufficient, and some industries, notably coal mining, were constantly plagued by labor shortages.

Donbas was decisively in a better position than the Asiatic parts of the USSR, such as the eastern Urals, western Siberia, or northern Kazakhstan, in which industrialization proceeded at a particularly high rate. These regions were very little, if at all, settled, and in addition are characterized by long, severe winters and, in the case of Kazakhstan, by very hot summers. Obviously, Soviet economists were aware that economic development in these areas could always be hampered by a labor shortage. Some of them thought that, in addition to the pioneering spirit, substantial wage differentials, and provision

20. Nesterenko, 1954, p. 393, and Lokshin, 1956, p. 277.

of good housing and a cultural environment would be sufficient incentive to induce the migration of necessary labor to the newly constructed plants from the overpopulated western USSR.²¹ Others were more skeptical, however, and at the early stages of industrialization advocated the use of compulsory methods of employment in case the number of volunteers was insufficient.²² Despite the extensive use of these notorious methods in the 1930's and despite the fact that wages were higher in these areas than in the west by as much as between 20 to 40 per cent, for example in the iron-and-steel industry,²³ the eastern industrial centers still experienced constant labor difficulties. Moreover, those workers who migrated did not stay long at their new jobs because of the harsh climate, the extremely poor housing conditions, and the lack of other amenities. The resulting turnover had an obvious negative effect on the productivity of labor.

On the basis of the preceding considerations, the following conclusions can be drawn. Because of the relatively large supply of labor in the European parts of the Russian SFSR, the possibility of the substitution of labor for capital was greater here than in Donbas. As a result, for this reason alone, the ICOR in those branches, which were concentrated in both areas (such as machine building, the chemical industry, and various consumers' goods branches) was pushed downward in the Russian areas as compared with the Ukraine. In contrast, such a possibility did not exist in the eastern areas, in which such branches of heavy industry as coal and ore mining and ferrous metallurgy were being developed. In view of the consistent labor shortages, capital had to be combined with less labor. Consequently, the ICOR was high as compared with similar branches in the Ukraine.

Empirical analysis of the preceding considerations is not possible because of the lack of employment data by industrial branches for

21. Khavin, 1930, p. 45. However, some argued that if reliance were entirely on the monetary factor, the necessary wage increases would have to be so high that, as far as the cost of production was concerned, all advantages of the favorable natural conditions, for example in coal mining, would be wiped out. See Mil'man, 1930, p. 45.

22. Kogan, 1930, p. 47. Evidence of witnesses suggests that the compulsory element was probably the most important factor in supplying labor to the east during the period under discussion. For example, in coal mining, political prisoners and *kulaks* were turned into miners.

23. Livshits, 1958, p. 95.

the Ukraine.²⁴ Such data are available for all industry. These data and those for the USSR are listed in Table 3.2, Panel A. Panel B shows an alternative set of employment data, which cover a little longer period than that under consideration and evidently refer to the less inclusive classification of workers. In view of the almost identical ratios of workers to all employed in the Ukraine and the USSR,²⁵ their changes may be considered representative of changes in all employed in both industries. Both sets of data indicate a faster growth in the USSR and, as a result, a marked decline in the Ukrainian share in the more recent year. If all other considerations determining the level of the ICOR were the same in the Ukraine and the USSR, this factor would have caused a lower ICOR in the USSR. Evidently all other factors were decisively more favorable in the Ukraine, however.

TABLE 3.2. Employment in the Industry of the Ukraine and the USSR in Selected Years

Dates	Ukraine		USSR		Ukraine as Percentage of USSR
	Thousands	Index	Thousands	Index	
A. 1928	769	100.0	3,773	100.0	20.4
1937	1,822	236.9	10,112	268.0	18.0
B. Jan. 1, 1927	536.9	100.0	2,371.6	100.0	22.6
Oct. 1, 1939	1,326.9	247.1	7,162.6	302.0	18.5

Sources: Panel A: Ukraine, Virnyk, 1967, p. 436; USSR, TsSU, 1964, p. 84.
Panel B: Vorob'ev, 1965, p. 135. The author does not specify the definition of data, but it seems that he refers to the labor classification of workers in large-scale industry.

As far as the availability and quality of mineral resources are concerned, it must be remembered that of greatest importance during this period were those which were used by heavy industry such as coal, iron ore, nonferrous ores, and water power. The Ukraine was in this respect in a better position than the European part of Russia

24. Fragmentary data for certain years are available in TsUNKhU, 1934, pp. 327-31, and TsUNKhU, 1936, pp. 520-22.
25. See Chapter 2, n. 12.

proper. It was certainly inferior to the regions east of the Urals, however. These resources had been exploited on a large scale in the Ukraine since the 1870's and diminishing returns were already being felt. It was necessary to dig deeper mines and to utilize poorer resources of coal in Donbas. The same was true in the case of iron-ore mining in Kryvyi Rih (Krivoi Rog). On the other hand, the eastern regions are extremely rich in mineral resources. They possess up to three-quarters of all the coal resources of the USSR, four-fifths of its water power, three-quarters of its timber, the principal resources of non-ferrous and rare metals, and enormous resources of chemical raw materials, iron ore, and building materials.²⁶ Moreover, the resources of these regions are easier to extract than those located in the Ukraine. For example, mining coal on the surface is much cheaper than mining it underground. In 1940, 4.1 per cent of all the coal in the USSR was mined on the surface, all in the eastern regions.²⁷ It is true that some of these resources, even at the present time, cannot be exploited because of extremely severe climatic conditions. Still, on balance, it seems that this factor was more favorable in the USSR than in the Ukraine and, consequently, pressed the ICOR of the former downward relative to the latter.

There is general agreement among economists that the stage of economic development is of great influence on the level of ICOR.²⁸ The construction of a given enterprise in an underdeveloped region is usually accompanied by the construction of other enterprises which supply its inputs or consume its outputs and which, by definition, previously did not exist there, while in contrast, such enterprises need only to be expanded in the more developed regions. Moreover, the desired output will only then come forth, if the time factor is important, when all vertically related enterprises are constructed simultaneously and not piecemeal. Because of the indivisibility of such investment outlays in the initial stages of economic development, the ICOR is high in underdeveloped regions as compared with those that are better developed.²⁹ The general lack of experience

26. These are the postwar estimates.

27. TsSU, 1961, p. 258.

28. Cf. Bruton, 1960, p. 282; Martin, 1957, p. 26.

29. Bruton, 1960, p. 282.

in the industrial processes by labor and management has the same effect; their use of capital is inefficient, and consequently more capital is needed per unit of output than in developed regions.³⁰ The former lack not only the industry but also developed social overhead and regional or communal agglomerations which are important sources of external economies for industrial enterprises but which cannot be transferred from one region to another.³¹ Again, their lack in underdeveloped regions causes the ICOR to be relatively high. It is true that most of the underdeveloped regions are characterized by the relatively large supply of labor which can be used to offset these disadvantages. This possibility is not applicable to the eastern regions of the USSR, which in addition to being underdeveloped were continuously confronted with a labor shortage. All these factors were responsible for the high ICOR in the eastern regions of the USSR as compared with the Ukraine. On the other hand, in view of the similar level of economic development in Donbas and the industrial centers of western Russia, these factors did not influence their ICORs differentially.

Another important factor that affects the level of ICOR is the relationship, in the increments to the total fixed capital, between buildings and structures, on the one hand, and the remaining components of fixed capital such as equipment, machinery, transmitting equipment, instruments, inventory (short-lived, small-value durables), and means of transportation, on the other hand.³² The higher the share in investment of the former, which are considered passive, the lower the increase in output usually is.³³ To quantify the difference between these two components in the Ukraine and the USSR, the following method is applied. The available data on the composition of fixed capital, in this respect, in most branches of the large-scale industry of the USSR in 1937 are used for this purpose.³⁴ On their

30. Martin, 1957, pp. 30-31.

31. Perloff, 1960, p. 82.

32. The classification of components of fixed capital is taken from Arakelian, 1938, p. 12.

33. E.g., Bunich, 1962, p. 65; Kantor, 1962, p. 53.

34. The share of buildings and structures in individual branches was as follows: coal, 66.3; sugar and food other than sugar combined, 52.9; iron and steel, 58.8; chemical, 44.4; metalworking and machine building, 53.7; electric power, 32.4; woodworking, 52.7; textile, 45.3; peat, 49.8. See Arakelian, 1938, p. 12.

basis, the composition in the remaining branches in the sample is estimated.³⁵ Now, under a drastic assumption that the shares of buildings and structures were the same in the same branches in the Ukraine and the USSR and have not changed for the period between the benchmark dates, these shares are weighted by the branch distribution of both industries on benchmark dates.³⁶ As a result, the following aggregate shares are obtained:

	<i>October 1, 1928</i>	<i>January 1, 1938</i>
Ukraine	54.6	52.8
USSR	50.4	50.9

The above calculation shows that the share of buildings and structures was larger in the Ukraine than in the USSR on both benchmark days, because they are relatively high in such branches as coal or iron and steel, which were important in the Ukrainian distribution. During the period under discussion, the Ukraine shows a small decline, while in the USSR a negligible change in the opposite direction is noticeable.

The above conclusion has been reached on the assumption that the share of buildings and structures in the total fixed capital by individual branches was the same in the Ukraine and other regions of the USSR. It is necessary now to discard this assumption for the following two reasons: (1) The bulk of investment in such favored branches as coal and iron and steel, in which buildings and structures are particularly important and which were growing faster outside the Ukraine during the period under discussion, went to the regions of the Urals and western Siberia, which are notorious for their long winters and low temperatures. Under these climatic conditions the share of structures and, in particular, of buildings is even higher.³⁷ (2) This share is also relatively high in new investment projects, while

35. For the remaining branches, for which the data are unavailable, the ratios of similar branches (shown in parentheses) are used; iron ore, 66.3 (coal); glass, china, and pottery, 50.3 (group B of total industry); apparel, 52.1 (total industry); leather, fur, boot, and shoe, 45.3 (textile); paper, 52.1 (total industry); other, 52.1 (total industry). For the data for branches in parentheses, see *ibid.*

36. Table 2.2.

37. Kantor, 1947, pp. 9-10.

the expansion and widening of existing facilities result mainly from the addition of machinery, equipment, etc., to the existing buildings and structures.³⁸ Some calculations indicate that the increase in output per unit of investment in some iron-and-steel plants was twice as high in the case of reconstruction as in the case of new projects.³⁹ It is obvious that a relatively high proportion of investment during this period went in the eastern regions into the new projects, in which such industries were previously simply nonexistent in most cases. Some fragmentary data suggest that, by contrast, in the Ukraine the expansion and widening of existing facilities accounted for the high percentage in total investment. For example, of all funds devoted to this purpose in the iron-and-steel industry, the Ukraine received all until 1931 and two-thirds between 1931 and 1937.⁴⁰ These two considerations suggest that the increase in the share of buildings and structures in the total fixed capital of USSR industry relative to the Ukraine was underestimated in the preceding paragraph and, as a result, the effect of this factor on the differential level of ICOR in favor of the Ukraine was considerably greater than the results obtained tend to indicate.

The level of ICOR is also affected by the scale of newly constructed enterprises. A completed larger enterprise requires initially a longer gestation period to attain its optimum output than does a smaller enterprise in the same branch.⁴¹ The effect on the differential level of ICORs in two regions is obvious: the more enterprises on a larger scale that are introduced in the industry of one region relative to the industry of another region, the higher will be the ICOR in the former.

There are some data available on this subject for the period between 1928 and 1940⁴² that nearly coincide with the period analyzed.

38. Bunich, 1960, p. 33; Khachaturov, 1964, p. 71. However, according to the latter author, the reconstruction is not so conducive to the introduction of new technology as new constructions.

39. *Ibid.*, p. 212.

40. Livshits, 1958, p. 147. It is probable that a similar situation existed in other branches.

41. Smolinski, 1962, p. 145; Meier, 1964, p. 95. Clearly, the gestation period has nothing to do with the period of construction of an enterprise.

42. Smolinski, 1960, pp. 229-30, Table 6.2. Changes in the scale of plant are measured here by the changes of output in physical units per plant.

On the basis of these data, the following observations can be made. The largest increase in the scale of plant took place in some branches of metalworking and machine building. For example, for the establishments producing motor vehicles (nonexistent in the Ukraine at that time) the increase was as high as thirty six times, and for ball bearings almost thirty times. Since the increase in fixed capital of metalworking and machine building was almost identical in the Ukraine and the USSR, the effect of the enterprise scale on the differential level of the ICOR cannot be ascertained.⁴³ Relatively high increases in the plant scale can also be observed in such branches of nonferrous metallurgy as lead and zinc smelting, eight and seven times, respectively. These branches were developed outside the Ukraine at that time and therefore these increases had an upward effect on the ICOR in the USSR. The threefold increase in the scale of all electric stations, and the sevenfold increase in hydroelectric stations tended to exert relatively greater upward pressure on the ICOR in the Ukrainian industry, because the increases in fixed capital of this branch were larger in the Ukraine than in the USSR. The data for other branches, primarily those of food and light industries, indicate generally smaller increases in output per plant than in the previously mentioned branches. The effect of these increases on the differential level of aggregate ICORs in the USSR and the Ukraine can be considered as not very important in view of the lack of attention to the development of these branches during the period discussed, as reflected in the relatively small increases in their fixed capital.

Of particular importance in this connection, however, are the coal and iron-and-steel branches, because of their weight in the structure of Ukrainian industry as well as the emphasis on their development at that time. Furthermore, it seems that the gestation period is usually longer in these than in other branches of comparable establishment scale.⁴⁴ The increase in the establishment scale here was relatively high, more than three and one-half times for coal mining and almost four times for the component of the iron-and-steel branch, namely,

43. For all references to the increases in fixed capital, see Table 2.2.

44. For example, according to Gřafov, 1957, p. 260, it takes approximately five years until a complete coal mine attains its optimum output.

for pig iron output, for which the data are available.⁴⁵ Since these branches grew at a faster rate in the USSR than in the Ukraine, the introduction of predominantly large-scale enterprises pulled the relative level of the ICOR upward in the former. Moreover, even within these branches the increases in the establishment scale were larger in the USSR than in the Ukraine, particularly during the Second Five-Year Plan. In the case of coal mining, the mines introduced during the First-Year Plan were on the average about one-quarter larger in the Donbas than in the Kuznetsk basin, while during the Second Five-Year Plan, when the growth of this branch was particularly rapid, the scale was about one-third larger in the latter.⁴⁶ The new blast and open-hearth furnaces of the iron-and-steel industry were generally larger in developing centers of the Urals and western Siberia than in the Ukraine during both five-year-plans.⁴⁷ On the basis of the preceding discussion, it seems reasonable to conclude that the scale of newly introduced establishments was on the average higher in the USSR than in the Ukraine. The resulting longer gestation periods tended to pull the aggregate ICOR upward in the former relative to the latter.

Finally, the effect of the change in branch structure on the differential level of the ICOR will be considered. Because of different production functions, the average capital-output ratios (ACOR) differ in individual branches of industry. Clearly, the larger is the share in the total industry of branches with relatively high ACORs, the higher is the aggregate ACOR. In order to determine in which in-

45. Smolinski, 1960, pp. 229-30, Table 6.2. The construction of the huge Magnitogorsk iron-and-steel complex can serve as a good example of the approach toward the development of this branch in general.

46. Calculated from Smolinski, 1962, p. 144, Table 2.

47. This can be seen from the following table:

AVERAGE CAPACITIES OF BLAST AND OPEN-HEARTH FURNACES INTRODUCED DURING THE FIRST AND SECOND FIVE-YEAR PLANS BY SELECTED REGIONS OF THE USSR

	Blast Furnaces (cubic meters)		Open Hearth Furnaces (square meters)	
	1st FYP	2nd FYP	1st FYP	2nd FYP
Urals	327	1180	19.9	65.8
Western Siberia	821	1163	54.7	66.6
Ukraine	644	955	26.5	51.7

Source: Calculated from Livshits, 1958, pp. 149-50.

dustry, that of the Ukraine or of the USSR, the ICOR tended to become higher between two benchmark dates as a result of a rise in the aggregate ACOR, the following calculation will be undertaken. The fixed capital on October 1, 1928, for fifteen branches and residual of the large-scale industry are divided by the output of these branches in 1928 in 1926/27 prices.⁴⁸ It must, of course, be assumed that these fixed capital data are representative of average values during 1928.⁴⁹ Thus, derived ACORs, under the assumption that they did not change between the benchmark dates, are weighted by the fixed capital distributions of both industries on these dates.⁵⁰ As can be seen, the Ukrainian ACORs are higher than those for the USSR on both dates.⁵¹ Obviously, of decisive importance for

	<i>October 1, 1928</i>	<i>January 1, 1938</i>
Ukraine	1.046	1.201
USSR	0.882	1.035

this phenomenon is the concentration in the Ukraine of heavy in-

48. ACOR for individual branches of USSR and Ukrainian (in parentheses) industries were as follows: (1) coal, 1.023 (1.301); (2) sugar, .651 (.639); (3) iron ore, .972 (1.038); (4) iron and steel, .917 (1.017); (5) chemical, .880 (1.833; the large difference between these two ratios may be due to the fact that that for the Ukraine includes the coking and oil refining industries, while that for the USSR refers to the chemical industry alone); (6) glass, china, and pottery, .912 (.682); (7) food other than sugar, .370 (.424); (8) apparel, .086 (.131); (9) metalworking and machine building, .851 (.747); (10) electric power, 3.904 (3.904); (11) leather, fur, boot, and shoe, .286 (.218); (12) paper, .978 (1.062); (13) woodworking, .425 (.425); (14) other, .596 (.466); (15) textile, .489 (.420); (16) peat, 1.332 (1.332). Sources: USSR, TsUNKhU, 1936, pp. 3-18, except branch (6) for which the fixed capital data is from Kaplan, 1951, Appendix Table II, and output from CAESS, 1934, p. 39; Ukraine branches (1), (3), (4), (5), (9), (12), (15) from Khromov, 1945, pp. 34-35, branches (2), (6), (7), (8), (11) from Kukharenko, 1959, pp. 110-11; for branches (10), (13), (16) the output data are unavailable, therefore, ACORs for the USSR are used; for branch (14) — other — the USSR ACOR minus oil industry is used, because this industry was then nonexistent in the Ukraine.

49. For justification of the meaningfulness of prices in 1928, see n. 12, above.

50. Table 2.2.

51. The aggregate ACORs are different from the ones calculated on the basis of total fixed capital and output. For example, in 1928 the latter is equal to .609 for the USSR and .754 for the Ukraine. See TsUNKhU, 1936, p. 3; Khromov, 1945, pp. 34-35. This is obviously due to the fact that computed here aggregate ACORs are arithmetical means of ACORs of sixteen branches weighted by their fixed capital.

dustry, which is relatively capital-intensive. However, of greater interest in the present context is the relative change in ACORs over the period discussed and not their differences in the absolute level. This change was almost the same for both the USSR and the Ukraine, 17 and 15 per cent, respectively. The difference between these increases is obviously too small to attribute the higher ICOR in the USSR to the fact that its industrial structure was becoming more capital-intensive.

Until now the increase in industrial output was considered to have resulted from an increase in investment or, more precisely, from an increase in fixed capital in industry. It could often have taken place, however, only if the supply of goods and services from other economic sectors to the industry increased concomitantly.⁵² One has only to think about the rising demand of an expanding industry for services of transportation, communication, and urbanization. Obviously, in order to increase their supply, an additional investment in these sectors is required and should be incorporated into the planning of the geographical distribution of investment in industry. A desired output should take place in the region in which the combined investment outlays, directly in industry and in other economic sectors, would be the lowest.

The paucity of data prevents any detailed analysis of this problem in regard to the Ukraine and the USSR. Nevertheless, the following can be said with certainty. The Ukraine, or rather its most industrialized region—Donbas—was as well developed as other industrial regions of the western USSR. The Ukraine was much superior in this respect to the eastern regions, which often were not yet even inhabited when the industrial projects were being constructed. The additional expenditures must have been indeed exceptionally high in such cases,⁵³ even despite the well-known Soviet policy of keeping them

52. Khachaturov, 1964, pp. 42–43.

53. According to Khachaturov, 1962, -p. 29, the investments in housing and in municipal and cultural-social projects are very high in underdeveloped regions when an industrial project is constructed there. They can be equal to 30 to 50 per cent of direct expenditures for the project. Or, for example, the construction of a chemical plant is accompanied by these additional expenditures which are 1.5 to 2 times smaller in a town of 150,000 — 300,000 than in a small town, and 2.5 to 4 times smaller than the construction of a new community. See Feigin, 1960, p. 239.

as low as possible. This can be seen, for example, from the fact that investment in transportation in the USSR during the Second Five-Year Plan, when the shift of industry from the west to the east was well under way, accounted for 21.4 per cent of all investment and in the Ukraine for 16.6 per cent, while during the First Five-Year Plan this percentage was almost the same in both.⁵⁴ If one assumes that during the period under discussion all other sectors of the Soviet economy (agriculture without kolkhoz, transportation, communication, housing, commercial and municipal enterprises, education, culture, and health services) were subordinated to industry, then they should receive only the absolutely unavoidable investment, i.e., the investment needed to expand or to maintain their output, not for its own sake but in order to facilitate the output of industry. The available data indicate that in order to sustain given output increases of industry, the planners found it necessary to invest in other economic sectors than in industry relatively more in the USSR than in the Ukraine during both the First and Second Five-Year Plans, 57.6 and 52.9 per cent, respectively.⁵⁵ As can be seen, on the average the Ukraine possessed an advantage over the USSR in this respect also.

The previous discussion has tended to show that the ratio of output increases to fixed capital increases was greater in Ukrainian than in USSR industry during the period under discussion. Moreover, it has been shown that the requirements for additional investment in other sectors of the national economy were higher in the latter. One may now ask to what extent the growth of either industry was affected merely by increases in the quantity of the two basic factors of production, labor and capital, and to what extent by increases in their efficiency. This latter concept refers in effect to the residual between the growth rate of output and the growth rate of combined inputs, and comprises a host of factors (some of which were discussed in greater detail in the preceding part of this chapter) such as the introduction of advanced technology; economies of scale; an improvement in labor skills as a result of education, training, and better health; an increase in the mobility of resources; an improvement in the planning of the national economy and its management; and

54. TsSU, 1961a, pp. 60, 82.

55. *Ibid.*

a better developed social overhead. The quantification of this residual requires, of course, in addition to independent output estimates, the data on services of capital and labor, i.e., the value of capital net of depreciation and its utilization, as well as the man-hours actually worked. Also, it is necessary to know the explicit or implicit returns to both factors, which, under the assumption of linear homogeneous production function, are to be used as weights in combining their growth rates. On this basis and on the basis of the independently derived growth rate of output, the rate of change in efficiency can be calculated. The necessary data for such a calculation are partially available for USSR industry, and with their help the increase in efficiency has been estimated for various periods.⁵⁶

The lack of data does not allow similar calculations for the Ukraine during the period under discussion. Since the comparison of changes in over-all efficiency between the Ukraine and the USSR is of obvious importance, in order to obtain some estimates, no matter how rough, the following assumptions must be introduced. Instead of growth rates of capital and labor services, the growth rates of gross fixed capital and employment must be used. In regard to capital, it must be assumed that the degree of depreciation and utilization was the same in the Ukraine and the USSR, and that growth of inventories was proportional to the growth of fixed capital. Since there was no difference in the labor regulations regarding the length of the work week between the Ukraine and other regions of the USSR, the growth rates of employment can be reliably used in place of growth rates of man-hours. Finally, since it is not possible to calculate explicit or implicit returns to labor and capital, following the usual practice in such cases, it is assumed that returns to labor in the Ukraine as well as in the USSR were three times as large as to capital.

Table 3.3 lists the necessary variables for this calculation for the Ukraine and the USSR: growth rates of output, fixed capital, two sets of employment, and both factors combined. On the basis of these variables two variants of changes in the over-all efficiency of inputs have been calculated. In both cases, one can observe respectable increases in the Ukraine, while the USSR experienced a small decline

56. Cf. Powell, 1963; Noren, 1966.

TABLE 3.3. Annual Rates of Change of Output, Fixed Capital, Employment, and implied Efficiency in the Industry of the Ukraine and the USSR Between 1928 and 1937 (per cent)

	Ukraine	USSR
1. Output	14.72	10.65
2. Fixed capital	16.70	16.94
3. Employment		
Variant A	10.06	11.58
Variant B	7.35	9.06
4. Fixed capital and employment combined		
Variant A	11.42	12.73
Variant B	9.02	10.59
5. Implied efficiency		
Variant A	2.96	— 1.09
Variant B	5.23	0.05

Sources: Line 1: Table A.6.

Line 2: P. 32.

Line 3: Table 3.2.

Line 4: Geometric mean of Lines (2) and (3).

Line 5: Derived according to the following formula: $[(1 + \text{Line 1})]/(1 + \text{Line 4}) - 1$.

in one case and virtually no change in the other case. The decrease in implied efficiency can be understood to mean that USSR industry was unable to absorb rapid increases in both factors: labor and capital.

As can be seen, the Ukraine had an important advantage over other regions in the USSR also in this respect, as it had in the previously discussed two aspects: lower ICOR in industry and lower investment requirements in other sectors of the national economy. All this warrants the conclusion that from a purely economic point of view there should be not the slightest doubt that a substantially larger share of total investment in the USSR should have been allocated to the development of Ukrainian industry during the first two Five-Year Plans than actually was the case.

4. SOVIET LOCATION THEORY

The previous discussion has shown that the Ukrainian share in industrial investment of the USSR declined between the First and Second Five-Year Plans. This decline and the relatively low level of the Ukrainian share in general were determined by the planners' preferring to allocate investment to regions of the USSR other than the Ukraine. In view of the lower ICOR and a greater rate of increase in the over-all input efficiency in the Ukraine than in the USSR, the reasons for this investment policy must have been other than strictly economic. Their explanation can be found in the Soviet theory of industrial location to which attention will now be turned.¹

A review of Soviet literature on location theory shows that until recently its authors have relied heavily on the theory as formulated by Alfred Weber.² This theory, stressing the fact that a plant should be constructed at a location where the cost of production, including transportation cost to consumption centers, will be lowest, influenced

1. For further discussion, see Koropecj, 1967.

2. Weber, 1909. The popularity of this theory in the USSR is probably due to the fact that the book was translated into Russian in 1926 and so became accessible to many Soviet economists.

the thinking of several important Soviet economists in the 1920's and 1930's. They felt that Weber's theory could be very useful for their planning under the conditions of economic stability associated with a socialist state. They realized that in order to achieve extremely ambitious output increases, the available resources would have to be utilized most efficiently. This was particularly important in the case of capital, which was scarce in relation to other resources at that time. Since its productivity depends greatly on its location, the question of the most efficient geographic distribution of new enterprises, and with it, the question of the applicability of Weber's theory to Soviet conditions, figured prominently in the contemporary economic literature.

Weber was admittedly a non-Marxist economist and for this reason alone his theory could not have been accepted by party-line economists. In addition, they raised many other objections to it. The theory was attacked for its pretense of being "pure," i.e., being applicable to all economic systems; its use of physical units in presenting the problem; its use of mechanical and mathematical solutions; its failure to explain the actual distribution of industry under capitalism; its overly abstract assumptions; its partial equilibrium approach; its limitations to the analysis of private costs and returns to an individual firm; its short-term character; and, most important, its stressing of only economic considerations; in other words, its recommendation of the selection of a location where the costs to an individual firm would be lowest.

The objections of Soviet economists to Weber's theory, primarily because of its focus on cost minimization to an individual plant and disregard of the interests of the national economy as well as because of its implied short-run character, were intended to provide the justification for a socialist state to deviate from these principles and to make location choices which could not be made by private entrepreneurs under capitalism, but which, according to the planners' judgment, would be beneficial to the whole national economy in the long run. If this judgment were correct, it might be true that the economy would grow faster than if it followed the Weberian principle indiscriminately. Furthermore, although the socialist state regards the rapid rate of economic growth of highest priority, it may consider

other objectives, often external to economics, more valuable.³ The change in the economic structure in order to build socialism and, eventually, communism is a supreme goal in the USSR, according to Soviet writers. Therefore, all factors that advance this goal have precedence over purely economic considerations. These factors are the consolidation of the dictatorship of the proletariat, defense considerations, and the shifting of the center of gravity of industry from the west to the east of the USSR.⁴ On the other hand, it is always emphasized by the Soviet leaders that complementarity exists between economic strength and the attainment of political goals. Therefore, the economic factor cannot be completely disregarded.

In order to give the planners a free hand in pursuing the preceding objectives—economic and noneconomic as well—it was necessary to discard the Weberian constraints. The Soviet economists, in their eagerness, discarded Weber's whole theory and did not see that it cannot be accepted in its pure form by any economic system. It was recognized long ago that governmental intervention in respect to industrial location is necessary and beneficial under capitalism as well as under socialism or communism; the zoning problem or defense considerations and, in more recent times, the development of backward regions represent only a few examples of situations in which capitalism has utilized this kind of intervention. Under both systems a compromise must prevail between Weber's purely economic considerations and noneconomic objectives. The difference is only one of degree. Soviet economists seemed to be unaware of this during the period under discussion, however.

Having rejected Weber's theory, Soviet economists had to substitute their own. They realized that such a theory is absolutely necessary in a planned economy in order to guide the planners in their location

3. The famous expression of Lenin has an application here: "Politics must have precedence over economics. To think differently means to forget the alphabet of Marxism."

4. Pishchaev, 1931, pp. 87–88; Balashov, 1932, pp. 112–14; Belov, 1939, p. 54; Gosplan, 1933, pp. 91, 93; Ziman, 1934, pp. 95–96; Kheifets and Ioffe, 1929, pp. 35–36; Pepper, 1932, p. 178; Bogdanchikov, 1940, p. 14; Grigor'ev, 1931, p. 43; Vasyutin, 1937, p. 65.

decisions, matters which would greatly affect the course of economic growth of the whole USSR as well as of its individual regions for many decades. Furthermore, the need for definite criteria in practical solutions was especially urgent in a country of the size of the USSR, where, for each economic activity, many alternatives are available. Some of the origins of Soviet location theory are attributed to the few remarks made by Marx, Engels, and Lenin on the subject.⁵ In addition, the official pronouncements of various congresses of the Communist party of the Soviet Union have served as a basis for its formulation.⁶ Since these pronouncements were meant to be a practical guide for the current economic policy, different aspects of location policy were emphasized in them, depending on the needs of the given stage of economic development. The resulting doctrine, which embraces all these diverse elements, consequently suffers from certain inconsistencies and ambiguities.⁷ Moreover, as might be expected, these characteristics of Soviet location theory and its crudity in general were not conducive to the efficient geographic distribution of industry.

On the basis of these fragmentary contributions of Marx, Engels, Lenin and, directly or indirectly (through party resolutions) of Stalin, and also on the basis of lively debate on this subject in the Soviet economic literature of the late 1920's and 1930's, after World War II Soviet economists formalized these components into a set of location principles that are constantly repeated with insignificant variations.⁸ According to their character, these principles can be classified into

5. See the proposed measure No. 9 in the *Communist Manifesto*; see also Engels, 1959, pp. 403-4, and Lenin, 1955, XXVII, 320-21.

6. See the resolutions of the Tenth Congress (1920) in *Kommunisticheskaia Partia*, 1954, I, 559-60; Twelfth Congress (1923), p. 714; Fourteenth Congress (1925), II, 197; Fifteenth Congress (1927), pp. 452, 463; Sixteenth Congress (1930), III, 45; Seventeenth Congress (1934), p. 216.

7. These inconsistencies and ambiguities led one Polish specialist in this field to remark candidly that current location theory in the USSR is not a completely rounded-out theory but rather a body of fragmentary works based on some theoretical assumptions. See Secomski, 1956, p. 4, n. 1.

8. Livshits, 1954, p. 13; Khanukov, 1956, pp. 97-98; Feigin, 1958, pp. 208-9; Danilov and Mukhin, 1960, pp. 14-21; Kostennikov, 1965, pp. 40-41; Ivanchenko, 1968, pp. 85-86.

three basic groups: (1) purely economic; (2) combined economic, social, and political; and (3) purely political.

(1) In the first group the following principles may be included: (a) Move industrial enterprises closer to sources of raw materials and to consumers in order to reduce freight costs. (b) Plan the geographical distribution of plants in such a way that the individual regions can develop specialized industries that will utilize the available natural resources most efficiently. This will facilitate the territorial division of labor. On the other hand, each region should strive to become economically self-sufficient. (c) Distribute industrial production evenly throughout the country in order to utilize all human and natural resources in all regions. (d) Abolish the contradiction between cities and rural areas, based on the difference between industrial and agricultural production, which will promote an increase in the productivity of labor. The implementation of all these objectives or, more realistically, of some of them, as the case may be, would result in the attainment of the basic economic goal: maximization of industrial output for the entire country essentially over the short run.

(2) The goal of economic development of underdeveloped regions inhabited by non-Russian nationalities, in terms of the equalization of industrial output per capita, comprises social and political elements in addition to the economic. The economic function of this principle is as follows: The mobilization of unemployed and underemployed resources will result in the faster growth of industry in the backward region than for the entire country, on the average. This is equivalent to the extension of the market, and the wider the market, the greater is the opportunity for the division of labor, including the geographical division of labor.⁹ The effect of the increase in the division of labor on the economic growth is obvious.

The equalization of economic development among regions for social purposes is an accepted goal of economic policy everywhere. However, this goal is of particular importance in the USSR, because, as an equalitarian society, it is obliged to assure equal opportunity for a higher standard of living and for social advancement for all its members.¹⁰ Such a goal would be most easily realized if the inhabitants of

9. Rutgaizer, 1968, pp. 24-25.

10. Dziewonski, 1962, p. 45.

all regions had the same opportunity to be employed in industry, as opposed to agriculture. Moreover, this goal has an additional and more important meaning in the USSR. According to the official doctrine, the socialist (and eventually communist) society can come into being only in a highly industrialized society. This means, of course, that the USSR cannot be considered a socialist or communist society until all its territorial subdivisions are developed in this fashion.

The goal under consideration also has an important political implication for the USSR as a multinational state. The Soviet regime inherited from its czarist predecessors considerable political and cultural inequality among different nationalities. As early as 1920 the Tenth Party Congress expressed the belief that these disparities would disappear only after economic inequality had been eliminated, i.e., after all regions had been industrialized and an indigenous working class had been created.¹¹ This objective is very desirable, since its implementation will prove that the treatment of non-Russians under the Soviet regime is the same as that of Russian nationals, in contrast to their notorious persecution under the czarist regime. The value of this objective for propaganda purposes must also be noted.

(3) Finally, the geographic distribution of industry should contribute to the strengthening of the defense capability of the country, a purely political principle.

Soviet location principles, taken one by one, are in most cases self-explanatory, except points (a) and (b), which seem to be internally contradictory. Point (a) — the minimization of transportation costs — must be understood to mean that in view of the divergence between sources of raw materials and consumption centers, the producers' goods industries should be located close to the former while the consumers' goods industries should be located close to the latter.¹² Point (b) — the requirement of self-sufficiency and, at the same time, spe-

11. *Kommunisticheskaia Partia*, 1954, I, 560. For a detailed discussion of this problem, see Holubnychy, 1968, pp. 50ff.

12. Hunter, 1957, pp. 28–29. In recent works “or” is substituted for “and” and the phrase “close to raw materials or consumers,” depending on the branch, conforms to the concept of optimization of industrial location. See Probst, 1962, p. 8 or 16.

cialization for individual regions — is usually interpreted by Soviet authors in the following way.¹³ Because of the climate, the natural resources, and the working habits of the population and also because of economies of scale, each region has an absolute advantage over other regions in the production of a certain commodity or of a group of commodities. The specialization of a region in such a direction is most desirable for the national economy, because it expands the territorial division of labor. At the same time, in order to utilize all available resources and to keep the demand for transportation services low, the structure of production in each region should be diversified. This does not mean that each region should produce everything. Rather, the concept of diversified or complex development is so interpreted that the output of each region should have a three-layer structure; it should possess branches in which it specializes on a nationwide scale, branches which are suppliers of inputs to specialized branches or consumers of output of the latter, and branches which utilize local resources for the production of building materials, food, and other consumer goods for local demand.

As can be seen, the ambiguities of the individual principles of Soviet location theory are more apparent than real when analyzed within the context of Soviet literature on this subject. The same appears to be true in regard to inconsistencies between individual principles. Point (a) and (b) seem to contradict each other because the goal of proximity of enterprises to raw materials' deposits and at the same time the goal of territorially proportional distribution of industry could be achieved only if the deposits of raw materials were also proportionally distributed. This, however, is often not the case.¹⁴ Therefore, a synthesis of these two objectives was proposed at an early stage of the discussion.¹⁵ Those branches in which the cost of production does not vary substantially with the location should be distributed all over the country and in such a way that they will facilitate

13. Kistanov, 1968, pp. 15ff.

14. There was a measure of coincidence, however, between these two postulates in the interwar USSR, because many unopened sources of raw materials and fuels were scattered throughout the country. Such an explanation of this contradiction was proposed by Blyumin, 1935, pp. 52–54; Belov, 1939, pp. 58–59; Granovskii, 1934, p. 51.

15. Preobrazhenskii, 1925, p. 73.

the even distribution of industry. On the other hand, in the case of certain branches of heavy industry, the cost of production will be minimized if they are located close to deposits of raw materials. Obviously, they should be located as postulated by point (a).

The discussion of the other ambiguities of Soviet location theory requires the inclusion of one characteristic of Soviet industrialization which, although not mentioned explicitly in the set of location principles, nevertheless was closely related to them. This characteristic, known as "gigantism," is the tendency to construct industrial establishments predominantly on a large scale.¹⁶ It found its application first of all in heavy industry, but it was by no means limited to it. The Soviet gigantism runs counter to two points of location doctrine, namely, counter to the more proportional distribution of industry throughout the country and to the economizing of transportation.

The requirement of proportional distribution of industry can be interpreted in two ways. On the one hand, proportionality may mean the density of industrial enterprises over the area. Gigantism is by definition contradictory to this interpretation; the construction of predominantly small plants for a given amount of invested capital can better serve this goal. Soviet planners, however, usually assign this function to consumers' industries,¹⁷ and it is interesting that the scale of such plants rose markedly less than that of the heavy-industry plants.¹⁸ On the other hand, territorial proportionality implies for Soviet economists the construction of additional centers of heavy industry in various regions.¹⁹ The implementation of the latter type

16. The reason for this tendency can be summarized as follows: The Marxist ideology with its emphasis on returns to scale, administrative convenience (it is easier to plan with a few units), the peculiarity of Soviet accounting (lack of charges on capital and land), the emulation of American methods of production. See Smolinski, 1962, p. 140. Moreover, it might have been easier to receive investment appropriation for larger than for smaller projects, and, in view of the limited number of managers and skilled personnel, it might have been more rational to use them in a limited number of large plants than to scatter them among a large number of small enterprises. See the comments of Alexander Erlich on Smolinski's paper, *ibid.*, pp. 163-64.

17. State Planning Commission, n.d., pp. 409-10.

18. Smolinski, 1962, p. 138.

19. State Planning Commission, n.d., pp. 401-2; Khomyakov, 1930, p. 10.

of proportionality can indeed be facilitated by the construction of predominantly large-scale enterprises. This is because, according to Soviet economists, only a large-scale enterprise can introduce advanced technology. As a result it is more feasible to utilize raw materials and fuels of inferior quality and to introduce various substitutions among the inputs in large-scale rather than in small-scale establishments. Moreover, a large plant usually produces a number of products, and for this reason utilizes raw materials more fully. It is then profitable for such a plant to transport its inputs over long distances. These factors allow the construction of heavy-industry centers in different regions of the country, without being completely dependent on the location of resources.²⁰

The tendency to construct mainly large-scale enterprises and the requirement of economizing on transportation also seem to be contradictory. Obviously, the larger the enterprise, the larger the area it must serve and the greater is its demand for transportation services. Soviet economists, however, argued that the demand need not rise proportionally with a growth of production from newly built large-scale plants. Central planning under socialism would minimize the total volume of transportation,²¹ and the unit costs of transportation were expected to be even lower than under capitalism because of the increasing returns and the continuous introduction of advanced technology that were thought to be associated with the expanding Soviet economy.²²

The optimism of Soviet economists — that the construction of large-scale enterprises need not require considerable increases in transportation facilities — was by and large justified during the late 1920's and during the first half of the 1930's. The possibility of increasing returns in the late 1920's lay in the fact that the Soviet regime was fortunate in inheriting from its czarist predecessor a railroad network that was built in excess of the requirements of the pre-World War I economy. The increased demand in certain areas of the USSR for transportation services could have indeed resulted in a lower cost

20. Weitz, 1936, p. 358.

21. Bessonov, 1929, p. 41; see also the quotations of other Soviet economists in Hunter, 1957, p. 45.

22. Berezov, 1928, p. 287.

per unit of hauling.²³ There also existed a potentiality for efficiency increases in the Soviet railroad system. It can be seen from the fact that, after the neglect of the railroad system at the expense of the development of industry during this period, the threatening breakdown in the early 1930's was averted by a relatively small investment in key equipment.²⁴ During the second part of the 1930's, however, the limit of the effectiveness of Soviet railroads seems to have been approached.²⁵ Further economic development required either considerable investment in transportation or the reversal of all those practices that resulted in an increased demand for transportation. The main culprit among the latter was obviously gigantism, with the accompanying specialization of individual regions. The alternative was the construction of small- and middle-scale enterprises with a resulting increase in regional self-sufficiency. Because of the approaching war, the investible funds could not have been diverted for the expansion of transportation. The choice of the second alternative was announced by the Eighteenth Party Congress in 1939.²⁶

As can be seen, the inconsistencies and ambiguities in the formulation of Soviet location principles are not so insurmountable as they might seem; the principles become quite logical when analyzed within the framework of the contemporary Soviet literature on this subject. Yet, in practice, not all of them could ever be implemented at the same time.²⁷ One solution of this problem would be to assume that Soviet planners, when faced with a choice between two or more location alternatives, were guided by a certain priority schedule. For example, if, for a given economic activity, two locations were appropriate with the difference that in one the location goal A would be maximized while in another the location goal B would be maximized, then the

23. For example, the railroad connecting Magnitogorsk with Kuznetsk, which was of crucial importance for the development of the Ural-Kuznetsk Combine, was reported to be able to carry an additional million tons of freight in 1928 without any increase in facilities. See *ibid.*, p. 292.

24. Hunter, 1957, p. 77.

25. *Ibid.*, p. 81.

26. *Land of Socialism*, 1939, p. 440.

27. This fact did not escape the attention of some Soviet economists. See, for example, Kheifets and Ioffe, 1929, p. 34.

choice will depend on which goal, A or B, is higher on the planners' priority schedule.

The question may now be asked, which of the three groups of locational objectives was of the highest priority during the period under discussion? Chapter 3 provided a partial answer to this question: the example of Ukrainian industry indicates that in any case the maximization of industrial output for the entire country was not the most important purpose of location policy during this period. It is my contention that the purely political objective, defense considerations, has been of overriding importance, with all others subordinated to it. This contention is in accordance with the consensus among Western students of the USSR that the supreme goal of Soviet leadership in regard to internal and external policy, economics, or any other aspect of human life, is always the retention and expansion of the power of the Communist party of the Soviet Union.²⁸ In view of such a purpose, the efficient location of industry from the point of view of defense capability of the country was of obvious importance before World War II.

On the other hand, the industrialization of backward regions inhabited by non-Russian nationalities was of the lowest priority. The attitude of Soviet leaders toward the last principle is also explicable within the context of their general policy. The rapid economic development, accompanied by equally rapid social and cultural progress, of the non-Russian nations that will bring them to equality with the Russians, on whose support the regime mainly depends, might generate some politically decentralizing tendencies which could challenge the power of the party leaders in Moscow. On the other hand, some progress for these nationalities should be facilitated in order to avoid too crass differences in the development level between them and the Russians, because the resulting dissatisfaction might be no less dangerous to the regime. Finally, the value even of moderate progress of non-Russians for the obvious propaganda purpose cannot be completely discounted.

28. Cf. the contribution of Leon Herman in *Committee of the Judiciary*, 1965, pp. 90-91; Bornstein, 1966, p. 75.

5. SOVIET LOCATION POLICY

It will now be worthwhile to analyze, within the framework of the previously discussed priorities, the implementation of the official location theory in the USSR during the First and Second Five-Year Plans. On this basis, it should become clear why the purely economic rationale was pushed into the background of economic planning and how this affected the differential development of Ukrainian industry in particular. An objection can be raised that no significant changes could have been introduced in the existing location pattern, because the time span was too short. The objection is invalid, however, because the investment in the USSR during this period was at so high a level that it would have permitted substantial regional shifts. In benchmark years, the gross investment in current rubles amounted to 25.0 and 25.9 per cent of the gross national product,¹ while the share in total investment devoted to industry amounted to 41 per cent during the First Five-Year Plan and ranged annually between 42 and 35.5 per cent during the Second Five-Year Plan.² Consequently, as may be recalled,

1. Bergson, 1961, p. 282. In the United States the highest percentage ever achieved was 22.1 per cent in the 1888-98 decade (*ibid.*).

2. Kaplan, 1953, p. 52. Such a high percentage during peacetime in the USSR was approached in the United States only during the war years, 1940-45 (*ibid.*, p. 58).

the gross value of fixed capital in USSR industry during the period under discussion, according to official estimates, increased 5.5 times (according to revised estimates 4.1 times),³ thus permitting considerable implementation of location objectives.

The locational objectives of the highest priority, defense considerations, will be discussed first and will be followed by the analysis of the low-priority objective: the equalization of industrial development among republics. The contention that defense considerations in the Soviet location practice were of the highest priority among all principles can be supported by the following reasoning. Since the Revolution and foreign intervention during the civil war, the idea of a hostile capitalist encirclement of the USSR has permeated the thinking of Soviet economists and, consequently, of official policies.⁴ The necessity of a strong war potential has always been emphasized, and naturally, the planning of economic development as its material base has been greatly influenced by this motive. Among all economic sectors, heavy industry is most important for the defense capacity. The authors of the First Five-Year Plan were explicitly charged in December, 1927, by the Fifteenth Party Congress: "In the preparation of the Five-Year Plan to devote maximum attention to the rapid growth of those branches of the national economy in general and of industry in particular, on which lies the main responsibility for assuring the country's defense and economic strength in the war years."⁵ The authorities never hesitated in executing these policies.⁶ The bulk of investible funds

3. Table 2.2; Powell, 1963, Table IV.12, p. 191. It must be pointed out that official data refer to large-scale industry, while the revised data refer to all industry.

4. For example, during the so-called industrialization debate in the 1920's, all its participants, regardless of differences in all other aspects, were in agreement that in any planning for industrialization defense requirements must be taken into account. This was the reason why all of them insisted that the rate of capital construction had to exceed the level considered as optimal. See Erlich, 1960, p. 51.

5. *Kommunisticheskaia Partia*, 1954, II, 452.

6. Stalin, as the man largely responsible for the preparation and the execution of the pre-World War II five-year plans, expressed the importance of heavy industry in the following way: "The Party [CPSU] remembered Lenin's words that without heavy industry it is impossible to uphold the country's independence, that without it the Soviet regime may perish. Therefore, the Communist Party of our country rejected the usual way of industrialization and began the task of the coun-

in all industry was used for the construction of new plants or for the reconstruction of old plants in heavy industry,⁷ and in both cases a part, which understandably is unknown, was devoted directly to the output of war materials. Enterprises that were working for civilian use were planned, according to Soviet sources, in such a way that in case of emergency they could switch in a short time to the output of munitions.⁸

Of immediate interest, however, is how defense considerations influenced the geographic distribution of heavy-industry plants. According to the point of view that prevailed early in the 1930's, plants making war products or those that could be converted to this use in an emergency were to be located in remote areas of the country in order to be invulnerable to occupation or destruction by aircraft. Also, the plants were to be dispersed in these hinterlands in order not to offer a concentrated target. The territorial distribution of industry in the USSR before 1928 met just the opposite of these requirements. All three important industrial centers in the west — near Moscow, the Leningrad region, and Donbas — were located relatively close to the borders and, in addition, were highly concentrated. On the other hand, they were too far removed from the eastern borders, where there was danger of a Japanese attack during this period. Therefore, in order to correct this situation, the new plants producing munitions and the suppliers of their most important inputs — iron and steel, nonferrous metals, machinery, chemicals, etc. — had to be located in remote areas of the country. Inasmuch as in the USSR remote areas always meant the regions east of the Urals, the new plants were supposed to be located there. Also, the stress on the necessity to construct in these regions plants that were duplicates of those existing in the west⁹ has to be understood from the defense point of view. In

try's industrialization with the development of heavy industry." See Stalin, 1967, pp. 14–15.

7. According to Lokshin, 1956, p. 276, out of 199.5 billion rubles, in current prices, invested in industry between 1929 and 1941, 170 billion rubles, or 85 per cent of the total, went to producers' goods industries.

8. Man'kov and Punanov, 1955, p. 15.

9. *Land of Socialism*, 1939, p. 434.

case there should be a conflict between other locational considerations and defense requirements, the latter were of decisive importance.¹⁰

It now becomes apparent why the shift of the point of gravity of industry from the west toward the east was so attractive to Soviet economists, who saw in the shift a way to implement other locational goals. In fact, some of them saw in this shift the synthesis of the whole location policy. For example:

This requirement [the eastward shift of industry] is not accidental: to conquer new heights in the construction of a communist society, to approach earnestly the elimination of the age-long contradiction between city and village, to liquidate finally the backwardness of regions inhabited by national minorities, and still more to increase the defense capability of our country is impossible without including all regions of the Soviet Union, and in particular its eastern part, in the process of industrial development. The eastward shift is based on the possibility of industrial exploitation of inexhaustible mineral resources which are possessed by the eastern regions. This expresses most strikingly the implementation of the Leninist-Stalinist principle of moving the industry nearer to sources of raw materials and fuels and implementation of proportionality as a basic principle of distribution of economic activity, already proclaimed by Engels.¹¹

This quotation, incidentally, may also serve as a good example of the formulation of locational principles by Soviet economists in such a way that it allowed them to obscure the one principle that actually counted, namely, defense considerations.

However, the view that defense considerations were decisive for the development of the eastern regions has been rejected¹² by some Western economists and belittled by others.¹³ Actually, their argument refers chiefly to the Ural-Kuznetsk Combine, but, in view of its importance, it can be safely assumed that the problems connected with the combine are representative of the problems of industrializa-

10. Quoted by Baritz, 1957, p. 18, from Khromov, Arakelian, Vorobiova' *Ekonomika promyshlennosti*, pp. 168-69.

11. Vasyutin, 1937, p. 65.

12. Clark, 1956, chap. xiii.

13. Hunter, 1957, pp. 48-50; Holzman, 1957, p. 401.

tion in all eastern regions during the period under consideration.¹⁴ Before the views of these writers on the importance of defense considerations in location policy can be analyzed, the effect of this policy on the growth rate of industry in the entire country will be discussed. This latter factor was obviously very important in contemporary economic policy because of the desire of Soviet leaders to make the USSR self-sufficient and to catch up with the Western industrialized nations in the shortest possible time.

It is necessary first to dispose of other possible reasons for location decisions. These decisions could have been made in such a way that would not have facilitated economic growth and would have been, at the same time, inefficient from the point of view of defense capability. Decisions of this kind can be attributed to planners' errors resulting from excessive centralization in such a huge country as the USSR¹⁵ or, it might be added, to the always growing bureaucracy in administering the Soviet economy. Or again, one can argue with Wiles that "The most important of all Communist criteria [for location decisions] by far is local political pull. Plants go to areas where local officials, especially Party officials, are important or unscrupulous."¹⁶ Most probably the locations only of individual plants could be explained in certain cases by planning errors or political influence. This explanation becomes rather implausible in the case of the locations of whole industries or whole industrial centers, because of their importance. These projects required a tremendous investment and would affect the whole national economy significantly for many years to come, and, therefore, it is unthinkable that they could have been undertaken without the careful analysis of pertinent factors, both economic and noneconomic. To be sure, it was not easy to arrive at most efficient decisions in view of such factors as the lack of an integrated location theory, the deficiencies and biases of price struc-

14. The authors of the Second Five-Year Plan foresaw the allocation of investment to the Ural-Kuznetsk Combine as equal to one-fourth of all investment in the national economy and one-third in all heavy industry. See State Planning Commission, n.d., p. 20. Of the other branches of heavy industry that registered substantial development in the eastern areas, specifically in the Kazakh SSR, during this period, only nonferrous metallurgy and chemicals deserve mention. See Gladkov, 1960, pp. 286, 316; Dobb, 1948, pp. 402-3.

15. Holubnychy, 1957, pp. 131-32.

16. Wiles, 1962, p. 152.

ture, the inflexibility of a top-heavy bureaucracy, and the inadequacy of statistical information, to name just a few.

In regard to the effect of the decision primarily to develop the undeveloped eastern regions on the growth rate of the total national economy, it is useful, following the example of Holzman, to make a distinction between the short run and the long run. As the discussion in Chapter 3 has shown, economic growth in the short run could not have been increased through this undertaking. Higher cost of production (if all costs were accounted for), higher transportation requirements, and larger secondary investment than that in the old industrial centers were responsible for this.¹⁷ But according to Holzman, "over the longer run (say more than thirty years) the development of Eastern metallurgy may be somewhat more defensible."¹⁸ The rationality of the long run view may also be questioned on the following grounds, however. It is clear from the previous discussion that capital and labor, which were used for the Ural-Kuznetsk Combine and other projects in the eastern regions, would have been more productive in the short run if they had been diverted to Donbas and other European centers of the USSR, in which conditions for the production of similar commodities existed. Larger increases in output would have been received there at an earlier date, and, if used again for further expansion of western capacities, would have served better through the "compounding effect," the cause of faster growth not only in the short run but also in the long run. The development of western centers should have been pushed until the demand for their output became less urgent and their advantages in the form of higher and earlier returns for a given investment had disappeared as a result of changed scarcity relations between capital and labor.¹⁹ Then, the development of the eastern regions could become more advantageous. This hypothesis, however, has yet to be empirically proved or refuted.

17. Holzman, 1957, pp. 396-400. Still, some economists believe that the movement toward the east was a growth-promoting factor. Cf. Kuznets, 1963, p. 335.

18. Holzman, 1957, p. 401.

19. For the general statement of this proposition, see Dobb, 1955, pp. 138-44; Sen, 1960, chaps. ii and iii. The line of reasoning used in this study follows Alexander Erlich in his comments to Smoliński, in Smolinski, 1962, p. 163, in contrasting the advantages of large-scale to those of small-scale enterprises in the long and short run.

If the development of the eastern regions of the USSR cannot be explained by economic motivation, then the only other possibility is political or military motivation. However, this latter alternative is rejected by Clark, specifically in regard to the most important contemporary project, the Ural-Kuznetsk Combine. The following two reasons led him to this proposition: (1) the literature on this subject does not often mention the military advantages of this project; and (2) with the approaching war, the authorities, instead of developing eastern metallurgy, were further expanding it in the western parts of the USSR, with the result that, starting with 1936, the share of the east in the output of iron and steel was declining.²⁰ In regard to the first argument, it is true that for obvious security reasons there was no detailed discussion of the defense merits of this undertaking and of the entire shift of the whole industry eastward as well. On the other hand, virtually all authors writing on this subject were explicitly stressing the importance of defense considerations in the planning of the geographic distribution of industry. Furthermore, the official pronouncements never omitted mentioning this factor in plans for future development.²¹ Finally, a recent Soviet author, in direct answer to Clark, rejects this proposition and states: "The Soviet state, in determining the distribution of investment by regions and in expanding the production of steel, coal, and machinery in the eastern regions naturally was taking into account the interest of strengthening the defense capability of the country."²²

Another reason for Clark's argument, namely, the decline of the eastern share in the total output of iron and steel of the USSR as the war approached, can be explained in the following way. In order to create an industrial complex devoted to the output of armaments, it was necessary to develop industries producing such important inputs as iron, steel, nonferrous metals, intermediate chemicals, and others, as well as those industries which utilize these inputs in the production

20. Clark, 1956, p. 232.

21. E.g., Gosplan, 1930, p. 190.

22. Vorob'ev, 1965, pp. 104-5. Vorob'ev, however, probably inadvertently, confuses the views of Clark, and of Schwartz, 1958, p. 222, and ascribes to Clark those of Schwartz, that location decisions were motivated by defense considerations. In turn, Schwartz is made responsible for Clark's views.

of actual military equipment, for example, machine building, precision instruments, chemical, and similar industries. Soviet leaders succeeded in the implementation of the first part of this program during the period under investigation: they created in the east a strong metallurgical industry—the Ural-Kuznetsk Combine, to name just one such enterprise—and also some other industries, primarily those producing raw materials and fuels. However, they failed to develop the machine-building and other final-product industries in the new centers of the east. The latter industries continued to grow in clusters in the traditional centers around Moscow and Leningrad.²³ There can be little doubt that, given sufficient time, the Soviet leaders would have also constructed final-goods industries in the eastern regions. Being comprehensively developed, these regions would have become a strong basis for the defense of the USSR.

This one-sided development of the eastern regions, which began with the 1930 decision to construct the Ural-Kuznetsk Combine, suggests the following inference. Despite the fact that in this year the Soviet leadership could not envisage a new war in the foreseeable future, its determination to locate industry in the eastern regions was nevertheless based on military considerations. The expansion of the iron-and-steel industry in these areas can be understood to represent the first step in the creation of a defense base in the regions beyond the Urals, the regions considered to be safe from the point of view of contemporary warfare. Obviously, it can be assumed with certainty that this beginning was to be concluded, in due course, with the development of final-goods industries, including armaments industries, of course. Such an approach toward location policy was of a rather long-run character and was justified by the absence of imminent threat to the security of the Soviet regime in these years. Only the

23. Gladkov, 1960, pp. 299–300, referring to these developments during the Second Five-Year Plan, states: “Moscow and Leningrad oblasts remained the basic centers of machine building and, because of favorable conditions for co-operation and the availability of highly skilled labor, became specialized in precise and complex machine building.” According to Granick, 1961, pp. 124–25, this also could have been the result of hidden resistance by Moscow-or Leningrad-based managers to their being relocated in the primitive regions of the eastern USSR.

seizure of power by Hitler in Germany in 1933 created a real danger for the USSR.²⁴

With the realization at this point that the war was unavoidable in the immediate future, the Soviet leaders faced a dilemma. They could have continued to expand eastern metallurgy and simultaneously could have tried to rapidly develop the machine-building and instrument industries nearby. If this alternative had been chosen, the delivery of armaments could not have been expected soon. But the Soviet leaders chose another alternative, one that was rightly expected to be more effective in the short run, i.e., in the period that was estimated to be left before the outbreak of the war. They de-emphasized the further development of eastern metallurgy in order to concentrate on the expansion of the established iron-and-steel centers in the western regions of the USSR.²⁵ At the same time, they rapidly expanded the munitions industries in the western USSR,²⁶ primarily those located in Leningrad, Moscow, and the lower and middle Volga regions. The obvious locational disadvantages of this choice from the military point of view were overcompensated by the following advantages: (1) the output of iron and steel could be expanded more and faster for the same investment in Donbas, for example, than in the east;²⁷ (2) the distance from machine-building plants in the west was shorter to the western metallurgical plants than to those in the east, which kept the requirements on the overburdened railroads low; (3) the productivity of both industries was greater as a result of well-established cooperation between their plants located in the west; and (4)

24. Erlich, 1960, p. 168. The immediate danger to Soviet security had already arisen in 1931, with the Japanese occupation of Manchuria. It seems, however, that the Soviet government played down the importance of these developments and by the summer of 1932 the tension receded until it appeared again in 1938. See Beloff, 1947, chap. vi.

25. As Clark points out, the share of eastern metallurgy in the total output of this industry began to decline with the year 1936. Taking into account the time necessary for the construction of blast and open-hearth furnaces, it becomes evident that the decision to decrease the share of investment allocated to eastern metallurgy must have been made not long after Hitler's access to power.

26. Clark, 1956, pp. 233-34.

27. As is shown in Chapter 7, even without considering secondary investment requirements, capital-output ratio in the iron and steel industry was slightly lower in the Ukraine than in the USSR.

most important, the delivery of armaments could be expected much sooner than if concentration on the development of the east were continued. If these alternatives had been recognized and the latter had been chosen a few years earlier, the USSR would probably have been better prepared to resist the invasion, at least as far as armaments were concerned.

To sum up the previous discussion, it seems that the improvement of military preparedness was consistently of highest priority among all locational principles. But the approach toward its implementation changed during the period under investigation: the long-term development of a safe defense base east of the Urals, primarily at the cost of the further growth of Ukrainian heavy industry, was superseded after 1933 by the emphasis on the highest possible output in the shortest time. The latter objective could be achieved only through the further expansion of traditional industrial centers, disregarding their relative proximity to western borders. The primary beneficiaries of this policy reversal were the relatively small iron-and-steel industry and the final-products branches located in the central regions of the Russian SFSR. Obviously, among the latter, the largest expansion was experienced by those working for defense. The Ukraine gained only insofar as its share in the fixed capital of the iron-and-steel industry of the USSR increased between 1932 and 1937.²⁸ Since the Ukraine's new plants did not yet perform satisfactorily, its share in the total output of the main products of this branch continued to decline during this period.

The view that location decisions were dominated by defense considerations in the USSR had already been expressed earlier by some Western students of the Soviet economy. For example, this conclusion was reached by the well-known authority on location economics, Andreas Predoehl.²⁹ After having completed a tour of the USSR at the end of the First Five-Year Plan, Predoehl reported

28. The Ukrainian share of fixed capital of the USSR iron and steel industry was 60.5 on October 1, 1928; 45.9 on January 1, 1933; and 50.6 on January 1, 1938. See Khromov, 1945, pp. 35, 37; Kaplan, 1951, Appendix Table II. The increase in the Ukrainian share during the Second Five-Year Plan was the result of putting into operation three large steel mills, the construction of which started during the First-Five-Year Plan.

29. Predoehl, 1932, pp. 466-67.

that the locations of new investment projects, notably of the Ural-Kuznetsk Combine, could not be justified by economic but only by political factors.³⁰ He also noted that although the latter were undoubtedly decisive, in their discussion Soviet economists insisted that the locations of these projects were economically most efficient. Predoehl believed that, from an economic point of view, only the further expansion of Donbas industry would be rational, because of the existing geographic distribution of population, transportation availability, etc. The extent of the development of new industrial centers in the Urals and in western Siberia should be determined by the local demand. Also, such an experienced observer of the Soviet economy as Harry Schwartz noted that noneconomic factors, such as defense considerations and the need to industrialize backward regions, often have overruled cost considerations in location decisions.³¹

Finally, the following quotation of such an eminent student of Soviet economy from its very beginnings as the late Vladimir Timoshenko illustrates not only this approach toward location policy in the USSR, but also the credulity of some of its observers abroad: "They [projects of agricultural development] may be quite reasonable from a strategic point of view . . . but attempts are frequently made to present these developments as reasonable from an economic point of view in peacetime and are often accepted abroad as such. Yet the great distances in the Soviet Union and the location of industry in inaccessible areas of the Asiatic continent, while assets from a strategic point of view, are mainly costly liabilities from an economic point of view."³² The agricultural projects that Timoshenko had in mind were actually a part of the Third Five-Year Plan. Nevertheless, this statement may be representative of the Soviet attitude for the earlier period, because similar projects were undertaken as early as the period of the First and Second Five-Year Plans.

Just as the defense consideration can be considered of the highest priority among locational principles, so the elimination of inequality

30. He calls this situation *Politisierung der Standorte*.

31. Schwartz, 1958, p. 222. As will be shown below, however, I disagree with Schwartz that the industrialization of backward regions, primarily of those inhabited by non-Russians, was also of top priority in the Soviet location policy.

32. Timoshenko, 1953, p. 247.

among republics or the elimination of the backwardness of territories inhabited by non-Russian nationalities can be considered of the lowest priority. Some results of the implementation or the lack of results because of the failure of implementation of the latter principle of Soviet location theory during the period under discussion are presented in Table 5.1 (see pages 76–77). Although the indicators are incomplete, they nevertheless seem to give a sufficiently clear picture of the differential development of prewar union republics.

As can be seen, only in the Russian SFSR and the Azerbaidzhan SSR the industrial investment shares were higher than the population shares. The Russian republic possessed the fastest growing regions in the country, e.g., the eastern regions as well as the old industrial regions in the west, while the favorable position of Azerbaidzhan was due to the fact that at that time its oil production had to satisfy the needs of the entire USSR. The investment shares also were slightly higher than the population shares in the case of the Ukraine, although they showed a declining tendency between the First and Second Five-Year Plans. This, of course, reflects the decision of Soviet leaders to shift the center of gravity of Soviet heavy industry eastward. For the remaining republics, the investment shares were below their population shares during both periods. In regard to the industrial employment per thousand population, these republics showed some improvement between 1926 and 1939, as shown in Columns (5) and (6). Still, they remained far below the average for the USSR.³³ As far as industrial output per capita is concerned, however, the Russian SFSR improved its above-average position even more, while the position of non-Russian republics, except for a very slight improvement in the Ukraine and Belorussia, uniformly deteriorated between 1926/27 and 1939. For some of them this indicator was very low indeed. For example, the industrial output per capita in Kirgizia was less than one-fifth and in Kazakhstan less than one-third of the USSR average after more than ten years of intensive industrialization.

In order to achieve the same level of industrialization, it was necessary for the non-Russian regions to grow at a much faster rate

33. It should be pointed out that the increase in industrial employment in the non-Russian republics proceeded also at the cost of migration from Russia proper.

than Russia proper. However, the rapid growth of a region was possible only if this region was specialized in the output of commodities for which the national demand was particularly strong.³⁴ During the period under discussion, of course, the development of heavy industry was strongly emphasized, and since favorable conditions did not exist for its development in the republics inhabited by non-Russian nationalities, except the Ukraine, they consequently received only a negligible share of the total investment in industry. This was the actual cause of their lack of economic progress—not just the excesses under Stalin's rule, on which an attempt was being made to put the whole blame.³⁵ An analysis of the situation led the late Academician Lyashchenko to observe: "During the period of socialist construction under discussion, covering the Second and part of the Third Five-Year Plans (1932–40), many national republics were still far from achieving an equal and sufficiently high level of development of their productive forces."³⁶ The failure of the non-Russian republics not only to catch up with the Russian republic but even to improve their relative position would suggest that except for lip service, very little, if any, attention was paid to this locational objective and that, by Soviet definition, the political and cultural equality of all nations in the USSR was not seriously approached before World War II.

While claiming, if even in theory only, the need to industrialize the backward regions, Soviet economists exclude the Ukraine from this category. This is, however, a considerable oversimplification. It is true that by any indicator the Ukraine was on the average much more industrially advanced than any other non-Russian republic. This fact was due to the development of heavy industry in two regions only—Donbas and lower Dnieper—because of rich mineral resources, favorably located in relation to each other. The following figures illustrate the disparity in development among the regions of the

34. Pepper, 1932, p. 187; Probst, 1962, p. 138.

35. "Additional obstacles for the economic development of [non-Russian] republics resulted from consequences of the cult of personality under Stalin — rude breaches of legality, restriction of the rights of republics in the administering economy, with the freezing of local initiative." See Gladkov, 1960, p. 320.

36. Lyashchenko, 1956, p. 73.

TABLE 5.1. Population, Investment, Employment, and Output of Industry by Union Republics of the USSR for Selected Years (per cent)

Union Republic	Population		Investment in Industry		Number of Industrial Workers per 1000 of Population		Output of Industry (1926/27 rubles) per capita	
	Dec. 17, 1926	Jan. 17, 1939	First Five-Year Plan	Second Five-Year Plan	1926	1939	1926/27	1939
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
USSR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Russian SFSR	63.5	64.0	69.2	69.1	n.a.	n.a.	111.0	114.8
Ukrainian SSR	19.8	18.1	20.6	18.5	114.9	101.1	96.7	97.6
Belorussian SSR	3.4	3.3	0.8	0.8	34.2	77.5	50.5	57.6
Georgian SSR	1.8	2.1	1.5	1.6	65.2		129.7	
Azerbaidzhan SSR	1.6	1.9	3.1	4.0				
Armenian SSR	0.6	0.8	0.5	0.6	10.6		34.1	
Kazakh SSR	4.1	3.6	2.7	3.0				
Uzbek SSR	3.1	3.7	1.0	1.6	14.9		42.9	
Tadzhik SSR	0.7	0.9	0.3	0.3				
Turkmen SSR	0.7	0.7	0.2	0.3	14.9	47.4	56.0	44.0
Kirgiz SSR	0.7	0.9	0.1	0.2	5.0	33.5	30.8	17.2

SOURCES TO TABLE 5.1

Columns (1) and (2) calculated on the basis of absolute data in TsUNKhU, 1939, pp. 8-9.

Columns (3) and (4) calculated on the basis of absolute data in TsSU, 1961a, p. 110.

Columns (5) and (6) from Vorob'ev, 1965, p. 139.

Columns (7) and (8): The estimates were derived in the following way: Vorob'ev, 1965, p. 140, gives the absolute figures for the output of small-scale industry and the share of large-scale industry in the total industry. On the basis of these figures the absolute figures for the total industry were calculated. The data for Kazakh SSR in Column (7) are for the year 1928. Vorob'ev gives the output data for the USSR and nine republics only. For some of them (for three Transcaucasian and also for Uzbek and Tadzhik republics) the data are combined. The data for the remaining two republics, Russia and Kirgiz, are not given at all. Since their combined output is equal to the difference between the total and the sum of nine listed republics, this balance was split between these two republics according to the ratio of their outputs in 1932 and 1937, Russian SFSR, 99.7 and 99.8 and Kirgiz, 0.3 and 0.2 per cent, respectively, as given in Gosplan, 1939, p. 115. Relating the figures thus obtained to the population in 1926 and 1939 gives the output of industry per capita by republics. On this basis the percentages (USSR = 100) in Columns (7) and (8) were calculated.

Ukraine. For example, in 1938, after ten years of emphasis on industrialization, out of fifteen contemporary Ukrainian *oblasts* (including Moldavian ASSR), two Donbas *oblasts*, Donets'k (then called Stalino) and Voroshylovhrad, and the adjoining Dnipropetrovs'k *oblast* accounted for 46 per cent of all workers employed in large-scale industry, 37 per cent of gross output, and 56 per cent of fixed capital. If two main cities, Kiev and Kharkov, are added, then these percentages are raised to 57, 59, and 66, respectively.³⁷ The bulk of the country, being only touched by industrialization, comparable in this respect to other non-Russian republics and having appropriate conditions, deserved much greater investment than actually was the case.

Similar reasoning applies to the analysis of the development of the Russian SFSR. In this republic, by far the largest in all respects among the republics of the USSR, live, in addition to Russians, various other nationalities which, according to the 1959 census, accounted for 17 per cent of the republic's total population.³⁸ Many of these nationalities live on their own ethnic territories and are quite numerous, for example, twenty-three numbered 100,000 and over.³⁹ The data indicating the differential industrial development of individual regions of the Russian republic are unavailable for the

37. Khromov, 1945, p. 73.

38. TsSU, 1961, p. 17.

39. *Ibid.*

period under discussion. Still, the following very general inference can be made on the basis of the pertinent Soviet literature. Two regions were experiencing particularly rapid growth during the period discussed: in the Urals and western Siberia many extractive and primary processing branches were developing quickly, while in the traditional industrial regions near Moscow and Leningrad and on the upper and middle Volga the existing processing industry was expanding. Since these regions were inhabited by Russians, the average indicators per capita for the whole republic would certainly tend to underestimate slightly the industrial development of Russian territories and overestimate heavily the development of non-Russian areas. The lack of additional data prevents a more detailed analysis of these disparities.

The lack of progress in the industrialization of the non-Russian nationalities, organized either in their own republics or within the Russian republic, and the above-average development of Russia proper, prompted some writers to argue that still another factor was of great importance for locational decisions. This factor, which obviously remained unmentioned among locational principles, was the colonial relationship between Russia proper and its non-Russian peripheries, similar to that which existed before the Revolution in the czarist empire.⁴⁰ According to this line of thinking, this colonialism finds its expression mainly through the withdrawal of accumulated funds from some non-Russian republics and their investment in Russian areas, despite the often lower productivity in the latter. The result of such a policy is a loss to the given republic and a gain to the Russian republic, but since the gain is smaller than the loss, the USSR as a whole loses in purely economic terms.

It is true that there were and are transfers of funds in the USSR, as in many other countries, from one to another region. For example, according to one study, during the First Five-Year Plan alone approximately five billion rubles, or almost 30 per cent of all revenue collected in the Ukraine, have been withdrawn by the central government,⁴¹ obviously without asking the consent of the population and

40. For the general discussion of this problem, see, for example, Committee of the Judiciary, 1965; Holubnychy, 1968, pp. 55-57, 76-86.

41. Melnyk, 1965, p. 90.

without compensation, and spent in other regions of the USSR, mainly in the form of investment in industry. Furthermore, as it is hoped the present study proves, it is also true that capital was on the average significantly more productive in the Ukraine than in the USSR. However, both phenomena are not sufficient to prove the existence of Russian colonialism in terms of the development of Russian ethnic areas at the cost of non-Russian republics.

As was stated earlier, most Western scholars agree that by far the overriding objective of Soviet policy, including economic policy, is to assure and expand the power of the Communist party. Thus, an industrial base, safely located in the hinterlands of the country, is an integral aspect of this objective. If this is so, then it is just a geopolitical incident that in the USSR natural conditions, coinciding with strategic considerations, were most favorable in the Russian SFSR. As a result, various defense-oriented industrial projects, notably the Ural-Kuznetsk Combine, were constructed in the 1930's. There should be not the slightest doubt, however, that given such conditions in non-Russian instead of Russian areas, the Soviet leaders would have proceeded with the industrialization of the former with no lesser determination.

What remained to be done in such a case was only to assure that the developed areas would serve faithfully the goals of the central government in Moscow. This could be easily achieved by injecting the native population with a sufficient number of Russian nationals, not only because of the industrial skills of the latter (which, to be sure, were lacking there), but primarily because of the presumably greater loyalty of Russians to the regime. Having entrusted the management of industry and administration in general to the hands of its supporters, the central government remained indifferent concerning by whom these areas were originally inhabited, as long as they were safely located from the strategic point of view. Precisely because of this, industrialization is of a very dubious value to the non-Russians inhabiting their republics.⁴² Kazakh SSR can serve as an excellent example of the implementation of such a policy. Because of its location and the availability of mineral resources important for

42. Cf. Wiles, 1962, p. 152.

defense, Kazakhstan showed the second highest rate of growth among all pre-World War II republics during the Soviet rule. But in the course of this development the Kazakhs became a minority in their own republic. According to the 1959 census, they accounted for 30 per cent of the republic's total population, while the Russians accounted for 42.7 per cent.⁴³ In summary, the primary purpose of locational policy is to strengthen the regime. Since it is dominated by Russians, thus, indirectly, this policy strengthens their power. Only in this broader sense, it seems, can one speak of the economic exploitation of non-Russians by Russians in the USSR during the period discussed.

43. TsSU, 1961, p. 18. The inflow of Russians is particularly strong to the capitals of national republics because of the industrialization of these cities and because the administration that is concentrated there is in their hands. See Brackett and DePauw, 1966, p. 634.

6. SUMMARY AND CONCLUSIONS

On the basis of the previous discussion an evaluation of Soviet location policy, particularly in regard to the Ukraine, can now be undertaken. As was shown at the beginning, the Ukrainian share in the industrial investment of the USSR declined slightly between the First and Second Five-Year Plans. This fact, however, did not cause the decrease in the Ukraine's share in the industrial fixed capital of the USSR at the end of the period under discussion, primarily because of the higher efficiency of construction and the more advanced economic development of the former than the average for the whole country. Also, the time lag between the investment and the introduction of new plants into operation during the second half of the period discussed accounts partly for this phenomenon, especially in view of the expansion of the armament program outside the Ukraine. There were, however, differences in the behavior of individual branches of industry. The sharpest decline in the importance of the Ukraine in the USSR can be observed in some extractive and intermediate goods branches. These decreases were compensated for by slight increases of the Ukraine in the majority of the remaining industrial branches.

The analysis of changes in fixed capital by industrial branches

of industry in the Ukraine relative to the USSR indicates that two almost equally important tendencies were at work. On the one hand, locations for new projects in other parts of the USSR than the Ukraine were preferred by the planners; and, on the other hand, the specialization of the Ukraine in high-priority branches was influencing the distribution of investment in its favor. On balance, the Ukrainian share in the fixed capital of all industry in the USSR remained unchanged. This investigation shows that the policy favoring the locations of new enterprises in other regions of the USSR rather than the Ukraine was on the average for the whole industry not justified on purely economic grounds, because the same increase in fixed capital resulted in considerably greater increases in output in the Ukraine than in the USSR. If the purpose of Soviet planners was the maximization of output, the share of the Ukraine in the total investment of USSR industry should have been significantly higher.

The purpose of investment policy in the USSR, however, is not to maximize over-all output but to maximize the output of the structure determined by the planners. Given this constraint, the allocated funds for the expansion of any one branch should be used most efficiently. In regard to their geographical distribution, these funds should be directed to that region in which the output increase will be the highest. If that were so, then there should be a correlation between the advantages of the Ukraine over the USSR in terms of ICOR and the relative increases in fixed capital for individual branches. Table 6.1 lists the relevant variables. In the first column are shown the Ukrainian ICORs as a percentage of the ICORs of the USSR for the branches discussed. The second column presents the ratios of relative increases in fixed capital between the Ukraine and the USSR,¹ with the numbers in parentheses indicating the ranking order. As can be seen, there is a great divergence between the order of ranking of these two columns. The calculation of the coefficient of correlation fails to reveal any correlation between these variables.² On this basis, one can conclude that economic considerations were also not a deciding factor in the

1. The smaller the percentage in the first column in this table, the greater was the advantage of the Ukraine over the USSR; and the larger the ratio in the second column, the larger was the relative increase in fixed capital in the former.

2. r^2 being equal to 0.083.

distribution of investment between the Ukraine and the USSR when the industrial branches are analyzed separately.

TABLE 6.1. Incremental Capital-Output Ratios and Increases in Fixed Capital of the Ukraine Relative to the USSR by Industrial Branches Between 1928 and 1937

Branches of Industry	Ukrainian ICOR as Percentage of USSR ICOR	Ratio of Increase In Ukrainian Fixed Capital to USSR Increase
Peat	27.9 (1)	1.59 (2)
Chemical	47.4 (2)	0.83 (9)
Paper	53.0 (3)	0.37 (15)
Food other than sugar	54.8 (4)	0.68 (12)
Glass, china, and pottery	61.2 (5)	1.11 (5)
Iron ore	63.2 (6)	0.56 (13)
Electric power	75.6 (7)	1.27 (3)
Coal	85.1 (8)	0.53 (14)
Leather, fur, boot and shoe	85.1 (9)	0.76 (11)
Sugar	90.5 (10)	0.85 (7)
Metalworking and machine building	93.7 (11)	1.07 (6)
Apparel	95.5 (12)	0.77 (10)
Iron and steel	97.3 (13)	0.84 (8)
Textile	116.8 (14)	3.32 (1)
Woodworking	163.4 (15)	1.17 (4)

Sources: Tables 2.2 and 3.1.

The explanation of this behavior by the planners has to be sought in Soviet location theory, which subordinates purely economic considerations to a political objective of such overriding importance as the consolidation and expansion of the power of the Communist party of the USSR. This obviously means that enterprises producing

goods, both final and intermediate, of importance for the country's defense have to be located in strategically safe regions even if production costs there are higher than in other regions. Largely within the framework of this priority can we understand the shift of the center of gravity of industry from the west of the USSR, notably from the Ukraine, toward the Urals and some other underdeveloped areas in the Asiatic part of the country during the prewar period. As a result, the national economy of the USSR had to forego a substantial amount of goods which could have been produced at the same cost if the location policy had been based on economic considerations. A rough calculation shows that a transfer of 1 per cent of the total industrial investment from other regions of the USSR to the Ukraine during this period would have caused the increase in output of the USSR as a whole to be by approximately 0.4 to 0.6 per cent larger.³

Yet, having decided to develop a defense base in the eastern regions, because of their favorable strategical location, efficiency would have required the planners to expand all stages of production there, from extractive through intermediate to final-goods branches. Locating these enterprises close to each other would minimize transportation costs and facilitate cooperation among them in such a way as to assure the most efficient utilization of resources, even withstanding the over-all economically faulty decision. Actually, some progress was made in the case of the coal, iron ore, iron-and-steel, and food-processing industries, the industries in which, according to Table 6.1, the Ukraine had a significant advantage over the USSR in terms of the ICOR. Nevertheless, the growth of these industries in the east would have been more defensible if the final-goods industries had been expanded there also, because the advantage of the Ukraine in this case was, if at all, only slight. However, the latter were rapidly growing in the traditional centers of the European parts of the Russian SFSR. To be sure, this tendency was not only the fault of the planners, but it was also a product of strong economic forces: economies of scale are very important in extractive and certain primary processing

3. This calculation is based on data in Table 2.1, and pp. 32-33, and is made under the assumption that the ratio between the increase in fixed capital and investment and the ICOR for the Ukraine and for the USSR outside the Ukraine, as derived on the basis of these data, remains unchanged in the event of such transfer.

industries, while the pressure of external economies draws the new final-goods plants toward existing centers. As a result, a breach was created between the east and the west of the country, both specializing in different but complementary industrial branches, with the obvious negative effect on transportation and the efficiency of resources in general.

This approach—developing in the eastern regions first primary and intermediate-goods industries on a large scale to be most probably followed in the future by an equally large-scale development of final goods industries—might have provided in some distant future a safe defense base, assuming that the strategic concepts of warfare would remain unchanged, and also might or might not have maximized the growth rate in the long run. From a more immediate point of view, however, this policy failed on both counts. As was shown above, it prevented industry from attaining maximum growth, and, in regard to defense considerations, its shortcoming was implicitly admitted when, in view of the imminent danger of war in the second half of the 1930's, the development of industry in the European part of the USSR was again stressed.

With the benefit of hindsight, one can argue that the most efficient means of satisfying both objectives was definitely to proceed with the opening up of the eastern regions in the early part of this decade, but on a much more limited scale and in a much more balanced fashion. In other words, the smaller than actual development of extractive and primary industries should have been accompanied by the corresponding development of the processing industries as well as of agricultural base, urbanization, transportation, etc. The purpose of this entire undertaking should have been production for the satisfaction of local demand and also for the modest contribution to the national armament effort. Thus a comprehensively developed base, although smaller than planned in reality, could have become the producer of any armaments sooner and, in the event of a national emergency, if other bases were endangered, it could have expanded more easily into the backbone of the war effort. In the meantime, the bulk of investible funds should have been allocated to the western regions of the USSR, where, as a result of the higher productivity of capital, the output of military as well as civilian goods would have

grown at a faster rate and would have strengthened the country's defenses and increased the standard of living.

The experience of the USSR in regional development during the prewar period can serve as a lesson for some other developing countries, regardless of their economic systems. In many of them, particularly the larger countries, such as China, India, and Brazil, just to mention a few, there is one or a few regions that are more advanced than the rest of the country. Possibly there are also some undeveloped and sparsely populated regions that are endowed with rich mineral resources. If such a country decides to undertake a determined effort to modernize its economy, it faces a problem similar to that of the USSR, i.e., whether to allocate investible funds to an already developed region for its further expansion or to use these funds primarily for starting industry in the backward regions. Assuming that no country, perhaps with the exception of China, must consider defense needs with the intensity with which the USSR was required to, the lesson is clear. Because of various factors existing in the developed regions, as described in this study on the example of the Ukraine, which outweigh some advantageous natural conditions in the undeveloped regions, capital is definitely more productive in the former than in the latter. Since capital is, as a rule, a limiting factor in the initial stages of industrialization, its bulk should be allocated to the better developed regions. Such a policy will insure the maximization of output for the entire country in the foreseeable future.

Finally, attention should be turned to an analysis of the effects of Soviet investment policy during the prewar period on the efficiency of Ukrainian industry. The USSR inherited this industry already specialized in some heavy-industry branches, based on the mineral wealth of Donbas and the Dnieper region, and in the food industry, processing the products of rich agriculture. Almost completely undeveloped was light industry, especially, its textile branch. As a result of contemporary investment policy, some branches of the heavy industry in which the Ukraine was already well developed expanded rapidly, while there was very little progress in light industry. Thus the imbalance between producer-and-consumer goods branches widened further. This imbalance had a negative effect on transportation because various intermediate goods were exported from the

Ukraine to Russia proper only to be later transported in the form of final products back to the Ukraine. Needless to say, these imports, primarily of light industry, were often inadequate to provide sufficient incentives for labor.

The imbalance existed not only between producer-goods and consumer-goods branches but also between individual branches of heavy industry. In general, final-goods branches were less important in the structure of Ukrainian industry than the branches supplying them with inputs. This was particularly true in the case of machine building, which, in addition to being less developed than its iron-steel base, also specialized in only a few metal-intensive branches. But going even further, there existed an imbalance within the iron-and-steel industry. The branches requiring less processing were developed relatively faster than the branches requiring more processing. In all these cases, the inputs that were not entirely utilized in the Ukraine were exported for further processing to other regions of the USSR.

To sum up, the effect of contemporary investment policy on the development of Ukrainian industry was not as great as possible. The Ukraine did not receive adequate investment in relation to its industrial potential, despite the fact that capital productivity was higher there than in other regions of the USSR. As a result, the USSR as a whole failed both to maximize the growth rate and to attain a sufficient level of military preparedness. The allocated investment was distributed among individual branches of Ukrainian industry in such a way that the imbalance among them continued to exist and the Ukraine remained a supplier of various inputs to other regions of the USSR, with a resulting negative effect on the overburdened transportation and the efficiency of industry in general.

PART II

**LOCATION PROBLEMS
OF SPECIFIC INDUSTRIES**

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7. THE IRON-AND-STEEL INDUSTRY

The iron-and-steel industry has always been considered by Soviet leaders and economists as one of the high-priority branches.¹ It must serve as a basis for the development of the most-favored branch, namely, machine building and thus be the backbone of the country's defense capability. Its importance for the economic growth of the whole country and of the individual regions as well was also recognized early.² The iron-and-steel industry played and still plays a very important role in the Ukrainian economy. During the period under discussion, significant changes in the geographical distribution of this industry in the USSR took place. They affected not only the

1. In the Soviet literature the definition of the iron-and-steel industry (ferrous metallurgy) is often ambiguous. In most cases it consists of the pig-iron, steel, and rolled-steel branches, but sometimes the coke industry and the mining of iron and manganese ores are also included. In this study the first definition is used if not otherwise stated.

2. The significance of the iron-and-steel industry for economic development is explained by the fact that it has the highest number of linkages (how many industries it buys from and how many industries it sells to) of all industries. Hence, its development stimulates the development of its many suppliers and consumers and through them the national economy as a whole. See Hirschman, 1958, p. 106.

entire industry of the Ukraine but also of the USSR as well. Therefore, the theory which governs the locational choice of this industry in the USSR deserves careful consideration.

It is necessary to state at the outset that Soviet economists, in discussing the location problems of the iron-and-steel industry as well as of other industrial branches, consider only purely economic factors. In other words, such a location should be always chosen where the combined costs of production and transportation are lowest. Noneconomic considerations, as was seen earlier, are included in the discussion of location problems of the whole industry.

In order to determine the least-cost location of iron-and-steel plants, the following three factors should be taken into account: the location and quality of mineral resources, technology, and the location of the consumers of the products of this industry.³ The location of mineral resources, which include iron ore, coal, manganese ore, limestone, refractories in the form of bricks, and water,⁴ are the most important of the three.⁵ Since the production of one ton of pig iron requires between four and eight tons of two main inputs, iron ore and coal, depending on the level of technology, it is self-evident that, in order to minimize transportation costs, the plant should be located close to the deposits of these inputs.⁶ If the deposits of both minerals are close to each other, then the situation does not require any further analysis. If the location of one resource is removed from the location of another, the location of the plant will depend on the technology employed, which determines the proportion between these two resources used in the metallurgical process. The remaining materials are available all over the country and thus need not be considered. In unusual cases an acute lack of water or a severe climate may preclude any development of this industry in a particular region. In more recent times the availability of iron scrap has played an increasingly important role in determining plant location.

3. Feigin, 1960, p. 175. Like their Western counterparts (cf. Isard, 1960, p. 235), Soviet economists recommend analysis of only those factors that vary regionally.

4. Clark, 1956, chap. vii.

5. The cost of mineral resources accounts for about 70 per cent of the total cost in this industry. See TsSU, 1961, p. 240.

6. Livshits, 1958, p. 27.

The available resources of coal and iron ore must be sufficient to supply the planned plant during its whole expected life.⁷ These resources must be of a certain chemical quality; i.e., the coal must be suitable for the coking process, and the iron ore, in spite of great progress in the technology of refining, must contain a certain minimum of iron. Also, their geological location greatly influences the cost of mining and hence the cost of final products. The thickness and angle of deposits, their depth, the presence of water, gas, etc., are of importance here.⁸

The nature of technology greatly influences the location of the iron-and-steel industry, according to Soviet economists. Large-scale production involves considerable economies. Integrated production, i.e., production in all stages from raw materials to finished goods, is usually cheaper than if it is done in separate plants.⁹ The construction of an iron-and-steel plant is accompanied by the development of complementary industries, either working on the same raw materials or supplying the intermediate products. Among the complementary industries the most important are the chemical industry based on the coking process, and metal-intensive machine building.¹⁰ Therefore, planning the location of the iron-and-steel industry should be done for the whole project (*kombinat*).¹¹ Finally, the great concentration of population that accompanies the construction of such a combine requires the development of housing, municipal services, food and consumer industries, some agriculture, transportation, etc. On the other hand, dependents of metallurgical workers enter the local labor

7. The average life expectancy of a steel-producing plant in the USSR is assumed to be forty years. See Feigin, 1960, p. 174.

8. Livshits, 1958, p. 88.

9. The savings realized through the output of all three basic metals in the same plant are the result of more efficient use of raw materials, labor, management, and transportation, and they may run as high as 20 to 40 per cent in comparison with the output in separate plants. In 1936, 78.7 per cent of the pig iron, 60.5 per cent of the steel, and 68.5 per cent of the rolled steel in the USSR were produced in integrated plants. See *ibid.*, p. 53.

10. See the discussion about the chemical and coke industries as complements in Donbas in Dvorin, 1958.

11. Veingarten, 1933, pp. 178-79.

market and facilitate the growth of industries that employ predominantly female workers. Before the locational decision is made, all these relevant factors have to be considered and the variant having the most advantages must be selected.

The presence of population concentration and of a skilled labor force is not an absolute condition for the development of the iron-and-steel industry in a given region, although it facilitates such a development.¹² Also, the differences in wages of metallurgical workers, which vary considerably by regions, do not influence the locational choice, despite the fact that wages represent about 20 per cent of the total cost of production in this industry.¹³ The relationship is rather the reverse; the development of the metallurgical industry provides a great stimulus to the concentration of population and to the general economic development in a given region because the scale of production in this industry is so large that an integrated plant needs about 15,000 workers, and together with their families this represents a population center of about 100,000. If to this figure the workers in complementary industries are added, their influence on the local economy becomes even more evident.

In the preceding discussion only the influence of the cost of production on the location choice of iron-and-steel plants was considered. For the national economy as a whole, however, transportation costs incurred in carrying the final products of this industry to its consumers are of no less importance. They would be minimized if the sites of production and consumption coincided. In case the deposits of mineral resources are considerably removed from the existing metal-consuming industries, the development of the iron-and-steel industry would be facilitated if the local demand for iron-and-steel products is expected to be developed accordingly. Soviet economists claim that their system has a definite advantage over its capitalist coun-

12. Feigin, 1960, pp. 182-84. The history of the development of the iron-and-steel industry before the Revolution confirms this statement. Its development took place in Donbas and in the Urals, where the population concentration was by far smaller than in the western or central parts of the country. The same is true for the development of this industry under the Soviet regime. It was always possible to recruit the necessary labor.

13. TsSU, 1961, p. 240.

terpart in this respect.¹⁴ They believe that because of central planning it is easy to foresee the future demand because the state can simultaneously proceed with the development of metal-producing and metal-consuming industries in the same region, unlike under capitalism, where the relevant decisions are made independently by several entrepreneurs.

The conditions discussed above for the development of the iron-and-steel industry are extremely favorable in the southeastern region of the Ukraine. In the second half of the nineteenth century a modern industry had already started to grow on the basis of the available deposits of high-grade iron ore in Kryvyi Rih and coking coal in Donbas, removed from each other by less than 450 km. This industry, in turn, stimulated the growth of Ukrainian machine building, particularly of branches producing transportation and mining equipment and agricultural machinery. Under the Soviet regime, primarily at the time of the introduction of the First Five-Year Plan, the demands on the iron-and-steel industry were exceedingly high. This goal could have been achieved if the capacities of this industry had been further expanded. There was unanimity among Soviet leaders and economists that a considerable share of total investment should be used for this purpose. However, a question arose whether to allocate the investment mainly for the Ukrainian iron-and-steel industry or to use it for the construction of a new base in the eastern Urals.¹⁵ The latter alternative was chosen, which, as will be shown subsequently, drastically affected the differential growth of this industry in the Ukraine.

As a result of this decision, the Ukraine¹⁶ received only 30 per cent of 10.8 billion 1955 rubles invested in this industry in the USSR during the First and Second Five-Year Plans, while the central region (European part of the Russian SFSR) received 10 per cent and the remaining 60 per cent was allocated to the newly developing centers

14. Feigin, 1958, pp. 332–33.

15. For the discussion of this problem see Appendix B.

16. In this case the iron-and-steel industry of the northern Caucasus is included in the Ukrainian data. The latter did not produce any pig iron in 1937, nor presumably in earlier years, and its steel output amounted to about 10 per cent of the combined output in this year. See TsSU, 1957, p. 113; Livshits, 1958, p. 153. Therefore, the share of non-Ukrainian metallurgy in the data in the text must have been relatively small.

in the Urals and western Siberia.¹⁷ Moreover, although during the First Five-Year Plan the Ukrainian share in this investment amounted to 35.1 per cent,¹⁸ it must have declined substantially during the succeeding period in view of the above data. This decline vividly indicates the determination of the Soviet leaders to shift the center of gravity of this industry from the west to the east of the country. The investment share of the Ukraine is greatly below its share in the total fixed capital of the iron-and-steel industry in the USSR, which at the beginning of the period under discussion was equal to 61.4 per cent. Consequently, this share declined to 50.6 per cent at the end of the Second Five-Year Plan.¹⁹ Among the most important plants constructed during this period were the plants in Zaporizhzh'ia, Zhdanov, and Kryvyi Rih in the Ukraine, and the well-known plants in Magnitogorsk and Kuznetsk outside the Ukraine.

The official data on fixed capital, expressed in value terms, suffer from certain deficiencies, as was discussed in Chapter 2. Therefore, it seems advisable when possible to supplement them with data in physical terms.²⁰ But changes in fixed capital, as shown in physical terms, can never be a perfect substitute for those in value terms. A modern plant consists of many different physical items that vary in quantity and in quality from one plant to another. The presentation of changes in physical terms must be limited to one or to only a very few technological variables so similar that they can be compared over time and space. Despite its deficiencies, this procedure is favored by the fact that in order to have an efficient production, it is impossible for one technological variable, no matter how important, to be out of balance with other variables. In view of the lack of any better method, it is necessary to proceed on the assumption that the change in one important technological factor is representative of changes in

17. *Ibid.*, p. 147. The data refer to the investment in the iron-and-steel industry and also in its servicing branches, which presumably means the coking industry and the mining of iron and manganese ores.

18. *Ibid.*, p. 148; Seredenko, 1957a, p. 63.

19. See Table 2.2.

20. Markowski and Rakowski, 1959, p. 12, believe that because of the uncertainty of the definitions and magnitudes involved, the interspatial comparison of fixed capital in natural units, although incomplete, is more meaningful than in value terms.

all fixed capital of the industry in question. It is perfectly true that mere changes in physical terms do not take technological improvements into account, but the same is often true when the change in fixed assets is shown in value terms.

Table 7.1 shows the number and capacity of blast and open-hearth

TABLE 7.1. Number and Capacity of Blast Furnaces and Open-Hearth Furnaces on Benchmark Dates and Their Introduction During the First and Second Five-Year Plans in the Ukraine and the USSR

Blast Furnaces					
Number and Capacity	Ukraine		USSR		Ukraine as Percentage of USSR
	Absolute Data	Index	Absolute Data	Index	
A. Number					
Oct. 1, 1928	30 ^a	100.0	69 ^a		43.5
Introduced	22 ^b		61 ^b		36.1
Jan. 1, 1938	46 ^a	153.3	g		
B. Capacity (cubic meters)					
Oct. 1, 1928	13,586 ^a	100.0	19,937 ^c	100.0	68.1
Introduced	17,278 ^b		37,046 ^b		46.6
Jan. 1, 1938	28,636 ^a	210.8	56,117 ^c	281.5	51.0
Open-Hearth Furnaces					
A. Number					
Oct. 1, 1928	82 ^a	100.0	220 ^e		37.3
Introduced	49 ^e		167 ^e		30.0
Jan. 1, 1938	130 ^a	158.5	g		
B. Capacity (square meters)					
Oct. 1, 1928	2,179 ^a	100.0	4,636 ^f	100.0	47.0
Introduced	1,928 ^e		5,590 ^e		34.5
Jan. 1, 1938	4,149 ^a	190.4	10,118 ^f	218.2	41.0

Sources: a. Khromov, 1945, p. 57.
b. Livshits, 1958, p. 149.
c. *Ibid.*, p. 151.
d. *Ibid.*, p. 150.
e. *Ibid.*, p. 150.
f. *Ibid.*, p. 152.
g. Not available.

furnaces at the beginning of the First and Third Five-Year Plans and their introduction during this period. An increase in the capacity of blast furnaces will result in an increase in the output of pig iron. The same is true for steel, which is produced in open-hearth furnaces. As can be seen from the incomplete data on the number of furnaces and data on their capacity, the Ukrainian shares declined between the benchmark dates. This is, of course, due to the fact that the shares of introduced furnaces and their capacities were below the initial share of the Ukraine. This confirms the previous finding in value terms that the Ukrainian share in fixed capital of the iron-and-steel industry decreased during the period under discussion because of the relatively low share of the Ukraine in the USSR investment in this industry.

This investment policy had a profound impact on the differential growth of output of the Ukrainian iron-and-steel industry during the period under discussion; the growth of output increased at a slower rate than in the USSR, 3.55 and 4.06 times, respectively. When the output of such allied industries as coke and iron and manganese ores is included, the increase amounted to 3.57 times for the Ukraine and 4.17 times for the USSR.²¹ As a result, the Ukrainian shares declined from 66.2 to 56.7 in the former case and from 60.8 to 53.1 in the latter. The slower growth in the Ukraine was experienced by all six commodities comprising this industry, with the consequent declines in the Ukrainian shares between benchmark years, as is shown in Table A.1.

In regard to the Ukrainian shares for individual commodities, another phenomenon deserves mentioning. At the beginning of the First Five-Year Plan the Ukraine held a dominant position in the USSR in the output of goods of this industry requiring less processing. It produced over nine-tenths of the coke, more than three-quarters of the iron ore, and more than seven-tenths of the pig iron and manganese ore, while its share in the output of steel and rolled steel amounted to 57 and 58 per cent, respectively. This means that the primary goods were not entirely processed further in the Ukraine, but part of them were exported for this purpose to other regions of the USSR. The investment policy during the period under discussion alleviated this situation only slightly, as can be seen from the continuing consider-

21. Computed from Table A.1., and Kaplan and Moorsteen, 1960, Table 1.

able divergence in 1937 between the Ukrainian shares of the output of steel and rolled steel, on the one hand, and of other products, on the other hand.

The question can now be raised whether this investment policy was economically justified, i.e., whether an increase in output per increase in fixed capital was greater in the USSR than in the Ukraine. The following data show that the ICOR during the period under discussion was slightly higher in the former.

	<i>Ukraine</i>	<i>USSR</i>
Increase in fixed capital (millions of current rubles) ²²	2,266	4,613
Increase in output (millions of 1950 rubles) ²³	10,415	20,573
Incremental capital-output ratio	0.218	0.224
Ukraine as percentage of USSR	97.3	

The same calculation for the iron-ore industry indicates that this ratio was also higher in the USSR but this time significantly so — by more than one-third.

	<i>Ukraine</i>	<i>USSR</i>
Increase in fixed capital (millions of current rubles) ²⁴	135	371
Increase in output (millions of 1950 rubles) ²⁵	449	779
Incremental capital-output ratio	0.301	0.476
Ukraine as percentage of USSR	63.2	

In other words, the increase in output per increase in fixed capital was in both cases relatively larger in the Ukraine than in the USSR. The objection that the output data are aggregated with the help of 1950 prices, while fixed capital is presented in current rubles may be dis-

22. Table 2.2.

23. The aggregate values for the benchmark years (in millions of 1950 rubles) for the Ukraine are 4,091 and 14,506 (Table A.1) and for the USSR, 6,724 and 27,297 (Kaplan and Moorsteen, 1960, Table 1).

24. Table 2.2.

25. The value figures in millions of 1950 rubles for the Ukraine are 170 and 619 (Table A.1) and for the USSR, 221 and 1,000 (Kaplan and Moorsteen, 1960, Table 1).

missed on the basis that it is not the absolute level of the ICOR but the relation between the Ukraine and the USSR that is of interest here.

The above findings, based on the data in value terms, can be supported by data indicating the purely technological efficiency of physical capacities. Efficiency in the case of blast furnaces can be measured by the volume of capacity, expressed in cubic meters, required to produce one ton of pig iron. In the case of steel, it is measured in terms of the number of tons of steel produced per square meter of area of an open-hearth furnace during twenty-four hours. Table 7.2 shows that in the benchmark years in all cases the equipment producing pig iron and steel was technologically more efficient in the Ukraine than in the USSR.²⁶ However, a slight decline of the advantage of the former is noticeable during the period under discussion. This divergence between the findings in value and in physical terms can be explained in addition to the inadequacy of data also by the higher cost of fixed assets in the eastern regions of the USSR than in the Ukraine.

TABLE 7.2. Efficiency of Blast and Open-Hearth Furnaces in the Ukraine and in the USSR for Benchmark Years

Year	Coefficient of Utilization of Blast Furnaces (cubic meters)			Tons per Square Meter of Open-Hearth Furnaces		
	Ukraine	USSR	Ukraine as Percentage of USSR	Ukraine	USSR	Ukraine as Percentage of USSR
1928	1.80	1.86	96.8	2.48	2.09	118.7
1937	1.08	1.11	97.3	4.77	4.33	110.2

Sources: Ukraine, TsSU-Ukraine, 1957, p. 37; USSR, TsSU, 1961, pp. 250-51.

26. Technological efficiency was greater in the Ukraine than in the USSR in new as well as in old plants, for example, in 1936, for which the comparable data are available. The coefficient of utilization of blast furnaces in the new Magnitogorsk plant was equal to 1.18 cubic meters (Livshits, 1958, p. 165), and in the new Ukrainian plants, 1.06 cubic meters (Seredenko, 1957a, p. 74). For the old plants in the Ukraine the coefficient for blast furnaces was equal to 1.08 cubic meters and for open-hearth furnaces, to 5.13 tons (*ibid.*, pp. 74-76). On the other hand, old plants outside the Ukraine, according to Livshits, 1958, p. 163, performed very poorly at that time.

Finally, it is necessary to consider the effect of investment policy in the iron-and-steel industry in the USSR on transportation. This relationship is of particular relevance because it played an important role in the discussion prior to the construction of the Ural-Kuznetsk Combine and because of Soviet difficulties with transportation in general during the period analyzed. Theoretically, a rational location policy would require that the production of a commodity in a certain region should take place only if its cost were lower than the combined cost of producing this commodity in and transporting it from another region. If the development of the iron-and-steel industry proceeds without the concomitant development of metal-consuming industries, its products have to be exported to other regions. Although the cost of production might be below the national average, the transportation cost incurred in exporting these products may outweigh the production advantages. In this case the production of iron and steel in a high-cost region would be preferred.

The scarcity of data prevents the exact analysis of this effect. Nevertheless, the following evidence can be cited in support of the assertion that the geographical distribution of investment had a negative effect on transportation. Between 1928 and 1937 the average length of a railroad haul for coke and coal went up from 615 to 709 kilometers and for all ores from 397 to 633.²⁷ The increased burden on transportation facilities is apparent here. Obviously, this is the result of the construction of the Ural-Kuznetsk Combine, which utilized the basic inputs, coal and iron ore, from deposits located far apart.

The average length of railroad haul of pig iron, steel, and rolled steel also increased considerably, from 786 to 1,004 kilometers.²⁸ Two factors contributed to the increase. There was a regional imbalance between different stages of production in this industry. As was indicated earlier, in the Ukraine the primary stages were more developed in comparison with the stages requiring more processing. For example, the south (the Ukraine) produced 66.1 per cent of all USSR pig iron and ferroalloys in 1938 but consumed only 57.4 per cent.²⁹ On the other hand, there was an overinvestment in the steel-producing capa-

27. Khanukov, 1956, p. 122.

28. *Ibid.*

29. Clark, 1956, p. 205.

cities of the Urals relative to the pig-iron producing capacities. As a result, the Urals had to import pig iron from the Ukraine,³⁰ thus increasing the demand for transportation services. As can be seen, the investment policy, instead of eliminating the existing imbalance, extended it. Furthermore, the machine-building industry remained concentrated in the regions of Moscow, Leningrad, and the upper Volga, which produced only 6.0 per cent of all USSR ordinary rolled steel and 30.2 per cent of quality rolled steel but consumed 30.0 and 50.6 per cent, respectively, in 1937.³¹ This deficit was historically eliminated with the supplies from Donbas. With the construction of the Ural-Kuznetsk Combine, the western regions of Russia became the main consumers of its steel products because the local demand for steel failed to materialize during the period under discussion.³² Since the distance to Moscow or Leningrad is greater from the Urals than from Donbas, the construction of the Combine in place of the expansion of Donbas contributed further to the overburdening of transportation.

To sum up, the previous discussion suggests that from the purely economic point of view the further development of the Donbas iron-and-steel industry during the First and Second Five-Year Plans was preferable to the construction of the Ural-Kuznetsk Combine. The ICOR in this industry was slightly lower and in the iron-ore industry, considerably lower in the Ukraine than in the USSR. The advantage of Donbas coal in the production of coke is also well recognized.³³ According to Soviet economists, the complementary investment in connection with the construction of the combine was very high as compared with the requirements of Donbas.³⁴ The considerable contribution of this investment policy to transportation difficulties must also be noted.

30. Khanukov, 1956, p. 244.

31. Speranskii, 1939, p. 72.

32. Omarovskii, 1962, p. 190, writes about this problem as follows: "The distribution of investment among the leading branches in the eastern regions was such that the demand for machinery and the supply of iron and steel were higher than the growth of the machine-building industry."

33. Cf. Dvorin, 1958.

34. See Feigin, 1960, p. 162.

8. THE COAL INDUSTRY

The development of sources of supply of fuel and energy is of crucial importance for an industrializing nation. In the USSR, during the period under discussion, the job of main supplier fell on the coal industry because the alternative resources were either not yet sufficiently expanded or those available were unsuitable for the technological processes used at that time. For this reason the differential growth of the Ukrainian coal industry deserves particular attention.

In formulating their location theory of the coal industry and of location-bound materials in general, contemporary Soviet economists could draw very little, even implicitly, on the established theory in the West. Initially, the Western economists, following Weber's example, paid no attention to the problem of which deposit of a mineral resource should be extracted, if there were more than one such deposit available. They usually assumed the locations of extractive industries as a datum,¹ although they admitted their vital importance for the location of processing industries. This was probably due to the fact that the observations of these economists were primarily limited to Western

1. Weber, 1909.

Europe in which, say, coal deposits are few and, in general, fully utilized. Only Oskar Englaender supplemented the basic location theory as formulated by Weber, in the sense that the demand in a given location for an extractive material should be satisfied from that deposit — in case there is more than one — in which the combined costs of production and transportation are lowest.² In other words, the geographical distribution of an extractive industry is determined first of all by the locations of the consumers of its products and, obviously, the change of the latter could result in the change of deposits under exploitation. This formulation should be qualified in regard to the quality of materials; as expressed in technological units, i.e., sometimes superior materials could be preferred to the inferior despite the higher transportation costs of the former.³

In contrast to Western Europe there are many coal deposits scattered throughout the USSR, several of which are in the eastern regions and had not been opened at the time of the introduction of the First Five-Year Plan. On the other hand, the population and industry were concentrated in the European part of the country. Thus, the need for a well-defined theory of location of the coal industry was much more urgent for the Soviet economists than for their Western counterparts. Also, the differential freight rates for the transportation of coal, which were established long before the Revolution and were continued by the Soviet regime, obscured its real costs to consumers and thus often led to losses to the national economy.⁴ This could have been corrected if cost-minimizing guidelines had been established and had been utilized in the economic policy in regard to the utilization of available deposits. For these reasons, Soviet economists devoted a great deal of their attention to this problem.⁵ Usually while discussing the specific problems of location theory of extractive industries and

2. Englaender, 1926, particularly par. 14.

3. Probst, 1929, p. 163.^{*}

4. Bessonov, 1928, p. 70; Probst, 1929, p. 162.

5. Among the Soviet economists, A. E. Probst was most interested in this problem; see Probst, 1929; Probst, "Electricification and the Reconstruction of the Fuel Supply of the USSR," in Weitz, 1936; probably this interest is most apparent in his book *Osnovnye problemy geograficheskogo razmeshchenia toplivnogo khoziaistva USSR*, 1939, cited by Khanukov, 1956, p. 68, but this volume was unavailable to me; Probst, 1962; Probst, 1962a.

abstracting from broader issues of general location theory, they follow Englaender's formulation without necessarily referring specifically to him.⁶

Despite the fact that several coal deposits were already known and exploited in the USSR at the end of the 1920's, 77 per cent of the total was mined in Donbas and 70 per cent in the part belonging to the Ukrainian SSR.⁷ This obviously resulted from the location of demand; the main coal consumers were located predominantly in the European part of the USSR. For example, in 1927/28 the railroads consumed 34.8 per cent of Donbas coal; the metal industry, 20.1; the sugar industry, 5.5; the chemical industry, 4.4; the textile industry, 4.2, etc.⁸ For them the Donbas coal, because of its quality and proximity, was cheaper than the coal from eastern regions, which were too distant, or the coal from the nearby Moscow basin, which is of low quality. However, the industrialization of the eastern regions and the concomitant growth of local transportation and urbanization made the opening of coal deposits that were nearer an absolute necessity, because Donbas was too far away and the excessive transportation costs would be an obstacle to economic development.

As a result of this policy, the share of Donbas in total coal mining in the USSR in 1937 declined to 60 per cent and for its Ukrainian part to 55 per cent.⁹ But still Donbas had to supply its consumers as before, because, as Table 8.1 indicates, there was little change in the distribution of its coal deliveries among the various regions during the 1930's. The large distance to the newly developed deposits in the east made their coal too expensive for industrial centers in the west. Since the latter experienced very rapid growth, primarily in the processing industries, their demand for coal was constantly rising; this demand could have been adequately satisfied if Donbas' mining facilities were correspondingly expanded.

6. Probst, 1962, p. 160; Danilov and Mukhin, 1960, p. 29.

7. TsSU, 1957, p. 135. In the subsequent discussion, if not specified, any mention of Donbas coal mining refers only to its Ukrainian part, which accounted for approximately 90 per cent of the total Donbas output.

8. Bakulev, 1955, p. 314.

9. TsSU, 1957, p. 135.

TABLE 8.1. Distribution of Donbas Coal Consumers by Regions of the USSR for Selected Years (per cent)

Regions	1933	1938
USSR	100.0	100.0
Ukraine	50.6	55.1
Central Industrial Region	15.3	13.2
Northwest	14.3	9.3
North Caucasus and Rostov Oblast	9.1	5.7
Central Black-earth Region	4.6	8.5
Middle and Lower Volga	3.9	4.7
Crimea	0.9	1.3
West	0.5	1.5
Other	0.8	0.7

Source: Bakulev, 1955, p. 346.

Despite the increased demand for Donbas coal, the investment policy of the Soviet leadership was centered on an all-out development of coal deposits in the eastern regions of the USSR. Consequently, a much smaller share in total investment was allocated to the Ukraine as compared with its share in total output. In the project of the First Five-Year Plan, the Ukrainian coal industry was supposed to receive 30.6 per cent of total investment in this industry.¹⁰ In addition, 100 million rubles was allocated to the non-Ukrainian part of Donbas.¹¹ The whole of Donbas was to receive over 1 billion rubles. The Second Five-Year Plan foresaw the allocation to the Ukraine of 36.2 per cent of total investment in this industry, or 1.3 billion rubles, and to all of Donbas, 1.47 billion rubles.¹² There are no data available for the fulfillment of the investment plan in the Ukraine.¹³ However, the change in its fixed capital share, which declined from 93.1 to 49.5 per cent between October 1, 1928, and January 1, 1938,¹⁴ confirms roughly the fact that its share in the realized investment in this industry amounted to a little less than two-fifths of the total during the period under discussion.

10. Gosplan, 1930, p. 570.

11. *Ibid.*, p. 574.

12. Podkolzin and Pinsker, 1957, p. 23.

13. For the realized investment for the whole USSR, see Kaplan, 1951, Table XII.

14. Table 2.2.

The faster growth of fixed capital in value terms in the coal industry in the USSR than in the Ukraine can be confirmed by a comparison of the number of coal mines introduced during the period under discussion. This physical indicator shows only a part of the whole picture because, in addition to the construction of new mines, investment is used for rehabilitating old mines, for furnishing mining equipment, and for providing the buildings and equipment of surface structures. Nevertheless, the bulk of investments usually goes for the construction of new mines. During the First Five-Year Plan, 149 new mines were introduced in the USSR, with 69, or 46.3 per cent of the total, in the Ukraine; and during the Second Five-Year Plan 145 and 46, or 31.7 per cent, respectively.¹⁵ Since it takes from five to six years to construct a new mine,¹⁶ the number of mines introduced during the First Five-Year Plan reflected rather the investment pattern of the period between the Revolution and 1928. Altogether, the share of Donbas in the number of introduced mines during the period under discussion amounted to 39.1 per cent, which corresponds closely to the Ukrainian share in the increase in fixed capital in the USSR coal industry.

This allocation of investment in the coal industry between Donbas and other regions of the USSR already had a significant effect on the growth of coal output by regions during the period under discussion. Although Donbas showed a considerable increase in output between the benchmark years, its share in the total output declined from over three-quarters to three-fifths, as shown in Table 8.2. For the Ukrainian part of Donbas, the decrease was from 70 to 54 per cent. Of course, other coal deposits experienced much faster growth than Donbas. In particular, this is true for the basins located in Asia, such as Kuznetsk, Karaganda, and eastern Siberia. The main impetus for the development of the first two was, of course, the construction of the Ural-Kuznetsk Combine. The Moscow region also showed a great increase, particularly during the Second Five-Year Plan when the official emphasis was on the development of local coals, i.e., those deposits which, although sometimes of lower quality, were located close to industrial centers.

15. Grafov, 1957, p. 259.

16. *Ibid.*, p. 260.

TABLE 8.2. Distribution of Coal Output by Regions for the USSR and Its Growth Between Benchmark Years (per cent)

Region	Percentage of Total		1937 (1928 = 100)
	1928	1937	
USSR	100.0	100.0	360.3
Donbas	77.0	60.5	283.4
Ukrainian part of Donbas	69.9	54.0	278.2
Moscow	3.2	5.9	661.3
Kuznetsk	7.4	13.9	680.4
Ural	5.6	6.3	406.5
Karaganda	—	3.1	
East Siberia	2.8	4.5	574.8
Far East	3.0	3.8	451.5
Other regions	1.0	2.0	449.5

Source: TsSU, 1957, p. 135.

Now the data on output and fixed capital can be used to determine whether the ICOR was higher in the Ukraine or the USSR. As can be seen, the ICOR was significantly lower in the Ukrainian coal industry than in the USSR.

	<i>Ukraine</i>	<i>USSR</i>
Increase in fixed capital (millions of current rubles) ¹⁷	780	1,916.3
Increase in output (millions of 1950 rubles) ¹⁸	4,022	8,405
Incremental capital-output ratio	0.194	0.228
Ukraine as percentage of USSR	85.1	

The peat industry is treated separately from the coal industry by Soviet economists; but, since it is also a fuel industry, a similar calculation will be undertaken for it at this point. In this case, the ICOR for the Ukraine is much lower than for the USSR, slightly more than one-fourth of the latter.

17. Table 2.2.

18. The value data in millions of 1950 rubles for the benchmark years for the Ukraine are 2,257 and 6,279 (Table A.1), and for the USSR, 3,227 and 11,632 (Kaplan and Moorsteen, 1960, Table 1).

	<i>Ukraine</i>	<i>USSR</i>
Increase in fixed capital (millions of current rubles) ¹⁹	16	746.9
Increase in output (millions of 1950 rubles) ²⁰	70.6	916.3
Incremental capital-output ratio	0.227	0.815
Ukraine as percentage of USSR	27.9	

An objection could be raised that the ICOR comparison for the coal industry is not conclusive, since the requirement of fixed capital per unit of output is greatly influenced by natural conditions of deposits. For example, some deposits might require deeper pits, while for others, in regions with a severe climate, surface structures are of greater importance. As a result, the ICORs are larger here than in the case of deposits with more favorable natural conditions. In order to account for these diverse conditions in individual regions, a group of economists in the USSR have prepared a study in which they propose to modify the results, obtained in the same way as in this study, with specially worked-out coefficients.²¹ In the absence of these officially prepared coefficients, it is necessary to assume that natural differences by regions would not be large enough to invalidate the results obtained. Furthermore, for another Soviet specialist there is no doubt that this method—the comparison of capital-output ratios—is the most important in determining the effectiveness of investment in fuel-extractive industries by regions even without any modification.²² The problem, as he sees it, lies in deriving comparable data on investment and output by regions.²³ Another objection to this method could be that instead of the total production of a given industrial branch only the output of main product is used, in this

19. Table 2.2.

20. The value data in millions of 1950 rubles for the benchmark years for the Ukraine are 5.4 and 76.0 (Table A.1), and for the USSR, 259.7 and 1,176.0 (Kaplan and Moorsteen, 1960, Table 1).

21. Krasovskii, 1962, p. 64.

22. Probst, 1962a, p. 53. He prefers, however, to use the average instead of marginal ratios. Also, in order to avoid annual fluctuations, it is better to average the output for a number of years, according to him.

23. *Ibid.*, pp. 49–52.

case the output of coal. Soviet economists favor such an approach for the analysis of branches in which a homogeneous product represents the bulk of total output, because in this way the influences of price structure and its changes are eliminated.²⁴

The conclusion that the ICOR for the coal industry was lower in the Ukraine than in the USSR, as derived above, can be supported with the following four pieces of evidence:

(1) Only the most efficient Ukrainian mines were kept in operation. Despite the introduction of new mines, the total number in Donbas declined from 428 in 1928 to 311 in 1937.²⁵

(2) As was mentioned previously, a mine put into operation requires about five years before it can work most efficiently at planned capacity. Since relatively more of the new mines were introduced during the Second Five-Year Plan outside the Ukraine than during the First Five-Year Plan, a relatively larger number of mines in newly developing regions were in the stage of gestation and did not yet produce most efficiently.

(3) It must be kept in mind that a part of investment was devoted to the mechanization of mining processes. The increases in mechanization have had a great and very rapid effect on the increase in output. After the acute fuel shortage at the end of the 1920's, a great emphasis was placed on this approach to the output increase in Donbas. In order to provide the necessary mining equipment, new specialized machine-building plants were constructed and the old ones were expanded.²⁶ Also new electrical stations were put into operation with the expressed purpose of serving Donbas coal mining.²⁷ However, the aggregate data on the degree of mechanization in Donbas and in the USSR show only a very slight advantage of the former, primarily in the cutting and delivery of coal, at the end of the period under

24. Cf. Kantor, 1962, pp. 54-55.

25. Grafov, 1957, p. 35.

26. In the Ukraine the new plants producing mining equipment were constructed in Voroshylovhrad, Kharkov, Krasnopil', Artem's'k, and Novocherkas'k. The old plants were expanded in Horlivka, Iuzivka, and Torets'k. See *ibid.*, p. 348.

27. In 1931 an electrical plant having 152,000 kw capacity was introduced in Shterivka, and in 1932 a plant with 200,000 kw was established in Zuivka. See Weitz, 1936, p. 79.

review.²⁸ This is the effect of averaging the degree of mechanization in the USSR: though it was greater in Donbas than in the old mining regions outside the Ukraine, it was smaller than in the new regions.²⁹ But even if coal mining were mechanized to the same degree all over the USSR, including the Ukraine, the effect of mechanization on the increase in output would be larger in the latter; here mining machinery would supplement the well-established and efficient mines. In the eastern regions this effect on the increase in output was weaker, because the new equipment had to be used with equally new mines, which were not yet working at full capacity.

(4) Such factors as social overhead, urbanization, transportation, administration, and climate were more advantageous in the Ukraine than in the developing regions of the USSR.

Despite the higher ICOR in the eastern regions of the USSR than in the Ukraine, the low cost of coal mining favored its faster development in the former. For example, in 1928 the cost of production of one ton of coal was equal to 6.80 rubles in Kuzbas and to 10.70 rubles in Donbas, or 57 per cent more in the latter.³⁰ The disadvantage of Donbas declines somewhat if the superior quality of its coal is taken into account.³¹ Since the coal industry is relatively labor-

28. Following are percentages of mechanization of some mining processes in the Ukraine and the USSR for benchmark years:

	1927/28		1937	
	USSR	Ukraine	USSR	Ukraine
Coal cutting	—	19.4	89.6	90.0
Coal delivery	—	25.9	84.4	90.6
Coal trucking	—	—	47.6	45.4

Sources: Ukraine: Khromov, 1945, p. 49;
USSR: Lyashchenko, 1956, p. 389.

29. Bakulev, 1955, pp. 412-13.

30. Berezov, 1928, p. 281.

31. A similar situation existed in 1958. According to Probst, 1962, p. 248, the cost of coal mining in the Donbas-Dnieper region was 147 per cent of the USSR average in this year. If adjusted for the difference in quality, the percentage declines to 114. The respective percentages for some other regions in this year were as follows (the figures in brackets indicate the relative cost of production adjusted for differences in quality): Central, 84 (157); western Siberia, 79 (62); eastern Siberia, 43 (47); Kazakhstan, 64 (60); Urals, 61 (82). In most of the eastern regions the coal can be partly mined on the surface, which makes the cost of production low.

intensive,³² the lower production cost in the eastern regions results mainly from the higher productivity of labor.³³ As Table 8.3 shows, the monthly output per worker was higher in the eastern regions and lower in Donbas than the average for the USSR. Furthermore, the growth of labor productivity was below average in the latter. Again, owing to the higher quality of coal, the actual disadvantage of Donbas was smaller.

TABLE 8.3. Monthly Coal Output per Worker by Regions of the USSR for Benchmark Years

	Tons		1937 (1928 = 100)
	1928	1937	
USSR	12.7	26.9	211.8
Donbas	12.0	23.7	197.5
Moscow	15.1	28.3	187.4
Kuzbas	19.7	41.2	209.1
Urals	18.7	31.0	165.8
Karaganda		30.9	
Central Asia	10.6	16.5	155.7
East Siberia	31.6	37.2	117.7
Far East	15.0	31.2	208.0

Source: TsSU, 1957, p. 135.

The main reason for the high productivity of labor in coal mining in the eastern regions was the extremely favorable geological conditions. Its growth, however, resulted primarily from large investments directed to these regions, in addition to the growing experience of workers, higher incentives than in Donbas, improving management,

32. For example, in 1960 the share of wages and social security amounted to 19.3 per cent of the total cost of production for all industry; while for the coal industry it was equal to 51.8 per cent and for coal mining only to 63.5 per cent. See TsSU, 1961, p. 240.

33. The higher labor productivity may also be reflected through the lower share of wages in the total cost of production. In Donbas, for example, in 1940, this share was equal to 61.3 per cent (Bakulev, 1955, p. 637), while for the USSR it was 60.3 per cent (Mikheev, 1957, p. 284). In 1955 these percentages were as follows for selected regions: Donbas, 66.8; Kuzbas, 60.3; Karaganda, 60.6; eastern Siberia, 56.2; Far East, 42.5. See Feigin, 1958, p. 336.

etc. The eastern miners were thus equipped with more capital than their counterparts in Donbas. Moreover, because of technological progress, they were equipped with better capital. In consequence, the lag of Donbas in regard to labor productivity in comparison with the USSR average became even larger between the benchmark years; it increased from about 5 to 12 per cent (Table 8.3).

The investment policy in the coal industry of the USSR with regard to its territorial distribution during the period under discussion can now be evaluated. The preceding discussion has shown that the ICOR was lower in Donbas while labor productivity was higher in the eastern regions. It is obvious that in view of this situation it was inefficient to increase the capital in the eastern coal industry further. If irrationality in Soviet planning is ruled out, the following proposition can explain such investment policy. In order to develop the coal industry in the east, almost from nothing, it was necessary to make discontinuous and substantial investment initially. If this capital were to produce most efficiently, it had to be combined in a certain optimum proportion with labor. But because of difficulties of recruiting labor, a disproportionality existed between these two factors of production throughout the period under discussion. Since the increase in capital in the east was taking place at the cost of Donbas, as a result the fixed capital per worker in the former was relatively too high and in the latter relatively too low. In view of the existing geological conditions, rather the reverse situation would be correct.³⁴ Even the increased output at a lower cost in the east cannot justify the inefficient combinations of factors of production in the regions of the USSR.

It may be recalled that in deciding where to develop the coal industry transportation costs as well as the cost of production have to be considered. The former are, of course, determined by the distance between the production and consumption locations. The eastern

34. Bauer and Yamey, 1957, pp. 122-23, have the following to say about such a situation: "The ratio [of capital to other resources or to output] need not be the same in all production units performing the same service or producing the same goods in a particular economy; just as there are differences in the capital intensity of techniques of production available in different sectors of an economy, so there are differences in the techniques available to different producers."

coal industry was started on the premise that a large number of coal-consuming enterprises would be constructed nearby at the same time, because the long distances make the export of eastern coal to western industrial centers extremely expensive. The actual development of the eastern manufacturing industry, however, did not proceed at the same rate as that of the coal industry. This was true before World War II; and it is still true, because as late as in the 1950's the supply of coal exceeded the demand in the eastern regions, with the result that it had to be transported from Kuzbas to the European part of the USSR.³⁵ During the period under discussion, this phenomenon had a negative effect on one of the most vulnerable sectors of the Soviet economy, railroad transportation, because the average haul of coal increased from 615km in 1928 to 709km in 1937, and long hauls—those over 1,200km—rose particularly rapidly.³⁶

Another disadvantage of this territorial investment policy in the coal industry was the fact that it was not conducive to meeting planned targets, which were excessive anyhow. According to the First Five-Year Plan, the output of coal in the USSR was expected to grow by 1932 to 75 million tons.³⁷ The plan was fulfilled by 86 per cent.³⁸ At the end of the Second Five-Year Plan an output of 152.5 million tons was foreseen,³⁹ which was realized by 84 per cent.⁴⁰ These failures were due to the fact that the eastern coal basins were not yet producing at planned capacity, because of the time required for construction and gestation. Therefore, the main responsibility for the fulfillment of the plans fell on the western coal regions. Since most of them performed rather badly,⁴¹ Donbas had to bear the brunt of the increased demand from the growing industry in the west

35. Khanukov, 1956, p. 186.

36. *Ibid.*, p. 122.

37. Gosplan, 1933, p. 95.

38. TsSU, 1961, p. 254.

39. Gosplan, 1939, p. 278.

40. TsSU, 1961, p. 254.

41. If all coal regions except Donbas, Kuznetsk, and Karaganda are included in this category, then they fulfilled the plan for 1937 by two-thirds. See Bakulev, 1955, p. 338.

of the USSR.⁴² In 1932 the Donbas coal industry fulfilled its targets by 86 per cent and in 1937 almost fully succeeded: the plan was met by 97 per cent.⁴³ Its performance would have certainly been still better if its share in investment allocation had been higher because, in view of the already sufficient number of efficient mines, this investment would have been used for reconstruction, mechanization, electrification, etc. These forms of investment usually result in larger and quicker increases in output than the construction of new mines in primitive regions.

42. In absolute figures the import of Donbas coal in the 1930's was increased by such oblasts of Russia proper as Moscow, Voronezh, Gorkyi, Ivanovo, Leningrad, and the present Volgograd. See Khromov, 1945, pp. 51-52.

43. Bakulev, 1955, p. 383.

9. THE ELECTRIC POWER INDUSTRY

The problem of electrification has always been of great importance for Soviet leaders and economists.¹ Significantly enough, the first attempts at planning in the USSR—the introduction of plan GOELRO in 1920—was intimately connected with the electrification of the country. Electric power had to become the main source of energy for the national economy, first of all for industry, and at the same time it had to facilitate the introduction of advanced technology.² Its effect on the territorial distribution of industry was considered to be very important for the following two reasons:

(1) The possibility of the transmission of electric power over significant distances, which was expected to increase continuously with technological progress, permits the construction of industrial plants at locations in which all economic requirements—labor, raw materials, and demand—are available, with the exception of energy resources.

1. Describing the backwardness of the country in 1920, Lenin asked: “Is it possible to realize the progress from the existing situation in Russia to socialism? Yes, it is possible, to a certain degree, but under one condition. This condition—electrification.” Quoted by Kukharensko, 1951, p. 7.

2. Feigin, 1960, p. 52.

(2) If some regions have no natural basis for economic development other than electric energy resources such as low-grade coal, peat, or hydro-energy potential, then these resources may be used for the output of electric power, which subsequently can be transmitted to neighboring regions. It also may induce the development of complementary industries in the resource-poor region.³ In both cases the output of electric power facilitates a more equal distribution of industry in the country.

In their discussion of the principles of the development of the electric power industry, Soviet economists emphasize the importance of planning more than in any other branch.⁴ This is because the plan for electrification must be coordinated with the plan for the development of the entire economy in a given region and at the same time must be an integral part of the plan for the nationwide power supply. Since electric power must become the main source of energy for the whole economy, its development must be faster than that of other economic sectors. It must be able to satisfy the increasing demand of existing and expected consumers.⁵ The electric power industry is required to build reserves so that in case of a breakdown of one producing segment there will be a ready substitute. Also, such factors as the location of an individual station, the configuration of a network, and the scale of operations can be decided only within the economic framework of a given region, taking into account present and future demand.⁶

In considering the location of individual electric power stations, the Soviet economists argue that the following three factors must be taken into account: the location of fuels and hydro-energy resources, the location of consumers, and the technology of production and transmission.⁷ Of course, the influence of these factors is interde-

3. *Ibid.*, pp. 98–100.

4. Weitz, 1936, pp. 50–52; Probst, 1936, p. 155; Shershov, 1959, pp. 18–19; Vinter and Markin, 1956, p. 20; Vasil'kov, 1957, p. 12.

5. It is estimated that this growth should be between 1.4 and 1.5 times faster than that of the rest of the economy. See Feigin, 1960, p. 51.

6. According to Kukharensko, 1951, p. 8, all these problems could be satisfactorily solved only under socialism.

7. Feigin, 1960, p. 53.

pendent and changes with technological progress. For example, the extension of transmission distances during the period discussed facilitated not only the construction of power stations on a large scale but also permitted the choice of their locations near power resources, if the latter are not situated near the location of consumers. Both factors were particularly important in the USSR because of the stress on large-scale production⁸ and the possibility of constructing the stations in the eastern regions of the USSR, far removed from the concentrations of population and industry in the west, and thus promoting their development in line with the general propositions of location theory. Also, improvement in the technology of production allowed the substitution of low-grade coals and peat for high-grade Donbas coal and Baku oil, which until now had been the main inputs for power generation,⁹ but first of all it allowed wider utilization of hydro-energy resources.¹⁰

In case the locations of consumers do not coincide with the locations of raw materials (this discussion refers mainly to coal) needed for the output of electric power, that site for the construction of a station

8. For example, "The theory and practice of world electrification during the past two decades have plainly shown that engineering is progressing in the direction of concentrating generating plants and centralizing the production of electrical energy, based on the establishment of extensive electric power systems that are in turn interconnected." See Weitz, 1936, p. 50.

9. In the early 1920's oil represented 40 per cent and Donbas coal 60 per cent of energy sources in the USSR electric power industry. See Vasil'kov, 1957, p. 8. The shift to cheaper resources in the Ukraine can be seen from the following table (in per cents):

	1930	1938
Total	100.0	100.0
Water	...	30.0
Anthracite, culm, and other wastes	20.5	50.8
Coal	63.3	17.1
Oil	16.2	2.1

Source: Khromov, 1945, p. 46.

10. The importance of hydroelectric power is characterized in the following terms: "An example of the most effective utilization of local energy resources is the construction of hydroelectric stations, which insure the complex exploitation of rivers and represent the most progressive method of utilization of potential energy of water streams." See Alampiev, 1959, p. 51.

should be selected from which the cost of electricity to the consumers is lowest.¹¹ Assuming that the size of the planned plant is the same in both variants, as are also other things, the investment necessary for the transportation of coal to the plant located in the proximity of consumers is higher than the investment necessary for the construction of transmission facilities over the same distance, when the plant is located close to raw materials deposits. The current operating costs are lower in the latter case than in the former. In practice the quality of the raw materials is very important. Steam power plants are usually drawn toward the deposits of low-grade coal and peat, while high-grade coals are transported to the plants located near the power consumers.¹²

Applying the above location principles of the electric power industry to the Ukraine, it is necessary to consider the availability of resources and the demand for its output. Of course, the third locational factor—technology—would be the same for the Ukraine and for the USSR during the period under discussion. According to recent estimates, the Ukraine, including the Moldavian SSR, in the present borders, possesses 4.1 per cent of all energy resources in the USSR.¹³ Comparable to the Ukraine, the industrially developed Northwest (Leningrad) and Central (Moscow) regions account for 0.6 and 0.8 per cent of all energy resources, respectively. The whole European part of the USSR including the Urals accounts for 13 per cent. The rest of the resources are located in the Asiatic part of the country. This relatively advantageous situation of the Ukraine is reinforced by the fact that the main components of its resources—anthracite in Donbas and hydro-energy in the region of lower Dnieper—are located in proximity to the main centers of Ukrainian industry. Or, one may say, industry was developed in the first place where energy resources were available.

In regard to the influence of demand on the development of electric power it is necessary to keep in mind that during the period under discussion its output was mainly intended for industrial use. In the

11. Feigin, 1960, p. 55.

12. *Ibid.*, pp. 63–65.

13. *Ibid.*, p. 117. The source does not give the year to which this information is applicable, but it probably refers to the same year in which the book was published.

Ukraine industry consumed 77.9 per cent of total output in 1927/28 and 74.7 per cent in 1938, while in the USSR it consumed 66.1 per cent in 1928 and 67.5 per cent in 1937.¹⁴ The structure of Ukrainian industry was largely responsible for its above-average demand for electric power. For example, in 1934, the approximate middle year of the period under discussion, the three most important consumers among industrial branches were the machine-building and metalworking, iron-and-steel, and fuel industries.¹⁵ The first one was developed in the Ukraine relative to the USSR in similar proportions as for total industry. But iron and steel and the main branch of the fuel industry—coal mining—were heavily concentrated in the southeastern Ukraine and, depending on the year, accounted for between one-half and three-quarters of the total in the USSR. Consequently, the demand for electric power by Ukrainian industry was relatively larger than by USSR industry. Indeed, the largest contemporary project in this industry, the construction of the Dnieper hydroelectric station, was undertaken with the specific objective of developing specialized branches of the iron-and-steel industry such as the output of ferroalloys (ferrosilicon, ferrochromium, ferrotungsten), high-quality steel, and alloy steels.¹⁶ The high demand of Ukrainian industry for electric power was reinforced by the fact that the locations of its centers coincided with the locations of electric-power resources. The resulting lower cost of power to its consumers in the Ukraine than in the USSR facilitated the faster growth of this industry in the former.

In order to meet the rising demand, the output of electric power increased between 1928 and 1937 7.49 times in the Ukraine¹⁷ and 7.22 times in the USSR.¹⁸ These increases were largely due to the growth in fixed capital, which rose 10.3 times between October 1,

14. For the Ukraine, Khromov, 1945, p. 43, and for the USSR, Vasil'kov, 1957, p. 77. The next largest share of the total electricity output was used for municipal needs: 15.0 and 10.1 in the Ukraine and 31.8 and 23.9 per cent of the total in the USSR in respective years.

15. In this year machine building and metalworking consumed 19.3 per cent of all electric power in the USSR, the iron-and-steel industry 15.8 per cent, and the fuel industry 21.3 per cent. See Weitz, 1936, p. 44.

16. *Ibid.*, p. 300.

17. Table A.1.

18. TsSU, 1964, pp. 231-32.

1928, and January 1, 1938, in the Ukraine and 8.1 times in the USSR.¹⁹ The increases in physical capacity, measured by kilowatts, were considerably smaller than in value terms. In the Ukraine, the capacity increased from 464,000 to 1,994,000 kw and in the USSR from 1,905,000 to 8,235,000 kw, or 4.3 times in both cases.²⁰ Obviously, the divergence between value and physical units indicators results from the existing inflation. The fact that the increase in the former exceeded the growth in the latter in the Ukraine relative to the USSR can be explained by the larger share of capacity in the Ukraine dependent on water power. In 1938, 30 per cent of electric power in the Ukraine was produced from water resources, primarily as a result of the construction of the Dnieper electric station, while in the USSR this percentage was equal to only 12.9.²¹ Since the construction of a hydroelectric station costs 2.5 times more than the construction of a thermal station with comparable capacity,²² it is clear that the value of fixed capital would be larger where the hydroelectric power plays a relatively larger role in the total capacity.

On the basis of the preceding data, the ICORs for the Ukraine and the USSR can now be estimated. As indicated below, the increase in output per increase in fixed capital was one-quarter larger in the former between 1928 and 1937.

19. Table 2.2. During this period, in the following Ukrainian cities large new thermal plants have been constructed: Kiev, Chuhuiv, Kryvyi Rih, Sivero-Donets'k, Dniprodzerzhyns'k, Zuiivka, etc. The largest hydroelectric station (with the capacity of 560,400 kw) then in the USSR as well as in Europe has been constructed on the Dnieper River. See Nesterenko, 1966, p. 109.

20. Seredenko, 1957, p. 93; TsSU, 1957, p. 171.

21. Khromov, 1945, p. 46; TsSU, 1964, p. 232.

22. Khanukov, 1956, p. 192. In addition, the construction of hydroelectric stations takes much longer than that of thermal stations, but this fact is not taken into consideration in the construction cost. The production cost is much lower for the former, however. For example, in 1935 the cost of 1 KWH amounted to .97 kopeks in the Dnieper hydroelectric station, while for thermal plants in Donbas it was equal to 2.02 kopeks. See Nesterenko, 1966, p. 145.

	<i>Ukraine</i>	<i>USSR</i>
Increase in fixed capital (millions of current rubles) ²³	990	4,989.9
Increase in output (millions of 1950 rubles) ²⁴	1,114	4,243
Incremental capital output ratio	0.889	1.176
Ukraine as percentage of USSR	75.6	

In physical units, the advantage of the Ukraine is somewhat smaller. The increase in one kw in capacity resulted in the Ukraine during this period in the increase of 5,353 KWH as compared with 4,924 KWH in the USSR, or 8.7 per cent more in the former.²⁵ In view of the larger productivity of capital in the electric power industry in the Ukraine than in the USSR, an even greater expansion of this branch in the Ukraine would have been economically justified.

23. Table 2.2.

24. For the Ukraine, the value data in millions of 1950 rubles for benchmark years are 171 and 1,285 (Table A.1) and for the USSR, 680 and 4,923 (Kaplan and Moorsteen, 1960, Table 1).

25. Computed for the Ukraine from Seredenko, 1957, p. 93 and Table A.1, and for the USSR from TsSU, 1957, p. 171, and Kaplan and Moorsteen, 1960, Table 1.

10. THE MACHINE-BUILDING AND METALWORKING INDUSTRY

The statement that the machine-building and metalworking industry is the heart of industrialization in the USSR is often met in Soviet literature.¹ It is expected that the wider application of machinery in the national economy will speed up the creation of the material base of socialism and eventually of communism. In addition, the machine-building industry is of utmost importance for the defense of the country. Therefore, during the whole period of Soviet industrialization and especially during the period under discussion, when an attempt was made to become independent of the importation of machinery,²

1. For simplification, the term "machine-building industry" will be used in the subsequent discussion.

2. For example, the decrease in imports of machinery to the USSR between 1931 and 1934 from 437 to 47 million rubles is considered a great achievement for this industry. See Nesterenko, 1954, p. 345. In 1937 only 0.9 per cent of all machinery supplied was imported. See Kukhareno, 1959, p. 104. Another similar success was the great advance of both technical and engineering skills. The technical assistance from abroad that was widely used at the beginning of the First Five-Year Plan for the construction of plants and for the introduction of new machinery was eliminated at the end of the Second Five-Year Plan. See Rozenfel'd and Klimenko, 1961, p. 279.

particular attention was paid to the development of this industry in both the USSR and the Ukraine.

There are four broad factors that determine the location of machine-building plants:

(1) Because wages represent a large percentage in the total cost of machine output, the plants are drawn toward labor concentrations.³ There is, in particular, a demand for skilled labor, including engineers and other technical personnel.⁴ In addition, because of the importance of science and research in the industry, machine-building plants tend to be located in close proximity to laboratories as well as to scientific and research institutions; therefore, the plants should be situated in a region having a certain level of scientific and cultural development.⁵

(2) At the early stages of industrialization, when specialization in the output of machine parts is not yet well developed and each plant makes all the necessary parts of the machinery produced,⁶ the location of plants concentrating on metal-intensive machinery is influenced by the location of metallurgical centers.⁷ But in the course of economic growth, specialization in the output of machine parts by individual plants allows the production process to be split into several stages.⁸ Primary production, with its extensive consumption of iron and steel,

3. In Soviet machine building, the percentage of wages in the total cost of production amounted to 51.1 in 1932 and 36.5 in 1940 and for all industry 35.6 and 22.4, respectively. See Omarovskii, 1962, p. 21.

4. For example, in recent times, of every 1,000 persons employed in the machine-building industry 129 were engineers and other technical personnel, while in the iron-and-steel industry this number was equal to 67, in the textile industry, 34, etc. See Feigin, 1960, p. 134.

5. Omarovskii, 1962, p. 23.

6. The reasons are as follows: (1) the small number of machines of given type produced prevents the use of specialized, more efficient equipment; (2) if the parts are produced elsewhere, they are often unprecise and require fitting during assembly; and (3) the development of standardization, normalization, and the unification of parts and aggregates is weak. See Alampiev, 1959, p. 96.

7. The importance of iron and steel in total cost varies extensively among different machine-building branches. For example, in recent times 100,000 rubles worth of gross output of grinding-machine tools requires 440 tons of iron and steel, while the same value of low-voltage electrical instruments needs only 48 tons. See Omarovskii, 1962, p. 40, Table 4.

8. Generally, each machine-building process may be split into (1) the assembly and testing of final products; (2) the mechanical processing of individual parts or their assembly; and (3) the output of forgings, castings, and stampings. See Alampiev, 1959, p. 95.

should be located near the metallurgical plants, while the succeeding stages of production and the assembling of final products should be situated near the consumers of these products. The proximity of the primary processing stage to iron-and-steel producers not only saves on transportation costs but also allows better cooperation between the two. Of less importance for determining the location of machine-building plants are the locations of fuel and energy suppliers because as more electric power is used, it can be transmitted over long distances.⁹ Finally, the climate can be important in this respect. It influences work conditions and consequently the productivity of labor. Also as a result of different climatic conditions, the cost of the construction of machine-building plants varies as much as 25 to 30 per cent.¹⁰

(3) As has already been noted, some branches of machine building should be located close to the consumers of their output. This is necessary for the following two reasons. First, the machine must be suited to local conditions, which in a country the size of the USSR vary significantly. Second, it is necessary to consider the cost of transportation of both the inputs and the final products. Although the output of one ton of machinery requires an average of between 1.3 and 1.5 tons of iron and steel,¹¹ as well as additional quantities of other industrial materials, the cost of transportation of one ton of machinery is in many cases much higher than that of these inputs; in the case of automobiles, it is four times as high.¹² Therefore, the influence of the location of consumers, none of whom were private consumers during the period under discussion,¹³ on the location of machine-building plants is obvious.

(4) Finally, the location of machine-building plants is influenced by the degree of specialization, which is, of course, very desirable because of increasing returns to scale. Other things being equal, however, the greater the scale of the output and the larger the degree

9. Omarovskii, 1962, p. 41. This refers to the early 1960's.

10. *Ibid.*, p. 42.

11. *Ibid.*, p. 45.

12. *Ibid.*, p. 113.

13. Moorsteen, 1962, p. 110.

of specialization of an enterprise, the larger is the area supplied by the enterprise.¹⁴ This would suggest that specialized plants should be located at great distances from each other and that each of them should supply a definite zone of consumption. Since specialization requires cooperation between producers of final goods and suppliers of semi-fabricates, machine-building clusters will be created around the former. Cooperation between producers of the same or similar commodities is of equal importance. Indeed, in the USSR it seems to outweigh the tendency of specialized plants to be spread out all over the country. These advantages (as Weber would say, agglomeration) are responsible to a large degree for the creation of specialized machine-building centers in the USSR. For example, the automobile industry is concentrated in the Moscow region, heavy machine building in Donbas, etc.¹⁵

The above principles will now be applied to the Ukraine. The availability of a skilled labor force in the Ukraine was slightly above the average for the USSR.¹⁶ The universities in Kiev, Kharkov, and other cities had well-developed scientific and research facilities. The supply of necessary industrial materials was particularly favorable in the Ukraine, where, for example, over one-half of the steel, more than one-half of the coal, and one-fourth of the electric power in the USSR were produced. Finally, the above-average level of development of the Ukrainian iron-and-steel industry, mining, the chemical industry, agriculture, and transportation constituted a very large market for all kinds of machinery that could have been produced there on a large scale in specialized plants. Furthermore, the output of this large variety of machinery would have been in accordance

14. Alampiev, 1959, p. 7.

15. Feigin, 1960, p. 152.

16. For example, in 1933, the percentage of engineers and technical personnel in the total employed in large-scale industry was 6.2 in the Ukraine and 6.1 in the USSR. See TsUNKhU, 1935, pp. 10-11. In 1940, of the total employed in the national economy of the Ukraine, 3.5 per cent were specialists with a high school, college, or special education, while for the USSR this percentage was 2.8. On January, 1, 1941, engineers accounted for 2.8 per cent of all employed in Ukrainian industry and 2.6 in the USSR. See TsSU, 1961, pp. 636, 639, 654; TsSU-Ukraine, 1957, p. 385.

with the requirements of a comprehensive development of economic regions.¹⁷

These favorable conditions for the development of the machine-building industry in the Ukraine seem to have been outweighed by the pull of investment to the existing centers in the European part of Russia proper. This resulted not only from the particular importance of external economies in this industry but also from the changed composition of demand; industrialization required a greater output of electrical and precise equipment, which was almost totally concentrated in the regions near Leningrad and Moscow.¹⁸ Consequently, the Ukraine failed to improve its situation in this respect relative to the USSR. In 1928 the share of the Ukraine in the total machine building of the USSR in terms of fixed capital was considerably below its share in all large-scale industry and in terms of gross output practically equal to its share. Since the growth of both variables was very similar in the Ukraine and the USSR, 8.26 and 7.69 times in the first case and 12.1 and 11.9 times in the second, the shares at the end of the period remained virtually unchanged.¹⁹ Based on these data, the following calculation of ICORs shows that this indicator was somewhat lower in the Ukraine than in the USSR. It thus represents an additional argument in favor of greater expansion of this industry in the Ukraine during the prewar five-year plans.

17. Ideally, in the individual economic regions, machine building should be developed in the following way: (1) the construction of parts and also of finished products for the whole national economy if favorable conditions exist; (2) the assembly of parts imported from other regions and the supply of final products to the region itself and to the neighboring regions; (3) the output of complementary parts for the assembly of final products in the region itself; (4) the output of forgings, castings, and stampings if the necessary raw materials are available; (5) the output of instruments, packaging, and the provision for repair facilities; and (6) construction bureaus, experimental and research laboratories, and technical teaching facilities. See Alampiev, 1959, pp. 102-3.

18. Gladkov, 1960, pp. 299-300.

19. Tables 2.2 and A.3.

	<i>Ukraine</i>	<i>USSR</i>
Increase in fixed capital (millions of current rubles) ²⁰	2,126	12,758
Increase in output (millions of 1926/27 rubles) ²¹	4,331	24,367
Incremental capital-output ratio	0.491	0.524
Ukraine as percentage of USSR	93.7	

The above comparison of ICORs between the Ukraine and the USSR was based on official data. Since these data suffer from certain deficiencies, particularly in the case of output,²² it would be preferable to base such comparison on revised indexes. However, the construction of such an index for Ukrainian machine building, similar, for example, to Moorsteen's index for the USSR,²³ is not possible in view of the paucity of necessary information. Also, in contrast to other industrial branches, the multiplicity and heterogeneity of output in machine building do not allow support of the above results with changes in the physical output of one or few representative commodities. Instead, an analysis of differential price increases within this industrial branch will be undertaken in order to determine whether they affected the official output data in the Ukraine and the USSR.

As was shown earlier, the rate of growth of machine building between 1928 and 1937 in official 1926/27 prices was slightly higher in the Ukraine than in the USSR. The deviation of this indicator from the actual output growth of this industry could have been caused by the following three factors:

- (1) The period under discussion was characterized, on the one

20. Table 2.2. During this period, the following important machine-building plants were introduced into operation in the Ukraine: a tractor plant in Kharkov; a combines plant in Zaporizhzh'ia; a metallurgical equipment plant in Dnipropetrovsk; a mining equipment plant in Horlivka; a heavy-machine-tools plant in Kramatorsk; machine-tools plants in Kiev, Kharkov, and Odessa; precise-equipment plants in Kiev; and shipyards in Mykolaiv and Odessa. See Akademia Nauk, 1965, p. 304; Virnyk, 1967, p. 395.

21. Table A.3.

22. See Appendix A. Also, Soviet authors (cf. Rozenfel'd and Klimenko, 1961, pp. 8-9; Kantor, 1962, p. 56) are fully aware of this problem.

23. Moorsteen, 1962.

hand, by great technological progress, which was realized through the introduction of new commodities, and, on the other hand, by the inflationary tendencies on the resource market. According to the contemporary Soviet practice, the new commodities were introduced in the 1926/27 constant index at current prices. Thus, they were biasing this index upward. The bias must have had a somewhat stronger effect on the index of the USSR because, as fragmentary data indicate, the share of new goods was slightly higher in the machine building of the USSR than of the Ukraine.²⁴

(2) Soviet authors agree that the Ukraine specialized in metal-intensive machine building during the period under discussion.²⁵ Since wages were rising at a faster rate than the prices of industrial materials,²⁶ an inference can be made that the growth of aggregate output of machine building in the Ukraine relative to the USSR was not overstated in 1926/27 prices.

(3) There are some indications that efficiency of labor and management was higher in the same line of machine building in the Ukraine than in the newly developing regions of the USSR, in which some of the new plants were constructed.²⁷ The resulting decreases in the cost of production would not be reflected in the 1926/27 constant-price index. All these three factors lead to the conclusion that the real

24. For example, in the USSR new goods accounted for 57.7 per cent of the total output of this industry in 1932 and 72.8 per cent in 1933 (Rozenfel'd and Klimenko, 1961, p. 222), while in the Ukraine this percentage was equal to 50 in 1932 (Nesterenko, 1954, p. 330). Furthermore, it seems that the innovation was taking place faster in the electrical and precision-equipment branches of the machine-building industry, which were concentrated in the Leningrad and Moscow regions, than in agricultural machinery or railroad equipment, in the production of which the Ukraine specialized.

25. Cf. Khromov, 1945, p. 44; Kukhareno, 1959, p. 107; Rozenfel'd and Klimenko, 1961, pp. 319-21; Omarovskii, 1962, p. 57.

26. The price index for industrial materials in 1937 (1928 = 100) was 222 and for industrial wages, adjusted for hours, 366. See Bergson, 1961, pp. 416, 422.

27. For example, the tractor plants in Volgograd (then Stalingrad) and Kharkov were put into operation within one year, 1930 and 1931, respectively. It took much longer for the former to reach its normal output than for the latter. Also the cost of production was higher and the quality was lower in Volgograd than in Kharkov for most of the period under discussion. See Rozenfel'd and Klimenko, 1961, pp. 248-51. This was allegedly the result of the Kharkov plant's being able to benefit from the experience of the Volgograd plant (see Nesterenko, 1966, pp. 105-6) and of the Kirov plant in Leningrad (see Kolomiychenko, 1963, p. 22).

TABLE 10.1. Price Indexes of Machine Building in the USSR and Ukrainian Shares for Selected Products for Selected Years

	Price Index for 1937 (1928 = 100) Weights		Year	Ukraine as Percentage of USSR
	1927/28	1937		
	(1)	(2)	(3)	(4)
<i>Total machine building</i>	143	171	1928 1937	17.5 17.8
I. Railroad rolling stock	139	146		
1. Freight cars			1937	32.4
			1940	33.3
2. Locomotives			1928 1937	50.1 75.1
II. Tractors	48	44		
3. Tractors			1928 1937	15.4 20.8
III. Construction and road building machinery				
4. Scrapers			1940	9.9
5. Excavators	101	101	1937	6.9
			1940	6.2
IV. Agricultural machines				
6. Stubble plows			1940	69.8
7. Combines	193	126	1932	59.5
			1937	40.6
8. Tractor plows			1937	25.3
			1940	51.6
9. Tractor-seeding machines			1937 1940	69.3 51.4
V. Diesel engines	122	122		
10. Diesel engines			1940	5.4
VI. Water turbines	654	654		
11. Water turbines			1940	0.2
VII. Electrical equipment	75	77		
12. Electric motors (less than 100 kw)			1940	27.8
13. Electric motors (more than 100 kw)			1940	2.2
VIII. Metalworking machines				
14. Metal-cutting machine tools	133	142	1928 1937	40.0 18.8

SOURCES TO TABLE 10.1

Columns (1) and (2): Moorsteen, 1962, pp. 382-91.

Column (4): shares in total output of machine building from Table A.3; shares for individual products:

Line 1: TsSU-Ukraine, 1965, p. 89; TsSU, 1964, p. 227.

Line 2: *Ibid.*, p. 276.

Line 3: TsSU-Ukraine, 1965, p. 90; TsSU, 1964, p. 279.

Line 4: TsSU-Ukraine, 1965, p. 89; TsSU, 1964, p. 270.

Line 5: *Ibid.*, p. 273.

Line 6: TsSU-Ukraine, 1965, p. 91; TsSU, 1964, p. 280.

Line 7: TsSU, 1957, p. 233.

Lines 8-9: TsSU-Ukraine, 1965, p. 91; TsSU, 1964, p. 280.

Lines 10-11: TsSU-Ukraine, 1957, p. 46; TsSU, 1964, p. 250.

Lines 12-13: TsSU-Ukraine, 1965, p. 87; TsSU, 1964, p. 250.

Line 14: TsSU-Ukraine, 1965, p. 88; TsSU, 1964, p. 255.

share of the Ukraine in the machine building of the USSR at the end of this period is understated if the comparison is based on official data in 1926/27 prices.

If that is so, then the branches in which the Ukraine specialized would show a lower price increase than the average for all machine building. Table 10.1, however, fails to confirm this proposition unequivocally. This table is concerned with total machine building and with its eight broad subdivisions, which are designated by Roman numerals. Columns 1 and 2 give the price indexes for 1937 (1928 = 100) for the total and for each group, using 1927/28 and 1937 output weights, respectively. Each group consists of a number of products. In view of the scarcity of data for Ukrainian machine building, only fourteen specific machine products are listed (preceded by Arabic numerals). In some cases the output data refer to 1940 because no such data can be found for the benchmark years. These products are shown below the group to which they belong, and the price changes of this group are, of course, relevant for its constituent products. The data in Column 4 indicate the share of the Ukraine in the USSR output of listed products (in physical units) in the years (Column 3) for which they are available.

As Column 4 of this table indicates, the share of the Ukraine was higher than its share in the total machine output in the output of railroad rolling stock, agricultural machinery, small electric motors,

and metalworking machines.²⁸ It was approximately equal in the case of tractor output. Except for electric motors and tractors, for which they declined, prices rose for all products in the USSR during this period. In view of this diverse movement of current prices, there is no reason to believe that the real output increase in the Ukraine relative to the USSR deviated from the one shown in official indexes. Therefore, the earlier finding that the ICOR was slightly lower in the Ukraine than in the USSR can be considered as showing the actual trend. This would indicate that, in addition to the favorable supply of resources and the availability of demand, this factor also favored a greater expansion of machine building in the Ukraine during the period discussed.

28. This can also be observed in the distribution of fixed capital among the branches of the machine-building industry. For example, in 1932 the railroad-equipment branch accounted for 14.6 per cent of the total, the tractor branch for 10.5, and the agricultural-machinery branch for 9.9 per cent. See UNHO, 1936a, p. 92.

11. THE CHEMICAL INDUSTRY

Soviet planners attribute great importance to the development of the chemical industry. The following factors are usually cited in support of this belief.¹ Many products are cheaper if produced by this industry than if obtained through natural processes. If chemical products are used as inputs, the resulting final products are often of a better quality and their production is also more efficient. Technological progress finds its expression to a large extent in the chemical industry through the development of new products, both final and intermediate. The existing material base is more efficiently and more thoroughly utilized in connection with the use of chemical products. Finally, technological progress in other economic sectors depends greatly on the development of this industry.

In addition to factors that are common to all industry, the location of chemical plants is influenced by factors that are unique for this branch of industry. The latter may be divided into two groups, one operating toward the wider distribution of the chemical industry throughout the country and another toward its geographical concentration. The most important factor of the first group is the wide

1. Fedorenko and Savinskii, 1960, pp. 9-15.

distribution of raw materials, and in processing them this branch utilizes a larger number than any other branch. Moreover, their number tends to increase as a result of technological progress. The ability of the chemical industry to produce many products from one raw material and one product from many raw materials also facilitates its distribution all over the country.² The development of synthetic processes and the improvement of transportation operate in the same direction.³

The tendency toward geographical concentration of chemical plants is due to the following three factors. (1) In some cases a certain raw material is concentrated in one region. If its transportation is uneconomical, then the branch of the chemical industry that utilizes this input more than any other must also be concentrated in this region. (2) About 30 per cent of the output of the chemical industry in the USSR in the late 1950's was used for further processing by other chemical enterprises.⁴ Therefore, if a new chemical plant has to be constructed, it may be advantageous to locate it near an existing plant, which may be either a supplier of inputs or a consumer of output in relation to this new plant. As a result, chemical enterprises tend to be located in regional clusters. These clusters are created not only through the construction of additional plants but also through reconstruction and expansion of the existing facilities in order to save on investment in this and in complementary industries and in other economic sectors.⁵ (3) The tendency toward concentration is reinforced by the fact that machine-building enterprises, which are the most important customers of the chemical industry, are also usually located in such industrial agglomerations.⁶ This arrangement is beneficial to the chemical industry, because of an easy access to skilled labor, since the skills required in these two industries, mainly the tending of machines,

2. Nekrasov, 1959, p. 300.

3. Fedorenko and Savinskii, 1960, pp. 95-96.

4. *Ibid.*, p. 47.

5. Feigin, 1960, p. 234.

6. The output of the chemical industry in the USSR in the late 1950's was distributed as follows: heavy industry and transportation, 61 per cent (out of this 30 per cent in the machine-building industry); light industry and food processing, 10 per cent; agriculture, 19 per cent; and the rest of the national economy, 10 per cent. See Fedorenko and Savinskii, 1960, p. 9.

are similar.⁷ The comparison of these two opposing tendencies—toward wider distribution throughout the country and toward greater regional agglomeration—seems to show that the latter tends to prevail in the USSR.

The above determinants are concerned with the location of one individual plant, but in reality it is necessary in many instances to decide about the location of more than one plant at the same time because the basic raw material may serve for more than one chemical process. Furthermore, since chemical production consists of many successive stages, plants specialized in any one of them should be located near the preceding and succeeding stages of production. Such a combination of production in groups of plants, or *kombinats*, is very desirable for the national economy because of lower investment requirements and lower current expenditures.⁸ The size of *kombinat* could be very large, but in practice economic factors, like limited raw material and the difficulties of coordination, restrict the number of products that should be produced there. It is advantageous to specialize in a limited number of products and to produce them on a large scale and thus to take advantage of the economies of scale.⁹ Such specialization, of course, postulates cooperation within the chemical industry and with other branches of industry and economic sectors.

During the period under discussion, the conditions for the development of the chemical industry were very favorable in the Ukraine. The raw materials utilized in the various chemical processes can be found throughout the country. Of particular importance are the deposits of coking coal in Donbas, because the by-products of the coking industry can serve as main inputs in so-called basic chemistry (mineral fertilizers, acids, alkalis, technical salts) and in organic chemistry (dyes, explosives, condensed tars, plastics).¹⁰ In addition, deposits of such important inputs as salt, sulfur, lime, and gypsum are located in Donbas. Deposits of phosphorites, which are used in the

7. Feigin, 1960, pp. 240–41.

8. Fedorenko and Savinskii, 1960, p. 96.

9. Feigin, 1960, p. 255. If the plants, which constitute a *kombinat*, were constructed separately, their investment cost might run 20–35 per cent more. See Nesterenko, 1966, p. 112.

10. Feigin, 1960, p. 224.

production of superphosphates, are found in the Chernyiv and Kharkov *oblasts*. Kaolin, of great importance in the china, pottery, paper, and rubber industries, is found in Zaporizhzh'ia, Kiev, and Dnipropetrovs'k *oblasts*. The basic minerals for the production of dyes and varnishes are available in Zhytomyr, Chernyiv, and other *oblasts*.¹¹ The above resources and the available labor force have served in modern times as a basis for the development of the chemical industry in the Ukraine. Its output could have been significantly expanded during the period under discussion in view of the potential demand of all economic sectors for various chemicals. For example, agriculture required all kinds of mineral fertilizers; the glass industry, soda products; the textile industry, dyes; the oil industry, sulfuric acid; the machine-building industry, varnishes; and the population, pharmaceuticals. The development of plastics opened up new prospects for different new products.¹²

According to official data, the development of the chemical industry in the Ukraine was very rapid during the period discussed. The output increased from 84 to 1,141 million 1926/27 rubles, or 13.6 times, between 1928 and 1937,¹³ while fixed capital rose 8.25 times between October 1, 1928, and January 1, 1938.¹⁴ These data, however, refer not only to the chemical industry but also to the coking and petroleum-refining industries. For the chemical industry alone, output in the USSR increased from 364 to 3,512 million rubles, or 9.6 times,¹⁵ while fixed capital increased 9.95 times.¹⁶ Other sources

11. Seredenko, 1957, pp. 184-86.

12. Lukianov, 1959, pp. 314-15.

13. Khromov, 1945, pp. 34-35.

14. Table 2.2. The following new plants have been introduced into operation during the period under discussion: nitrogen fertilizers in Horlivka; camera films in Shostka; plastics in Kharkov and Dniprodzerzhyns'k; red lead in Kryvyi Rih and coking in Alchevs'k, Rutschenkovo, Horlivka, and Makiivka. The following plants have been substantially reconstructed and expanded: the chemical plant in Konstiantynivka, the chemical *kombinat* in Rubizhne, the superphosphate plant in Vinnytsia, and the soda plant in Donetsk. See Akademia Nauk, 1965, p. 308; Nesterenko, 1966, p. 113.

15. 1928, from TsUNKhU, 1936, p. 5; 1937, the figure for 1932 (1,165 million rubles from *ibid.*) multiplied by the index for 1937 (301.5 [1932 = 100] from Gosplan, 1939, p. 76).

16. Table 2.2.

indicate that the Ukraine accounted for 23.0 per cent of the total output of the chemical industry of the USSR in 1925/26, 17.8 in 1934, and 17.7 in 1937.¹⁷

The above data for fixed capital in the chemical industry in the Ukraine and the USSR cannot be used for the calculation of the respective ICORs, because of the difference in coverage. For this reason, the following adjustment had to be made. Data for fixed capital are available for the coking industry in the USSR but only for January 1, 1933, 1934, and 1935. Adding them to the fixed-capital data for the chemical industry proper gives data comparable to those for the Ukraine.¹⁸ On this basis, the change during the period between January 1, 1933, and January 1, 1935, as shown below, is calculated. In order to enhance the comparability of ICORs, the increase in fixed capital for the Ukraine is calculated only for the period between January 1, 1933, and January 1, 1938. (Data for January 1, 1935, are unavailable for the Ukraine.) It is necessary to point out that the Ukrainian data include the fixed capital of the petroleum-refining industry. This difference can be safely ignored, however, because of the negligible importance of this branch in the structure of Ukrainian industry at that time.

In order to eliminate the possible effect of deficiencies and biases of official indexes,¹⁹ the increase in output is calculated on the basis of five representative commodities, namely, coke, mineral fertilizers, sulfuric acid, soda ash, and caustic soda. The output of these products in physical units is aggregated with the help of 1950 prices, and the increase for the Ukraine and the USSR is calculated. As can be seen, the resulting ICOR for the Ukraine is less than one-half of that in the USSR.

17. Feigin, 1960, p. 231.

18. On January 1, 1933, the fixed capital of the chemical industry was equal in millions of rubles to 1,169.3 and of the coking industry to 324.5, and on January 1, 1935, to 2,026.0 and 590.7, respectively. See Kaplan, 1951. Appendix Table II.

19. The growth of the chemical industry was to a great extent due to the introduction of new products. According to Feigin, 1958, p. 229, the assimilation of complicated new products in this industry was entrusted to the old experienced centers of Moscow and Leningrad. This fact could have an upward bias on the official USSR index relative to the Ukraine, as is discussed in Appendix A.

	<i>Ukraine</i> (1932–37)	<i>USSR</i> (1932–34)
Increase in fixed capital (millions of current rubles) ²⁰	732	1,122.9
Increase in output (millions of 1950 rubles) ²¹	2,408.8	1,752.4
Incremental capital-output ratio	0.304	0.641
Ukraine as percentage of USSR	47.4	

The large difference between the ICOR in the Ukraine and the USSR may be the result of inadequacy of data. As was explained above, the fixed-capital figures differ slightly in regard to the product coverage, and both they and the output data refer to somewhat different periods. Assuming that they nevertheless indicate the actual trend, the difference can be partially accounted for also by the changing structure of USSR output, and, of course, of fixed capital, primarily by the rising share of the coke industry in all chemical industry. This can be seen from the fact that the share of the Ukraine in the coke output of the USSR declined from 95.7 per cent in 1928 to 87.0 in 1932, 77.3 in 1934, and 74.8 in 1937.²² Since the coke industry is much more capital-intensive than the other branches of the chemical industry,²³ the ICOR for the entire chemical industry of the USSR was rising relative to the Ukraine. Also, the share of the Ukraine in the USSR output of other important chemicals, in the production of which the Ukraine was specialized, was declining.²⁴ This required high initial investment in the USSR in these branches,

20. For the Ukraine, Table 2.2; for the USSR, see n. 18 above.

21. For the Ukraine the aggregate values for the benchmark years (in millions of 1950 rubles) are 2,263.7 and 4,672.2 (TsSU-Ukraine, 1965, pp. 83, 86) and for the USSR, 2,728.5 and 4,480.9 (TsSU, 1964, pp. 142, 143, 146, 160). Prices are from, Table A.1.

22. For the Ukraine, see TsSU-Ukraine, 1965, p. 83, and for the USSR, TsSU, 1964, p. 160.

23. Dividing fixed capital for 1932, 1933, and 1934 in the coke industry of the USSR by output for respective years, the average capital-output ratio of 1.55 is obtained (TsUNKhU, 1936, p. 7), while a similar ratio for the remaining branches of the chemical industry for 1928, 1932, and 1934 is equal to 0.97 (*ibid.*, p. 5).

24. Between 1928 and 1937, the Ukrainian share in the output of mineral fertilizer declined from 41.9 to 26.2, for caustic soda from 73.0 to 44.6, and for sulfuric acid from 33.9 to 22.3 per cent. See Table A.1.

and this fact obviously also had an upward effect on the ICOR of the chemical industry. Finally, the difference in the level of the ICOR between the Ukraine and the USSR could be explained simply by the existence of better mineral resources, more skilled labor and management, better social overhead, etc., in the former. In any case, in view of this obvious advantage of the Ukraine, its chemical industry should have been expanded further during the period discussed.

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12. THE FOOD INDUSTRY

The level of development of the food industry has a great influence on the productivity of the labor force.¹ The more productive this industry, the better the population is fed and the more productive is its labor.² Also, the more productive this industry, the fewer workers it employs, and workers thus released can be utilized in other ways. The industrial processing of food is usually more efficient than the preparation of food at home. Since it takes over a large part of women's traditional work, more women may be employed in other work, some of them in the food industry itself. This fact explains to a certain degree why the availability of a labor force is not an important locational determinant in this industry.³ The significance

1. It is necessary to point out that not all output of the food industry is directed toward final consumption. In recent times about one-quarter of the food industry's output belongs to Group A (producers' goods). See Sivolap and Shatkhan, 1957, p. 6.

2. Opatskii, 1958, p. 86.

3. Thus released, women usually find employment in the food industry, which explains why the proportion of females in this industry amounts to 60 per cent, while in all industry they account for 45 per cent. See Feigin, 1960, p. 426. In newly developing regions, however, where males outnumber females because

of this industry is much greater for urban than for rural populations. The preparation of food at home prevails among the rural population even when the economy is already well advanced.⁴ Urban concentrations differ in their demand for processed foods. The differences in demand depend to a large degree on the purchasing power of the population, which, in turn, depends on the character of employment because of variability in earnings, other things being equal.⁵

The location of food-industry plants is influenced by considerations common to all industry, namely, locations of resources and consumers. Because of the importance of transportation costs, such problems as perishability of inputs and outputs and the loss of weight of raw materials during their processing have to be taken into account in selecting a plant site.⁶ In general, the plants, which have to be located near the sources of raw materials, do not tend to be concentrated in one locality. (The effect of the productivity of agriculture on the scale of the plant is evident here.) Instead, the concentration of complementary enterprises in such localities is very desirable, because of the saving on investment in social overhead. There is an interaction between the food industry and agriculture. The development of the former in one region may result in an increase in productivity of the latter when it has to specialize in the output of necessary raw materials and to supply them regularly and continuously.⁷

Finally, Soviet location theory for the food industry, as for all other branches of industry, is concerned with the desirability of concentrating production in large enterprises. The size of enterprises

the first migration is predominantly male, a shortage of labor in the food industry is also felt. *Ibid.*, p. 428.

4. Opatskii, 1958, p. 88.

5. *Ibid.*, p. 93.

6. The relationship between weight of inputs per unit of output varies widely among different products of this industry. For example, 22.6 units of milk per unit of butter is necessary and, on the other hand, 0.1 unit of barley per unit of beer. See *ibid.*, pp. 97-98.

7. Some Soviet writers believe that the regularity of agricultural supplies to the food industry is only possible when the agriculture is socialized. Cf. Pokshyshevskii, 1930 .

should vary among different branches of this industry.⁸ The general rule must also apply here, however, that location and scale must be chosen so that the combined costs to the national economy of production and transportation will be least.⁹ The following factors are of influence in the relationship between transportation and the scale of food-processing plants. The greater the density of population and the greater the density of output of raw materials, the larger the plants can be. A similar relationship exists in the case of high prices of final products and low transportation rates.¹⁰

In the Ukraine the conditions for the development of the food industry were particularly favorable. The highly fertile soil and mild climate permit cultivation of virtually all raw materials necessary for its development. This situation was recognized long ago, and the Ukraine was historically the center of food processing in czarist Russia and the USSR.¹¹ Also, the importance of the food industry in the structure of all large-scale industry in the Ukraine was significant.¹² In regard to urbanization, which to a large degree tended to determine the demand for food products during the period under discussion, the Ukraine and the USSR were equally developed.¹³

The food industry consists of many branches specializing either in the output of a particular kind of product (canned goods) or having in common the utilization of a certain raw material (the meat industry). During the First Five-Year Plan, seventeen branches of this industry were subject to central planning. Their number increased to thirty-one

8. During the 1930's, gigantism spread also to this industry, often not justifiably. See Opatskii, 1958, pp. 153-54.

9. In some cases, as in the milling or the meat industry, transportation costs are twice as high as production costs. See Feigin, 1960, p. 429.

10. Opatskii, 1958, p. 140.

11. In 1908 the Ukraine with the regions of Bessarabia and the Don accounted for 36.2 per cent of all food processing. See *ibid.*, p. 209. This percentage for the Ukraine alone was 30.3 in 1928 and 27.5 in 1937. See Table A.3.

12. In terms of fixed capital, the food industry accounted for 26.9 per cent of Ukrainian large-scale industry on October 1, 1928, and 11.7 per cent on January 1, 1938 (Table 2.2), and in terms of gross output, 37.9 per cent in 1928 and 21.8 per cent in 1937 (Table A.3).

13. The urban population accounted for 19 per cent of all population in the Ukraine and 18 per cent in the USSR in 1926 and 33 and 32 per cent, respectively, in 1939. See TsUNKhU, 1939, pp. 8-9.

TABLE 12.1. Fixed Capital and Gross Output of the Ukrainian Large-Scale Food Industry by Its Particular Branches for Benchmark Years

<i>Fixed Capital</i>					
Branch	Oct. 1, 1928		Jan. 1, 1938		Jan. 1, 1938 (Oct. 1, 1928=100)
	Millions of Rubles at Original Cost	Percentage of Total	Millions of Rubles at Original Cost	Percentage of Total	
<i>Total</i>	582	100.0	1,400	100.0	240.5
A. Sugar industry	335	57.6	613	43.8	183.0
B. Other food than sugar industry	247	42.4	787	56.2	318.6
Meat products	9	1.5	83	5.9	922.2
Milk products	1	0.2	43	3.1	4,300.0
Bakery products	6	1.0	91	6.5	1,516.7
Confectionery	6	1.0	43	3.1	716.7
Canned goods	3	0.5	54	3.9	1,800.0
Spirits	29	5.0	106	7.6	365.5
Tobacco and makhorka	13	2.2	19	1.4	146.2
Others	180	31.0	348	24.7	193.3
<i>Output</i>					
	1928		1937		1937 (1928 = 100)
	Millions of 1926/27 Rubles	Percentage of Total	Millions of 1926/27 Rubles	Percentage of Total	
<i>Total</i>	1,107	100.0	3,529	100.0	318.8
A. Sugar industry	524	47.4	846	24.0	161.5
B. Other food than sugar industry	583	52.6	2,683	76.0	460.2
Meat products	40	3.6	321	9.1	802.5
Milk products	1	0.1	109	3.1	10,900.0
Bakery products	28	2.5	370	10.5	1,321.4
Confectionery	27	2.4	343	9.7	1,270.4
Canned goods	8	0.7	63	1.8	787.5
Spirits	28	2.5	100	2.8	357.1
Tobacco and makhorka	48	4.3	103	2.9	214.6
Others	403	36.5	1,274	36.1	316.2

Source: Adapted from Kukharensko, 1959, pp. 112, 113.

in 1935.¹⁴ Virtually all these branches were developed in the Ukraine. Table 12.1 presents the distribution of the Ukrainian food industry by selected branches in terms of fixed capital and gross output. As can be seen, the total fixed capital increased 2.4 times between the benchmark dates, while the gross output in 1926/27 prices increased 3.2 times. In distribution, the sugar industry was by far of the greatest importance, although its share in the total declined during this period. In terms of output, the importance of branches producing meat, canned, and bakery goods was rising.¹⁵

It is necessary to point out that the increase in output and to a lesser extent in fixed capital in all large-scale industry but especially so in this branch can be attributed not only to the growth itself but also to the fact that small-scale enterprises had been consolidated and hence merited upgrading to the large-scale category.¹⁶ This is because the role of small-scale enterprises was always more important in the food industry than in other branches of industry. Furthermore, although during the period under discussion the significance of small-scale industry in this and other branches tended to decline, the inclusion of its output, and to a much lesser degree of its fixed capital, with the large-scale food industry in the respective time series would still make a noticeable difference.¹⁷ Finally, the inferences concerning the welfare of the population on the basis of data for the large-scale food industry should in most cases be avoided, since in a time of rapid industrialization increases in the volume of food processing are often the result of a transfer of economic activities from the home to industry.¹⁸

Table 12.2 summarizes the situation of the Ukraine with regard to the food industry within the USSR for the initial and terminal years of the period under discussion. As was indicated earlier, the data on the development of the food industry become more meaningful when

14. Opatskii, 1958, pp. 202-3.

15. The output in physical units of six important products, for which data are available, is shown in Table A.1.

16. Hak and Marin, 1957, p. 30.

17. See the discussion on the importance of small-scale industry on the index of consumer goods in the USSR in Kaplan and Moorsteen, 1960, pp. 11-13.

18. Excluded from the data in this study are also foods sold on the *kolkhoz* market.

TABLE 12.2. Indexes of Population, Fixed Capital, Output, and Output per Capita of the Large-Scale Food Industry in the Ukraine and the USSR and the Ukrainian Shares for Benchmark Years

	1937 (1928 = 100)		Ukraine as Percentage of USSR	
	Ukraine	USSR	1928	1937
A. Population				
1. Total	106.6	115.9	19.8	18.2
2. Urban	208.3	213.3	20.4	20.0
B. Fixed capital				
3. Total food industry	240.5	397.5	38.0	23.0
4. Sugar industry	183.0	214.9	80.3	68.4
5. Other than sugar food industry	318.6	465.8	22.2	15.2
C. Output				
6. Total food industry	318.8	351.2	30.3	27.5
7. Sugar industry	161.5	178.4	81.9	74.1
8. Other than sugar food industry	460.2	387.9	19.3	22.9
D. Output per capita of all population				
9. Total food industry	300.0	300.0	152.0	152.0
10. Sugar industry	150.0	175.0	450.0	385.7
11. Other than sugar food industry	435.0	323.8	95.2	127.9
E. Output per capita of urban population				
12. Total food industry	152.9	164.7	148.2	137.6
13. Sugar industry	77.6	83.3	408.3	380.0
14. Other than sugar food industry	221.3	181.7	93.9	114.4

Sources: Line (1) and (2): Data refer to censuses on December 17, 1926, and January 17, 1939, from TsUNKhU, 1939, pp. 8-9.

Line (3): Data refer to October 1, 1928, and January 1, 1938, from Table 2.2.

Line (4): Ukraine, Table 12.1; USSR, for 1928, 417 million rubles (TsUNKhU, 1936, p. 17). For Jan. 1, 1938, extrapolated in the following way: TsUNKhU, 1936, p. 17, gives the value of fixed capital of the large-scale sugar industry for the USSR on January 1, 1935, as 680.5 million rubles. The average rate of growth of fixed capital in this industry between 1928 and 1935 is calculated and applied for the extrapolation to January 1, 1938. The value of 896 million rubles is obtained. This estimate can be supported by the following evidence: In 1927/28, 82 per cent of all sugar refineries of the USSR were located in the Ukraine (Voblyi, 1946, p. 5), or 80 per cent in value terms. During the period under discussion, fourteen new sugar refineries were constructed in the USSR (TsUNKhU, 1939, p. 81), five of them in the Ukraine (Voblyi, 1946, p. 6). According to Voblyi, on January 1, 1939, the Ukraine accounted for 75 per cent of all sugar refineries of the USSR. Present estimates indicate that the share of the Ukraine on January 1, 1938, was equal to 67. Abstracting from the one-year difference,

SOURCES TO TABLE 12.2 (CONTINUED)

the relatively smaller share of the Ukraine in fixed capital than in the number of refineries may result from the fact that more refineries during this period were constructed outside the Ukraine, and, because of the rising cost of construction, their value increased more than their number in comparison with the Ukraine.

Line (5): Difference between Lines (3) and (4).

Line (6): Table A.3.

Line (7): Ukraine, Table 12.1; USSR, for 1928, 640 million rubles (TsUNKhU, 1936, p. 17). The figure for 1937, equal to 1,142 million rubles, was obtained on the basis of growth of output of granulated and refined sugar, using 1950 sales as weights (Kaplan and Moorsteen, 1960, p. 203). This can be supported by the following evidence: In 1928, the Ukraine produced 81.1 per cent of granulated sugar (Table A.1), and the share of the Ukraine in output of sugar in value terms was equal to 81.9 per cent. In respect to the output of refined sugar, the position of the Ukraine changed very little between 1913 and 1938, from 74.1 to 77.6 per cent (Opatskii, 1958, p. 228). Since the share of the Ukraine in output of granulated sugar was 73.4 per cent in 1937, the estimate in this table of the Ukrainian share in total sugar production in value terms of 74.1 per cent seems to be very credible.

Line (8): Difference between Lines (6) and (7).

Lines (9), (10), and (11): Obtained by dividing Lines (6), (7), and (8) by Line (1).

Lines (12), (13), and (14): Obtained by dividing Lines (6), (7), and (8) by Line (2).

related to the changes in population. In Section A, the growth of the total and urban population of the Ukraine and of the USSR is shown. Fixed capital and output in the food industry are subdivided into the sugar industry and other food industry (Sections B and C). The emphasis on the sugar industry is, of course, because of its importance in the structure of the Ukrainian food industry. Section D indicates the growth of the output per capita of the entire population and the last section the output per capita of the urban population. Both are subdivided into sugar and other than sugar food industries. The output per capita of all the population is perhaps less important than the output per capita of the urban population only, because in the contemporary USSR the output of the food industry, with the exception of sugar, was mainly directed toward the satisfaction of urban consumers.

Although the growth of output of the food industry was faster in the USSR than in the Ukraine, because the growth of the population of the latter was slower, there was no change in the relationship between the Ukraine and the USSR with respect to total food output per capita of the entire population between 1928 and 1937, as shown in Line 9. The output per capita in the Ukraine was more than 50 per cent larger than in the USSR. The output of the sugar industry per capita

was 4.5 times as large in the Ukraine as in the USSR in 1928, but it declined considerably and was 3.8 times in 1937. The output of other food per capita tended to rise in the Ukraine and was more than one-quarter larger than in the USSR at the end of the period. Section E shows the output of food per capita of the urban population. It might be observed that here, as previously, the Ukraine was in a favorable position. It was producing almost 50 per cent more per urban consumer than the USSR, but this advantage declined to over one-third at the end of the period. In the output of the sugar industry per capita of urban population there is also a slight decline in the Ukraine, from 408 per cent to 380 per cent. In the output of other foods per urban consumer the Ukraine increased its percentage in relation to the USSR from 94 to 114 between 1928 and 1937.

This table also shows that the fixed capital in food industry increased faster in the USSR than in the Ukraine during the period under discussion, 3.98 and 2.41 times, respectively. The increase was greater for branches of industry other than sugar than for the sugar industry. As a result, the Ukrainian share in fixed capital of the whole food industry and its two subdivisions in the USSR declined between the benchmark dates. According to one source, the food industry of the USSR received seven billion rubles of investment during the First and Second Five-Year Plans. Out of this, only one billion was invested in the Ukraine,¹⁹ despite the fact that it accounted for almost one-fifth of the total population in the USSR.

In terms of ICOR alone, such an investment policy was not justified. As the figures in Table 12.3 indicate, the ICOR was lower by one-tenth in the Ukraine than in the USSR for the sugar industry and by almost one-half for other than sugar food industry during the period under discussion. One of the basic reasons for this great

19. Hak and Marin, 1957, p. 33. The authors do not explain what rubles they use in deriving this figure. Other sources give different estimates of the total investment in the USSR food industry during this period of time. According to Kaplan, 1951, p. 66, it amounted to almost 6 billion rubles in current prices, while Sivolap and Shakhtan, 1957, p. 32, give the figure of 9.2 billion 1955 rubles. Assuming that Hak and Marin are consistent in their calculations, no matter what rubles they use, the Ukraine received one-seventh of the investment, which is far below its initial share in fixed capital, which, as might be recalled, was larger than one-third.

TABLE 12.3. Capital-Output Ratios in the Large-Scale Food Industry by Main Branches for the Ukraine and the USSR Between Benchmark Years

Branch	Increase in Fixed Capital (millions of current rubles)		Increase in Output (millions of 1926/27 rubles)		Incremental Capital-Output Ratio		
	Ukraine	USSR	Ukraine	USSR	Ukraine	USSR	Ukraine as Percentage of USSR
Total	818	4,554	2,422	9,182	0.338	0.496	68.1
Sugar	278	479	322	502	0.863	0.954	90.5
Other than sugar food	540	4,075	2,100	8,680	0.257	0.469	54.8

Sources: Fixed capital: Ukraine, Table 2.2; USSR, Table 2.2 and 12.2, n. 4. Output: Ukraine, Table 12.1; USSR, Table A.3 and 12.2, n. 7.

difference was the fact that the investment in the Ukraine, and in other western regions of the USSR, was used for the reconstruction and expansion of existing plants, while in the east, to which its large part was allocated, it was used for new construction.

In view of the higher ICOR in the USSR than in the Ukraine, the following explanation can be offered for the fact that fixed capital increased after all at a faster rate in the former. In the 1930's there was a general emphasis on the development of certain heavy-industry branches in the Urals, in western Siberia, and to a lesser degree in other areas of the Asian part of the USSR. Since at the beginning of the period under discussion these regions were very backward, industrialization was necessarily accompanied by urbanization, which implies the establishment also of a food industry.²⁰ This was absolutely necessary because many foods produced in the western regions of the USSR were too heavy or too perishable to be transported over long distances to new industrial centers. Even if the differentials in the cost of production were greatly in favor of the west, transportation costs in many cases would outweigh them. Therefore, having decided to go ahead with the development of heavy industry in the east, the concomi-

20. While the share of these regions in the total population in the USSR increased from 19.4 to 24.4 per cent between 1913 and 1940, their urban part tripled between 1926 and 1940, from 5.5 to 14.7 million. See Opatskii, 1958, p. 207.

tant development of a local food industry was unavoidable, regardless of cost. As a result of this policy, the share of the eastern regions increased between 1908 and 1938 from 0.6 to 5.7 per cent of the total food output. In sugar output alone, this share rose from 0.5 to 8.5 per cent of the total.²¹ Despite these substantial increases, Soviet authors complain that they were still too low to meet the growing demand for food products in the east.²²

The relationship between the Ukraine and the USSR in regard to the productivity of capital varied among individual branches of the food industry. For example, it is possible that investment in the meat and milk industries in Siberia, based on its livestock economy, might have been more efficient than in the Ukraine. As was shown above, the opposite was true for the sugar industry. Since the latter is of particular importance in the structure of Ukrainian industry, it deserves separate attention. The sugar industry can be established in a region in which the conditions are appropriate for the growing of its main input, sugar beets, because they lose in processing more than three-quarters of their weight, and thus their transportation over longer distances is inefficient.²³ The mild climate, fertile soil, and the ample supply of labor facilitated sugar-beet production in many regions of the Ukraine. The high and stable yields allowed the construction of sugar mills there on a large scale and assured their full utilization. It was then economical to export sugar to urban centers of the western USSR, because the transportation costs were offset by the low cost of production. However, the distance from the Ukraine to the newly developing industrial and urban centers in the east was prohibitive.²⁴ Since the idea of importing the necessary

21. *Ibid.*, pp. 209 and 223.

22. *Ibid.*, p. 212.

23. The average transportation distance of sugar beets in the Ukraine amounted to 81.8 kilometers in 1934/35, 108.7 in 1935/36, and 154.7 in 1937/38. See Voblyi, 1946, p. 14.

24. For example, in the 1950's the shipping cost of one ton of sugar from the Moldavian Republic, which would be comparable to the southwest Ukraine, to Novosibirsk in West Siberia amounted to 333 rubles, and Novosibirsk is only half-way to, say, Khabarovsk in the far east. See Opatskii, 1958, p. 242. This amounts to almost one-third of the retail price of sugar. According to Kaplan and Moorsteen, 1960, p. 207, in 1947 it was equal to 1,148 rubles for one ton of granulated sugar and 1,320 rubles for one ton of refined sugar.

sugar from abroad through Pacific ports was not even contemplated, in order that these regions could start their own sugar industry they had to develop first their own raw material base.

As a result, the area under sugar-beet cultivation in the USSR increased 81 per cent between 1913 and 1940, while in the Ukraine it increased 46 per cent.²⁵ The development proceeded in general in two directions:²⁶ (1) An extension of sugar-beet cultivation was undertaken from Russian black-earth regions toward the east, as far as climatic conditions allowed. This location for the sugar industry was preferable to that in the Ukraine, because from there the transportation costs per ton of sugar would be lower than, for example, from Moldavia: 85 rubles lower to western Siberia and 100 rubles lower to the far east.²⁷ The disadvantage was the low yield of sugar beets in these regions. In two oblasts, Kursk and Voronezh, the yield was 83 and 86 per cent, respectively, of the average in the Ukraine between 1934 and 1938.²⁸ Obviously, this pulled the cost of the production of sugar upward relative to its cost in the Ukraine.

(2) Some high-temperature areas in Transcaucasia and in Central Asia were taken under cultivation, but their aridity caused them to require irrigation. In regard to Transcaucasia, the Krasnodar region showed a good sugar-beet harvest, although sometimes the excessive summer heats damaged the crop.²⁹ The possibility of developing the sugar industry in the Altai region in Central Asia was even more attractive, because of its proximity to the Ural-Kuznetsk industrial centers. But two obstacles were encountered. First, the growing season was much too short, so that frequently nearly half of the planted area had to be abandoned. Secondly, the supply of labor, primarily during sugar-beet harvests, was much too small, because of the general low density of population in these areas and because of competition from the livestock industry and grain cultivation.

25. TsSU, 1961, p. 402. Data refer to the present political borders, but they should not obscure the tendency toward development in the 1930's.

26. Timoshenko, 1951, pp. 3-4.

27. Opatskii, 1958, p. 237.

28. *Ibid.*, p. 239. For all Russian SFSR, the yield was below the average for the USSR; for example, 82.5 in 1939 and 75.4 per cent in 1940. See Timoshenko, 1951, p. 7.

29. *Ibid.*, p. 4.

As a result, in some prewar years the yields in this region averaged as low as 6 tons per hectare, while in the Ukraine they amounted, for example, to 14.5 tons in 1939 and 18 tons in 1940.³⁰ Consequently, the cost of sugar-beet production in the Altai region was much higher than in the Ukraine. In fact, this difference was more than twice as high as the transportation cost from the Ukraine to western Siberia.³¹ This shows clearly that, within the framework of contemporary autarchic policy, it was cheaper, after all, to transport the sugar from the Ukraine to the eastern industrial centers than produce it locally.

Another area, and a much more appropriate one, in which the development of the sugar industry took place was the valley of the River Chu in Kazakhstan and North Kirgizia. The temperature here is hot, and the summers long enough to grow sugar beets. The spare rainfall had to be supplemented by irrigation. But even including expenditure on irrigation the cost of the production of sugar beets was lower here than in the Ukraine. The former required two man-days for the production of one ton of sugar beets, while in the latter three man-days were necessary.³² Also, the percentage of sugar component in the sugar beets was higher in Central Asia than on the average for the USSR, which consequently kept the cost of sugar production lower.³³ The final argument for the development of the sugar industry in these regions was their location. The cost of sugar transportation from these regions to eastern consumers would have been much cheaper than from traditional sugar suppliers in the west of the USSR. The only factor preventing large-scale expansion in sugar-beet cultivation was the limited availability of the irrigated area because of competition from a more valuable crop, cotton.

30. *Ibid.*, p. 5.

31. With the introduction of differential procurement prices in the 1950's, the differences in the cost of production of sugar beets among regions became more evident. In Altai the price per ton of sugar beets amounted to 320 rubles, while in the Ukraine it was 210 rubles. Since for the production of one ton of sugar seven tons of sugar beets are necessary, the difference in the cost of raw materials amounted to 770 rubles, and the transportation cost from the western Ukraine to western Siberia was equal to about 333 rubles. See Opatskii, 1958, p. 242.

32. *Ibid.*, p. 245. In 1939 the sugar-beet yield in Kazakh SSR was 216 per cent of the average yield for the USSR and in Kirgiz SSR 284 per cent. In 1940 the respective percentages were 163 and 253 per cent. See Timoshenko, 1951, p. 7.

33. Opatskii, 1958, p. 237,

Only the acreage unfit for cotton could be used for the planting of sugar beets.³⁴

The previous discussion has shown that the expansion of acreage under sugar-beet cultivation outside the Ukraine was possible only at a higher cost. The successful development in some regions of Central Asia was hindered by the scarcity of suitable area. Now the question may be raised whether sugar refineries constructed in new sugar beet areas were as productive as in the Ukraine. During the prewar five-year plans, eighteen new sugar refineries were constructed. They were distributed as follows: five in the Ukraine, three in Kazakhstan, two each in Kirgizia and in Altai Krai, and one each in Primorye Krai, Georgia, and Krasnodar Krai.³⁵ The three not accounted for must have been located in the black-earth *oblasts* of the Russian SFSR. As was shown previously, the ICOR was higher for the sugar industry outside the Ukraine. This can be explained by the following two factors. The Ukraine has three-quarters of a century more experience in producing sugar; and, secondly, according to Soviet writers, the largest sugar plants were constructed in the Ukraine because of the high yields in sugar-beet cultivation prevailing there.³⁶ Other things being equal, the investment in larger plants would be more productive than in smaller ones. The lower productivity of investment in the sugar industry outside the Ukraine and the higher cost of sugar-beet production previously discussed were implicitly admitted by the Soviet authorities themselves. There was not a single sugar refinery constructed in the eastern regions during the Fourth and Fifth Five-Year Plans. Moreover, some refineries which had been constructed in these regions during World War II were dismantled afterwards,³⁷ apparently because of their low productivity.

34. Timoshenko, 1951, p. 4.

35. Opatskii, 1958, p. 233.

36. In the Ukraine refineries were constructed in Lokhvytsia, Kupians'k, Veselyi Podil, Hnivan', and Shpola. The first three are called "giants" and are the largest in the USSR. See Voblyi, 1946, pp. 6 and 14. According to Hak and Marin, 1957, p. 37, the refinery constructed in Lokhvytsia was the largest in the USSR and in Europe. In general, the capacity to process sugar beets per twenty four hours increased in Ukrainian plants by 23 per cent between 1927/28 and 1940/41. See *ibid.*, p. 52.

37. Opatskii, 1958, p. 224; for example, four plants in Tadzhik SSR.

In view of the above, it seems clear that the attempts to develop a sugar industry in regions other than the Ukraine were economically unjustified. However, in order to supply refined sugar which was actually suitable for consumption to the population of the eastern regions and also in order to promote a more even geographical distribution of the industry, the refined-sugar plants should have been constructed there. These plants work on granulated sugar as intermediate material and utilize it almost completely in the processing.³⁸ The granulated sugar could have been imported to these plants from traditional sugar-producing centers. But during the period under discussion not one such plant was constructed.³⁹ And out of twenty such plants in existence,⁴⁰ nine were located in the Ukraine, producing around three-quarters of the entire refined-sugar output,⁴¹ while the remaining plants were located in the vicinity of the main consumer centers of Russia proper.

38. Khanukov, 1956, p. 213.

39. Opatskii, 1958, p. 228.

40. Voblyi, 1946, p. 6.

41. Hak and Marin, 1957, p. 53. The output of refined sugar amounted to 474,060 tons in the Ukraine in 1940/41 (*ibid.*), while in the USSR in 1940 it amounted to 628,000 tons (TsSU, 1964, p. 427).

13. LIGHT INDUSTRY

Like the food industry, light industry produces most of its output for direct use by individual consumers.¹ Its output can be subdivided into the following three broad groups: textiles, including knitwear; apparel; and leather and shoe, including furs.

The location of light-industry plants depends to a great degree on the location of agriculture, which during the period under discussion supplied most of the needed raw materials.² Since some of them, for example, cotton, can be produced only under specific climatic and natural conditions, their supply is concentrated in a few regions of the USSR. In most cases their transportation is more expensive than that of intermediate goods derived from them. Hence, it is an advantage to locate primary processing plants in regions producing raw materials.³ The fertility of land has a direct influence on the scale of plants. In many cases, light-industry plants through their demand

1. Before World War II approximately 10 per cent of the total output of this industry was used by other industries and economic sectors. See Khromov, 1946, p. 82.

2. Feigin, 1960, p. 375.

3. Khanukov, 1956, pp. 207–8. For example, in order to obtain one ton of cotton fiber, it is necessary to process three tons of cotton, on the average.

may influence the kind of crops grown in the surrounding area.⁴ In more recent times, the development of many artificial materials that are good substitutes for raw materials has made the locations of light-industry plants less dependent on agricultural locations. The same can be said about the relationship between the locations of this industry and locations of sources of power and fuel.⁵

Since the bulk of light-industry output is used directly by consumers, it seems logical that its plants, if they are not drawn to the locations of raw materials, should be located proportionally to population distribution. In such a way not only would the transportation cost be minimized, but the output would also be adapted to local needs and tastes, which are usually determined by customs and climate. In reality light-industry plants are often concentrated in large industrial centers because of the availability of labor, which is recruited primarily from the female dependents of workers employed in other branches of industry. As a result, the percentage of women employed in light-industry is much higher than in the industry as a whole.⁶ When light industry is located in industrially underdeveloped areas, it has a beneficial effect on the local economy, because, in addition to satisfying the local demand for consumer goods, it offers job opportunities for excess labor in neighboring agriculture and for the seasonally unemployed.⁷

Usually the locations of consumers, raw materials, and fuel sources do not coincide.⁸ The location of a light-industry plant is then chosen with the objective of having the combined costs of production and of transportation at a minimum. If locations of raw materials and consumers alone are considered, it is better to split productions of textiles, for example, into two parts—primary processing close to

4. Feigin, 1960, p. 376.

5. *Ibid.*, p. 375. Output of one ton of cotton goods requires 1.88 tons of standardized fuel and 2,964 KWH of electricity, while woolen goods require 3.9 tons of fuel and 2,934 KWH. However, fuel and energy used accounted for only 3.7 per cent of total production cost for textiles in 1932 and 2.7 per cent in 1937. See Khromov, 1946, p. 149.

6. In some cases this percentage is as high as 99. See Feigin, 1960, p. 383.

7. *Ibid.*, p. 405.

8. Assuming that labor is easily available at any of these locations.

sources of raw materials and output of finished products close to centers of population.⁹ The location decision becomes more complicated when fuel is introduced as another variable. If deposits of fuel, usually coal, do not coincide with the location of raw materials or of consumers and if each weight unit of final product requires as much as six or seven times as much coal, then the logical choice for the location of a textile plant should be one near fuel deposits.¹⁰ In Soviet practice this advantage of fuel location for the determination of textile plants is eliminated by the differential freight rates. They are below the real cost of coal transportation, and they are in effect a subsidy by the national economy to the textile industry. In order to shift the burden of this subsidy to the consumer, the freight rates on textile products are higher than their real transportation costs.¹¹ Since transportation costs are a small fraction of the price of textiles, the difference is not felt by the consumer, although the total burden to all consumers is significant and could be avoided if the plants were located more rationally.¹²

Finally, the existing light-industry plants tend to attract new ones because of lower investment requirements, complementary relations and the availability of a skilled labor force.¹³ This fact is particularly important when an increase in output is needed in a short time, and it may be facilitated by the use of investment funds for reconstruction instead of for new projects, because the former are usually more

9. There are some exceptions, however. For example, it would be more rational to process hides at locations where there is livestock, but because there is a demand for meat at centers of population and if meat cannot be transported over longer distances with the available transportation equipment, it is necessary to haul animals to the slaughtering centers, and the processing of hides has to take place there, too. See Khanukov, 1956, p. 210.

10. This factor explains why in czarist Russia the textile industry originated in the central regions. The availability of peat and wood fuel, together with an ample supply of labor, accounted for the advantageous conditions for the development of this industry, although the main input — cotton — had to be transported from Central Asia or from abroad.

11. *Ibid.*, p. 61. This subsidy to the textile industry was more than compensated for if one takes into account very high turnover taxes on textile products.

12. Feigin, 1960, p. 379.

13. Khromov, 1946, p. 75.

productive than the latter.¹⁴ Such external economies existed in the textile centers of Russia proper. They, together with the below-cost freight tariffs on coal from Donbas and cotton from Central Asia, assisted in the production of textiles at low cost. Despite its ample consumer market and its relatively favorable raw-material situation as shown below, the Ukraine failed to develop its own textile industry before the Revolution because it would not survive the competition with the established industry in the North. After the Revolution, the Ukraine's disadvantage of being late in this respect was reinforced by the general lack of attention to the development of this industry and also by the bureaucratic inflexibility of central planners.

As will be shown subsequently, the Ukrainian light industry was generally less developed than other branches of industry. This cannot be explained by the lack of necessary labor in the Ukraine, since this industry employs ordinary labor skills available everywhere. Also, most of the necessary raw materials were available in the Ukraine. For example, in the case of the textile industry the Ukraine was certainly no less endowed with raw materials than the Russian SFSR and its Central region, in particular, where the bulk of this industry was located. The Ukraine produced 3.2 and 2.6 per cent of cotton fibers of the total for the USSR in 1932 and 1937, respectively, while the Russian SFSR produced 3.5 and 2.2 per cent in the same years.¹⁵ In both cases the necessary cotton had to be imported from Central Asia, although the distance to the Moscow area was a little shorter than to the Ukraine. The other input, fuel, the Ukraine had in ample supply, while the Central region had to import the bulk of its needs.¹⁶ In the case of washed wool the Ukraine produced 18 per cent of the total for the USSR in 1940, while the Russian SFSR produced 45.8 per cent, with the Central region producing only 3.1 per cent.¹⁷ Other inputs for the textile industry, such as flax, hemp, kenaf, and natural

14. Feigin, 1960, p. 386.

15. TsSU, 1957, p. 324.

16. For example, in 1940 the textile industry of the Central region consumed 4.2 million cubic meters of wood, 3.8 million tons of peat, and 1.4 million tons of coal. Only 128,000 tons of coal were produced there; the rest of the coal had to be imported, presumably from Donbas. See Feigin, 1960, p. 394.

17. TsSU, 1957, p. 326.

silk also originated in the Ukraine.¹⁸ There was no output of artificial fibers in the Ukraine during the period under discussion while outside the Ukraine, in addition to the existing plant in Mytishchi, near Moscow, new plants were constructed in the Moscow *oblast* (Klimvolokno)¹⁹ in Mogilev, and in Leningrad.²⁰

The main raw materials for another important branch of light industry, namely, the production of leather and furs, are supplied by livestock. In this respect the Ukraine was in a much better situation than in the case of raw materials for the textile industry. Table 13.1

TABLE 13.1. Share of the Ukraine in Stock of Horses, Cattle, Pigs, Sheep and Goats in the Total for the USSR for Benchmark Years (per cent)

Stock	1928	1937
Horses	17.1	17.3
Cattle	14.3	14.9
Hogs	31.6	32.2
Sheep and Goats	7.6	5.2

Sources: Ukraine, Gorelik, 1956, pp. 61, 66; USSR, TsSU, 1961, p. 448.

shows the share of the Ukraine in the various kinds of livestock of the total for the USSR. As can be seen, it was the highest in hogs, followed by horses and cattle. Another input for leather processing—tannin—was produced in three Ukrainian plants,²¹ while outside the Ukraine eleven plants, nine of which had already been constructed during the First Five-Year Plan, were working.²² A leather substitute was produced in the Ukraine in only one newly constructed plant in Odessa, while outside the Ukraine thirteen such plants were located, seven of which were new.²³ In addition, the Ukraine was endowed with a great number of other important industrial and

18. Of the total area under flax the Ukraine accounted for 6 per cent in 1938. See Korneev, 1957, p. 127.

19. Strumilin, 1961, p. 251.

20. Korneev, 1957, p. 140.

21. Gorelik, 1956, p. 68.

22. *Ibid.*, p. 63.

23. *Ibid.*, pp. 63 and 68.

agricultural products which could have served as an excellent basis for the development of diversified light industry.

The development of Ukrainian large-scale light industry for the benchmark years can be observed from the data in Table 13.2. It

TABLE 13.2. Fixed Capital and Output of Ukrainian Large-Scale Light Industry by Particular Branches for Benchmark Years

<i>Fixed Capital</i>					
Branch	Oct. 1, 1928		Jan. 1, 1938		Jan. 1, 1938 (Oct. 1, 1928 = 100)
	Millions of Rubles at Original Cost	Percentage of Total	Millions of Rubles at Original Cost	Percentage of Total	
Total	63	100.0	285	100.0	452.4
Textiles	29	46.0	182	63.8	627.6
Apparel	8	12.7	37	13.0	462.5
Leather and shoes	26	41.3	66	23.2	253.8

<i>Output</i>					
Branch	1928		1937		1937 (1928 = 100)
	Millions of 1926/27 Rubles	Percentage of Total	Millions of 1926/27 Rubles	Percentage of Total	
Total	249	100.0	1,419	100.0	569.9
Textiles	69	27.7	509	35.9	737.7
Apparel	61	24.5	511	36.0	837.7
Leather and shoes	119	47.8	399	28.1	335.3

Source: Kukharensko, 1959, pp. 110-11.

shows fixed capital and output for the total and for the three main branches. As can be seen, the fixed capital grew 4.52 times in the Ukraine and 2.09 times for the USSR between October 1, 1928, and January 1, 1938. This increase was the result of the faster growth of the textile branch in the former, the share of which rose from 1.4 to 4.8

between benchmark dates, while for the apparel and leather and shoe branches it declined from 20.6 to 15.9 and 13.4 to 10.1, respectively.²⁴ As in the case of the food industry, it is necessary to point out that the increases of large-scale light industry were partly due to the absorption of small-scale and artisan enterprises. This can be seen from the rising importance of large-scale industry in the output of all light industry in the Ukraine. Its share rose between 1926/27 and 1940 from 64.7 to 95.8 for the textile industry, from 55.4 to 98.3 for the knitwear industry, from 11.9 to 80.0 for the shoe industry, and from 14.5 to 85.2 for the apparel industry.²⁵ These increases resulted also from new investment. During the First and Second Five-Year Plans, the planners allocated to the Ukrainian knitwear industry 37.7; leather, 30.9; shoe, 35.9; and apparel, 34.0 million rubles.²⁶ These funds were used for the construction of many new enterprises and the reconstruction of many old ones,²⁷ with the result that these facilities accounted for 81 per cent of the total output in this industry at the end of the period discussed.²⁸

As a result of an increase in fixed capital, the output of Ukrainian large-scale industry increased 5.7 times during the period under discussion, while for the USSR this increase amounted to 3.2 times. For the benchmark years the share of the Ukraine increased for the total from 4.8 to 8.4, for textiles from 1.7 to 5.0, and for apparel from 13.6 to 15.3. For the leather and shoe industry it declined from 17.5 to 11.8.²⁹ This trend is confirmed by the uniformly larger shares of the Ukraine in the USSR output of selected commodities of this industry in physical units in 1937 as compared with 1928, as shown in Table A.1. Another reason for larger output increases in the Ukraine may

24. Table 2.2.

25. Iudin, 1957, p. 89.

26. Gorelik, 1956, p. 71.

27. The following new plants have been constructed: shoe plants in Kiev, Kharkov, and Dnipropetrovs'k; an apparel plant in Kiev; knitwear plants in Kiev, Odessa, and Kharkov; twenty-two hemp-processing plants, two flax-processing plants, and a large cotton-spinning plant in Poltava; and others. See Serechenko, 1957, pp. 235, 240.

28. Nesterenko, 1954, p. 400. In contrast, only 39 per cent of all textile and 24.1 per cent of cotton textile plants in the USSR were new or reconstructed at that time. See Korneev, 1957, p. 160.

29. Ukraine, Table 13.2; USSR, Table A.3, n. k.

be the fact that the fixed capital of this industry doubled between 1925/26 and 1928/29, and after the period of gestation the plants were operating at full capacity.³⁰ However, the upward bias caused by the introduction of so-called new goods might also have been influential on the growth of output in constant 1926/27 prices.³¹

The preceding data on fixed capital and output can now be used for the calculation of ICORs for the total light industry and its branches during the period discussed. As can be seen in Table 13.3,

TABLE 13.3. Capital-Output Ratios in Large-Scale Light Industry by Particular Branches for the Ukraine and the USSR Between Benchmark Years

Branch	Increase in Fixed Capital (millions of current rubles)		Increase in Output (millions of 1926/27 rubles)		Incremental Capital-Output Ratio		
	Ukraine	USSR	Ukraine	USSR	Ukraine	USSR	Ukraine as Percent- age of USSR
Total	222	2,438.2	1,170	11,592	0.190	0.210	90.5
Textiles	153	1,787.0	440	5,993	0.348	0.298	116.8
Apparel	29	194.2	450	2,886	0.064	0.067	95.5
Leather and shoes	40	457.0	280	2,713	0.143	0.168	85.1

Sources: Fixed capital: Table 2.2. Output: Ukraine, Table 13.2; USSR, Table A.3, n. k.

this indicator for all light industry is about 10 per cent lower in the Ukraine than in the USSR. For its particular branches, the Ukrainian ICOR is higher in the textile industry and lower in the remaining two branches in comparison with that in the USSR. Judging from this factor alone, there is no reason why the Ukraine accounted for such a

30. Nesterenko, 1954, p. 247.

31. See Appendix A, n. 9. It is reported that the variety of apparel produced doubled during the Second Five-Year Plan; that of shoes tripled; and during the year 1937, 246 new types of outer clothing were brought on the market, as compared with 34 types in 1933. See Seredenko, 1957, p. 239.

small share in the USSR output of light industry, and in particular of the apparel and leather and shoe branches, as compared with its share in the population or in the industry as a whole.

The Ukraine was not alone among the regions of the USSR in being relatively underdeveloped in regard to light industry. The majority of them were in a similar situation because the bulk of the output of light industry, and particularly the output of textiles, was produced in the Moscow and Leningrad regions. This concentration was the heritage of prerevolutionary development. Light industry on a large scale in Russia was started first in these two regions in the eighteenth century. Subsequently, because of external economies, it was more profitable to add new plants to existing ones or to expand them than to develop new centers in other regions of the country. This extremely uneven distribution of light industry was noted by the Tenth Party Congress, which passed a resolution calling for the location of new plants of this industry more evenly throughout the country.³² In such a way not only would light industry be proportionally distributed, with the resulting savings on the transportation of the final output, but the industrialization of backward regions would also be facilitated.

However, partly because of the higher productivity of investment in the textile industry in the Moscow and Leningrad regions³³ but mainly because of a general lack of interest in the development of this industry and bureaucratic inflexibility, very little dispersion took place during the period under discussion. Table 13.4 illustrates the extremely uneven distribution of the main branches of the textile industry in 1939, almost twenty years after the realization that this situation required correction. As can be seen, the two Russian regions possessed the bulk of the processing facilities, although their population amounted to one-third of the total. Moreover, they lacked the necessary raw-material base. All other republics or economic regions show only a very weak development. This is particularly strange in the case of the Central Asian republics, from which nearly the entire cotton supply in the USSR was obtained. This table refers

32. *Kommunisticheskaia Partia*, 1954, I, 560.

33. Korneev, 1957, p. 172.

TABLE 13.4. Distribution of Population and of Textile-Spinning and Silk-Weaving Capacities by Selected Regions of the USSR on January 1, 1939 (per cent)

	Popula- tion	Spindles in the Textile Industry			Looms in Silk Weaving
		Cotton	Flax	Wool	
USSR	100.0	100.0	100.0	100.0	100.0
South (the Ukraine and Moldavia)	18.9	1.1	2.5	5.0	...
Center (Moscow and Northwest (Leningrad)	31.5	92.2	83.7	80.2	76.2
Rest of Russian SFSR and Belorussia	35.1	2.1	11.7	12.1	1.8
Transcaucasus (Armenian, Georgian, and Azerbaidzhan SSR)	4.7	2.7	2.1	2.2	15.0
Central Asia (Kazakh, Uzbek, Tadjik, Kirgiz, and Turkmen SSR)	9.8	1.9	...	0.5	7.0

Source: Adapted from Korneev, 1957, p. 174.

to the spinning branches of the textile industry only, but the weaving capacities were concentrated even more in these regions.³⁴ Also, other branches of light industry were concentrated in these two regions of Russia proper.³⁵

Owing to the concentration of light industry in the Moscow and Leningrad regions, it was necessary to distribute its output throughout the country. Therefore, the whole national economy had to suffer an additional loss in the form of increased transportation costs. For example, in 1940 the Ukraine consumed 550 million meters of cotton textiles, of which 4 per cent was produced locally, while 94 per cent had to be imported from these two areas.³⁶ In the case of woolen

34. *Ibid.*

35. "The knitting factories were constructed and expanding primarily in Moscow, Leningrad, and in Belorussia, from which the hosiery and knitting products were distributed all over the Union." See *ibid.*, p. 173.

36. *Ibid.*, p. 353.

fabrics, the consumption in the Ukraine in the same year amounted to 14 million meters, of which the local output supplied only one-third and the imports from Russian centers accounted for one-half of the total consumption.³⁷ Also, three-fourths of the entire value of the silk products consumed in the Ukraine was imported from there.³⁸ A similar situation most probably existed in the case of other branches of light industry. The resulting substantial transportation costs could have been eliminated or at least materially reduced if the investment policy had been more rational, i.e., if, in view of the existing very productive resources and available demand, this industry had been expanded much more in the Ukraine.

37. *Ibid.*, p. 354.

38. *Ibid.*, p. 355.

14. OTHER INDUSTRIES

In this chapter the derivation of the ICOR for the woodworking, paper, and glass, china, and pottery branches will be shown. They are considered together, because their importance in the structure of Ukrainian industry was very small, and consequently the sources of information about their development are rather limited. This exposition will conclude the discussion of the individual branches listed in Table 2.2, except the residual branch called "Other". The latter, which accounted for 3.1 and 9.8 per cent of total fixed capital of Ukrainian large-scale industry on the benchmark dates, comprises a number of insignificant branches. The most important among them and certainly deserving separate attention is the building-material industry, for which, however, no data on fixed capital are available.

The woodworking industry consists of various timber-cutting and timber-processing branches, of which the paper industry is one. The location of its enterprises, in addition to the considerations applicable to Soviet industry in general, is influenced primarily by the availability of raw materials and demand.¹ The raw material base was rather limited in the Ukraine; for example, on January 1, 1935, only 6.1 per

1. Feigin, 1960, p. 289.

cent of all its area was forested.² The resulting supply of wood products was very small in relation to the existing demand, which was mainly determined by the demands of construction, industry, and transportation.³ Since the Ukraine accounted for about one-fifth of these sectors in the USSR the deficit had to be closed by imports from other regions and by the severe restriction of timber consumption by other economic sectors and especially by private consumers.

The following data show the changes in fixed capital of the large-scale woodworking industry and in the output of four main products, namely firewood, industrial timber, sawn wood, and plywood, in the Ukraine and the USSR during the period under discussion.

	<i>Ukraine</i>	<i>USSR</i>
Increase in fixed capital (millions of current rubles) ⁴	90	1,175.9
Increase in output (millions of 1950 rubles) ⁵	592	12,637
Incremental capital-output ratio	0.152	0.093
Ukraine as percentage of USSR	163.4	

The resulting ICOR is by two-thirds higher in the former than in the latter. Two reasons can be cited for this difference. The natural resources were certainly inferior in the Ukraine as compared with those in other regions of the USSR. Also, the faster growth of processing as compared with the extractive branches required higher investment in the Ukraine relative to the USSR. For example, the share of processing branches in the total output of the Ukrainian

2. TsUNKhU, 1936, p. lxiii.

3. All timber cut in the USSR is divided roughly into two parts. One part is used for firewood, and the other is processed. About three-quarters of the latter are consumed by these three sectors. See Feigin, 1960, p. 284.

4. Table 2.2.

5. The aggregate values in millions of 1950 rubles for the benchmark years are 309 and 901 for the Ukraine (Table A.1) and 8,357 and 20,994 for the USSR (Kaplan and Moorsteen, 1960, Table 1).

woodworking industry rose from 43.7 to 83.5 per cent between 1927/28 and 1940.⁶

The following data refer to the paper industry alone. The output is represented by two products, paper and cartons.

	<i>Ukraine</i>	<i>USSR</i>
Increase in fixed capital (millions of current rubles) ⁷	8	488.7
Increase in output (millions of 1950 rubles) ⁸	40.1	1,314.4
Incremental capital-output ratio	0.197	0.372
Ukraine as percentage of USSR	53.0	

The results here are more favorable for the Ukraine than in the case of the rest of the woodworking industry; its ICOR is almost one-half of that for the USSR. There is no evident reason for this difference.

Finally, the glass, china, and pottery industry will be discussed. The name itself indicates the product mix of this branch. The main consumers of glass are the construction sector, other industrial branches, and also private consumers. On the other hand, the demand for china and pottery comes almost exclusively from the population. Since the necessary raw materials are ubiquitous, this industry was fairly well developed in the Ukraine. For example, before World War I there were in operation twenty-three glass and nine china and pottery factories.⁹ Their number was probably not much different during the period under discussion, except that two large glass plants have been introduced into operation in Lysychans'k and Kherson.¹⁰ The following data show that the ICOR during the period discussed was much lower in the Ukraine than in the USSR.

6. Seredenko, 1957, p. 218. According to this source, between 1912 and 1940 the timber cut increased 2.2 times, while the output of plywood increased 3.4 and of furniture 105 times.

7. Table 2.2.

8. The aggregate values in millions of 1950 rubles for the benchmark years are 76.0 and 116.7 for the Ukraine (Table A.1) and 675.4 and 1,989.8 for the USSR (Kaplan and Moorsteen, 1960, Table 1).

9. Akademia Nauk, 1965, p. 313.

10. *Ibid.*

	<i>Ukraine</i>	<i>USSR</i>
Increase in fixed capital (millions of current rubles) ^{1 1}	111	377.3
Increase in output (millions of 1926/27 rubles) ^{1 2}	255	531
Incremental capital-output ratio	0.435	0.711
Ukraine as percentage of USSR	61.2	

Again, there is no obvious explanation for this phenomenon.

11. Table 2.2.

12. In millions of 1926/27 rubles, for the Ukraine for 1928, 30; for 1937, 141 (Kukhareno, 1959, pp. 110-11). For the USSR, for 1928, 128 (CAESS, 1934, p. 39); for 1937, per cent increases of 117.8 and 100.7 (TsSU, 1957, p. 273) are applied to data for 1932 (glass, 143.7, and china and pottery, 129.3 — see CAESS, 1934, p. 39), giving a total of 659.7 million rubles.

APPENDIXES
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A P P E N D I X A

Derivation of the Output Index for Ukrainian Industry

There is general agreement among Western students of the USSR economy that, because of their deficiencies and biases, Soviet official indexes cannot be used for international comparisons.¹ Similarly, they cannot serve as reliable indicators of the differential growth of the Ukrainian industry relative to the USSR, particularly during the First and Second Five-Year Plans, when the rapid industrialization and concomitant changes in scarcity relations were accompanied by considerable changes in the product mix of both industries. In order to be able to give a meaningful answer to the latter problem, it is necessary to calculate an independent output index for Ukrainian industry and to compare it with the similarly estimated index for the USSR.

At the outset, one obvious but nevertheless very important fact has to be emphasized, namely, that the results of any index depend greatly on the methodology used in its construction. Since the purpose here is

1. Since these comparisons are very important, several independent indexes for USSR industry have been constructed in the West; for example, Kaplan and Moorsteen, 1960; Nutter, 1962; Powell, 1963; Noren, 1966, just to mention a few. For further discussion, see Koropecjy, 1965.

TABLE A.1. Physical Output Series of Selected Products of Ukrainian Industry, Its Shares In USSR Output For Benchmark Years, and Price Weights

Commodity	Units	1928		1937		Weights
		Output	Ukraine as Percentage of USSR	Output	Ukraine as Percentage of USSR	
	(1)					(6)
Producers' goods other than machinery						
1. Pig iron	Thous. tons	2,361	71.9	9,216	63.6	476 Rubel/ton
2. Steel ingots and castings	"	2,409	56.7	8,738	49.3	"
3. Rolled steel	"	1,995	58.1	6,468	49.9	"
4. Coke	"	3,997	95.7	14,981	74.8	"
5. Iron ore	"	4,722	77.0	17,185	61.9	"
6. Manganese ore	"	499.7	71.2	956.9	34.8	"
7. Coal	"	24,832	69.9	69,072	54.0	"
8. Peat	"	111.5 ^a	2.1	1,552	6.5	"
9. Electric power	Mill. KWH	1,261	25.2	9,451	26.1	0.136 R/KWH
10. Mineral fertilizers	Thous. tons	57	41.9	848	26.2	275 Rubel/ton
11. Caustic soda	"	42.8	73.0	73	44.6	"
12. Soda ash	"	176	81.6	416	78.7	"
13. Sulfuric acid	"	72	33.9	386	22.3	"
14. Firewood	Mill. m ³	1.4	2.8	3	3.2	38.05 R/m ³
15. Industrial timber	"	1.0	2.4	3.9	3.4	"
16. Sawn wood	"	0.8 ^b	5.8	2.2 ^c	6.4	"

17. Plywood	Thous. m ³	21.3	12.3	36.6	5.4	1,160	"
18. Paper	Thous. tons	20.6	7.2	28.4	3.4	1,980	Rubel/ton
19. Cardboard	" "	14.8	31.8	25.4	17.6	2,380	" "
20. Cement	" "	297	16.1	1,220	22.4	116	" "
21. Building bricks	Mill.	660	25.6	1,941	22.4	270	" /thous.
22. Construction and technical lime	Thous. tons	192.1	36.9	1,174.6	24.5	150	Rubel/ton
23. Window glass	Mill. m ²	9.3	31.5	26.8	33.8	7	R/m ²
<i>Food industry</i>							
24. Granulated sugar	Thous. tons	1,041	78.1	1,780	73.5		
25. Fish, marine animal, and whales	" "	44.7	5.3	144.1	9.0		
26. Butter	" "	8.8	10.7	25.5	13.8		
27. Vegetable oil	" "	46.8	10.4	113.6	21.1		
28. Confectioneries	" "	21.7	21.9	200.8	22.9		
29. Salt	" "	1,164	50.6	1,513	47.3		
<i>Light industry</i>							
30. Cotton fabric	Thous. m.	2,000	0.1	7,109	0.2		
31. Woolen fabric	" "	1,964	2.3	9,845	9.1		
32. Linen fabric	" "	300 ^d	0.2	788	0.3		
33. Hosiery	Thous. pairs	9,600 ^e	14.2	71,637	17.5		
34. Knit underwear	Thous.	807 ^b	11.7	28,780	25.8		
35. Knit outerwar	"	3,214 ^f	14.3	9,173	20.3		
36. Leather footwear	Thous. pairs	12,400 ^a	16.1	33,037	18.1		

a. 1929. b. 1928/29. c. 1938. d. 1932. e. 1924/28. f. 1934.

SOURCES TO TABLE A.1

- Commodities 1-5: TsSU-Ukraine, 1965, p. 83.
 Commodity 6: TsUNKhU, 1939, p. 55.
 Commodity 7: TsSU-Ukraine, 1965, p. 79.
 Commodity 8: 1929: TsUNKhU, 1939, p. 54. 1937: TsSU-Ukraine, 1965, p. 82.
 Commodity 9: *Ibid.*, p. 78.
 Commodities 10-13: *Ibid.*, p. 86.
 Commodities 14-15: 1928: share of the Ukraine in the USSR given in Akademia Nauk, 1949, p. 132, applied to the data for the USSR in TsSU, 1964, p. 294. 1937: TsSU-Ukraine, 1965, p. 95.
 Commodity 16: 1928/29: TsUNKhU, 1934, p. 127. 1938: TsSU- Ukraine, 1965, p. 95.
 Commodity 17: 1928: Nechuiatova, 1963, p. 54. 1937: TsSU- Ukraine, 1965, p. 95.
 Commodity 18: *Ibid.*, p. 97.
 Commodity 19: 1928: sum of monthly output data from *Ezheme siachnyi statisticheskii biulleten'*, Moscow, 1927-29. 1937: TsSU-Ukraine, 1965, p. 97.
 Commodity 20: *Ibid.*, p. 100.
 Commodity 21: *Ibid.*, p. 106.
 Commodity 22: 1928: TsUNKhU, 1934, p. 114. 1937: interpolated on the basis of data for 1932 (678.6 th. t.) from the same source and for 1940 (1,632.4 th.t.) from TsSU-Ukraine, 1965, p. 101.
 Commodity 23: 1928: Sum of monthly output data from *Ezhemesiachnyi statisticheskii biulleten'*, Moscow, 1927-29. 1937: TsSU-Ukraine, 1965, p. 112.
 Commodity 24: *Ibid.*, p. 142.
 Commodity 25: *Ibid.*, p. 145.
 Commodity 26: 1928: TsUNKhU, 1936, p. 218. 1937: TsSU-Ukraine, 1965, p. 145.
 Commodity 27: 1928: UNHO, 1937, p. 19. 1937: TsSU-Ukraine, 1965, p. 145.
 Commodity 28: 1928: Akademia Nauk, 1937, p. 45. 1937: TsUNKhU, 1939, p. 80.
 Commodity 29: TsSU-Ukraine, 1965, p. 142.
 Commodities 30-31: *Ibid.*, p. 115.
 Commodity 32: TsSU, 1964, pp. 372-73.
 Commodity 33: 1927/28: Iudin, 1957, p. 44. 1937: TsSU-Ukraine, 1965, p. 127.
 Commodity 34: 1928/29: Iudin, 1957, p. 72. 1937: TsSU-Ukraine, 1965, p. 127.
 Commodity 35: 1934: UNHO, 1936, p. 38. 1937: TsSU-Ukraine, 1965, p. 127.
 Commodity 36: 1929: Iudin, 1957, p. 59. 1937: TsSU-Ukraine, 1965, p. 135.
 Output data for the USSR for the calculation of the Ukrainian percentages (Columns 3 and 5) : 1928 and 1937: Kaplan and Moorsteen, 1960, Tables 1, 2, and 3. Other years: TsSU, 1964, pp. 298, 364, 384, 394.
 Weights (Column 6): Kaplan and Moorsteen, 1960, Table 1.

to compare the industrial growth of the Ukraine with that of the USSR, both revised indexes have to be constructed along precisely the same lines. As a model an index prepared by Norman Kaplan and Richard Moorsteen has been chosen.² A brief explanation of the procedure of these writers is, therefore, in order. The authors intended to construct a net product index of civilian industrial output in the USSR. For this purpose they used a large number of physical output series, the number being fixed for all benchmark years. In-

2. Kaplan and Moorsteen, 1960. A shortened version of their study appeared as an article: "An Index of Soviet Industrial Output," *American Economic Review*, June, 1960. All subsequent references are to the former work.

dividual commodities were combined into industrial groups with the help of 1950 wholesale prices in the case of machinery and other producers' goods and with the help of retail sales of this year in the case of consumers' goods. In turn, industrial groups and branches were aggregated into an index of total industry with the help of the payroll distribution in 1950. The entire payroll of each individual group or branch was used to weight the available time series. In such a way, the weight for any missing output series of a group or branch was imputed. The estimate of civilian output was derived by weighting the machine-building industry at 50 per cent of its payroll, assuming that one-half of its output was devoted to military uses.

It is necessary to state that, because of a lack of data for Ukrainian industry for the benchmark years, it was not possible to construct a revised index, which would have been identical to that of Kaplan and Moorsteen in the sense of being based completely on the physical output series and having the same number. Instead, as is described subsequently, it was necessary to use some official value data despite the fact that they are generally considered to be inferior in quality to the data in physical units.

To apply the Kaplan and Moorsteen classification, the total output of Ukrainian industry was divided into four groups: producers' goods other than machinery, machinery,³ food, and light (consumers' goods other than food) industries. The rate of growth of the first group was estimated on the basis of the physical output series of the twenty-three most important products for which data are available for both benchmark years. They are shown in Table A.1. These products were then aggregated with the help of the 1950 wholesale prices into the following six subgroups: ferrous metals and ores (commodities 1–6), fuels (7, 8), electric power (9), chemicals (10–13), lumber, wood products, and paper (14–19), and building materials (20–23). These groups were subsequently aggregated, using the payroll

3. According to the official classification, machine building is a component part of a branch called machine building and metalworking. In the Ukraine the former accounted for 72.4 and 81.9 per cent of the total production in 1928 and 1937, respectively. See Kukharensko, 1959, p. 106. Since Kaplan and Moorsteen calculate the output index for machinery only, this designation is used here. As the index for the industry as a whole is concerned, it has to be assumed that metalworking was growing at the same rate as machine building.

distribution as weights, into an index of producers' goods other than machinery, and finally into an index of total industry (Tables A.2 and A.5).

TABLE A.2. Revised Output Indexes of Producers' Goods Other than Machinery in the Ukraine for 1937 (1928 = 100)

Goods	Index
Total producers' goods other than machinery	311.2
Ferrous metals, including ores	357.3
Fuels	280.8
Electric power	749.5
Chemicals	356.0
Lumber, wood products, and paper	264.4
Building materials	335.8

Source: Output series and prices from Table A.1, and weights from Table A.5.

As Table A.1 shows, the physical output series for food and light industries for the benchmark years are very sketchy. Similar data for the machine-building industry are limited to a few items only and therefore are not shown here. As a result, the indexes for these three groups had to be derived in the following way. First, the Ukrainian shares of these groups in the total output of the corresponding groups for the USSR as a whole, according to official statistics, are calculated. The relevant data are shown in Table A.3 (see pages 182 and 183). Thus, derived percentages are then applied to the magnitudes of the respective groups for the USSR, as calculated by Kaplan and Moorsteen (Table A.4, page 183) and, as a result, absolute data for the Ukraine are obtained. They underlie the index numbers for these three groups, which together with the index for producers' goods other than machinery are aggregated with the help of the 1950 payroll distribution in Ukrainian industry into an index of the whole industry (Table A.5, page 184).

It is necessary to emphasize that this procedure, which was used because of the lack of required data, is based on some important assumptions. The Kaplan and Moorsteen index represents the output of all industry, while this one is of a hybrid nature. The physical output series, which underlie the index of producers' goods other

than machinery, refer to all industry in contrast to value data for the remaining three groups, which show only the output of large-scale industry. This fact should, however, have only a minor influence on the comparability of revised indexes, because of virtually identical proportions between large and small-scale industries in the Ukraine and in the USSR for the benchmark years.⁴ There is reason to believe that these proportions were also very similar for individual industrial groups. In other words, the Ukrainian shares for these three groups, calculated on the basis of large-scale industry, differ probably very little if at all from such shares for all industry and, therefore, they can be applied to the Kaplan and Moorsteen magnitudes.

Furthermore it must be assumed that the Ukrainian share in the official 1926/27 prices can be applied to the Kaplan and Moorsteen estimates in 1950 prices. This assumption is very strong indeed, because of the differential price increases between 1926/27 and 1950, and because of the changes in product mix within individual groups of industry in the Ukraine and in the USSR between 1928 and 1937. Finally, the problem of coverage has to be considered. Ukrainian shares were calculated on the basis of official statistics which are comprehensive. These shares were applied to the Kaplan and Moorsteen magnitudes, which are based on the sample for the USSR, and the assumption had to be made that this sample is also representative for Ukrainian industry. For example, these authors estimated the index of machinery output only, while the shares were derived on the basis of official data for metalworking and machine building. It was assumed in this procedure, therefore, that the share of machinery output in the metalworking and machinery industry was the same in the Ukraine and in the USSR for the benchmark years; and, moreover, that the sample of machinery products, which is considered by Kaplan and Moorsteen to be representative for the machine building of the USSR, is also representative for Ukrainian machine building.

Individual indexes of the four main groups were aggregated with the help of payroll distribution in Ukrainian industry in 1950 into an index of total industry. The labor costs were used as weights in order to approximate the index of net product in contrast to the official

4. See p. 10.

TABLE A.3. Output of Large-Scale Industry by Four Main Groups in the Ukraine and the USSR for Benchmark Years and Ukrainian Shares by These Components

Ukraine							
Groups	1928		1937		1937 (1928 = 100)	Ukraine as Percentage of USSR	
	Millions of 1926/27 Rubles	Percentage of Total	Millions of 1926/27 Rubles	Percentage of Total		1928	1937
Total, large-scale industry industry ^a	2,926	100.0	16,152	100.0	552.0	17.4	17.9
Producers' goods other than machinery ^b	1,178	40.3	6,481	40.1	550.2	20.6	19.2
Machine building ^c	392	13.4	4,723	29.2	1,204.8	17.5	17.8
Food industry ^c	1,107	37.8	3,529	21.9	318.8	30.3	27.5
Light industry ^d	249	8.5	1,419	8.8	569.9	4.8	8.4
USSR							
Total, large-scale industry	16,860 ^e	100.0	90,010 ^f	100.0	533.9		
Producers' goods other than machinery ^b	5,731	34.0	33,740	37.5	588.7		
Machine building	2,239 ^g	13.3	26,606 ^h	29.6	1,188.3		
Food industry	3,655 ⁱ	21.7	12,837 ^j	14.3	351.2		
Light industry ^k	5,235	31.0	16,827	18.6	321.4		

SOURCES TO TABLE A.3

- a. Kukharenko, 1959, p. 119.
- b. Derived by subtracting the remaining three groups from the total.
- c. Khromov, 1945, p. 43.
- d. Kukharenko, 1959, p. 111. This group consists of the following branches: textiles, apparel, and leather, fur, and shoes.
- e. TsUNKhU, 1936, p. 3.
- f. The rate of increase (131.8) from TsSU, 1957, p. 9, applied to the absolute figure (38,831 million rubles) for 1932; see TsUNKhU, 1936, p. 3.
- g. *Ibid.*, p. 8.
- h. In view of the lack of data for large-scale machinery output, the rate of increase of all machine building (182.8), from TsSU, 1957, p. 9, applied to the absolute figure for 1932 (9,408 million rubles); see TsUNKhU, 1936, p. 8.
- i. *Ibid.*, p. 16.
- j. The rate of increase (93.7) for all food industry, from TsSU, 1957, p. 367, is applied to the absolute figure for 1932 (6,627 million rubles); see TsUNKhU, 1936, p. 16.
- k. There is no information available about the aggregate output of light industry for the USSR as a whole. The total output of branches listed in Note 'd' above was estimated for 1928 and 1937 as follows (millions of 1926/27 rubles):

	1928	1932	Per cent Increase	1937
Total	5,235	9,758		16,827
Textiles	4,106	5,664	78.3	10,099
Apparel	449	2,142	55.7	3,335
Leather, fur, and shoes	680	1,952	73.8	3,393

Sources: 1928 and 1932: TsUNKhU, 1936, pp. 12-15. 1937: derived through the application to the absolute data for 1932 the percentage changes between 1932 and 1937, from TsSU, 1957, p. 319.

TABLE A.4. Estimated Output of Three Industrial Groups in the USSR and in the Ukraine for 1928 and 1937 (millions of 1950 rubles)

	USSR		Ukraine	
	1928	1937	1928	1937
Machine building	1,983	11,956	348	2,128
Food industry	110,428	173,175	33,460	47,623
Light industry	63,158	108,077	3,032	9,078

Sources: USSR: The data are calculated from the absolute amounts for 1950 (machine building, 29,232 million rubles; food industry, 165 559 million rubles; and light industry, 136,117 million rubles); see Kaplan and Moorsteen, 1960, pp. 141, 146. The distribution for benchmark years is based on their Table 22, p. 235.

Ukraine: Derived through the application of percentages from Table A.3, to the USSR data.

index, which, being a gross-product index suffers from various deficiencies, as is described below. The derivation of weights is presented in Table A.5. The distribution of wage earners by main industrial branches in the first column is weighted by the average monthly earnings in these branches, as shown in the middle column. The resulting distribution of the industrial wage bill is presented in the last column. Following Kaplan and Moorsteen, the weights of the machine-building industry were decreased by 50 per cent. In this way,

TABLE A.5. Derivation of Weights for the Output Index, Using Industrial Payroll in the Ukraine in 1950 as a Base

	Distribution of Industrial Wage Earners (per cent)	Average Monthly Individual Wage Earnings (rubles)	Distribution of the Industrial Wage Bill Exclusive of Munitions (per cent)
	(1)	(2)	(3)
All industry	100.0	740	100.0
I. Producers' goods other than machinery	45.5		60.4
1. Ferrous metals and ores	6.8	880	9.5
2. Fuels	15.6	1,060	26.1
3. Electric power	1.4	655	1.5
4. Chemicals	2.0	700	2.2
5. Lumber, wood products, and paper	12.3	665	12.9
6. Building materials	7.4	705	8.2
II. Machine building	28.9	730	16.7
III. Food industry	11.4	565	10.2
IV. Light industry	10.2	565	9.1
Other	4.0	565	3.6

Sources: Column (1): TsSU-Ukraine, 1957, p. 25.

Column (2): Kaplan and Moorsteen, 1960, Table 7, p. 219.

account can be taken of the unavailable time series of munitions output, which is assumed to be concentrated in this branch. For the same reason, the weights of the group called "Other" are left out in the aggregating index for the total industry.

Two deficiencies in the calculation of weights for the Ukrainian revised index have to be pointed out. First, under the assumption that wages in the same industrial branches do not vary by regions, those for the USSR were used. This assumption is certainly not true, because the wages do vary by regions (compare Asiatic versus European regions of the USSR); but it is unavoidable in view of the lack of wage data for the Ukraine. This fact has definitely an effect on the level of the revised index, but in what direction and to what extent it is impossible to ascertain. Second, in order to make this index comparable to that of Kaplan and Moorsteen, the weights of the same year, 1950, have been used. The employment structure in this year refers to the post-World War II borders of the Ukraine, while the indexes of individual products and branches covering the period under discussion refer to prewar borders. As a result of the reunion of Ukrainian lands previously belonging to Poland, Czechoslovakia, and Rumania with the Ukrainian SSR, the industrial structure of the latter was changed. This effect must not have been very pronounced, because these regions were very weakly industrialized in comparison with the prewar Ukrainian SSR. Still, since 100 per cent of all the fixed capital of the petroleum and natural gas industries in the Ukraine was located in two new *oblasts* (Lviv and Ivano-Frankivs'k) in 1950,⁵ and in only three of these *oblasts* (Ivano-Frankivs'k, Zakarpattia, and Chernivitsi) were located 35 per cent of all timber resources,⁶ the weights of the fuel and even more of the lumber, wood products, and paper branches certainly have been raised as compared with the prewar structure. As can be seen in Table A.2, these two branches experienced less-than-average growth among branches of producers' goods other than machinery, and this fact tended to bias the aggregate index down.

The results of the calculation are shown in Table A.6. For comparison, this table lists also the revised indexes for the USSR as well

5. Khramov, 1964, pp. 89, 136.

6. Akademia Nauk, 1965, pp. 311-12.

TABLE A.6. Official and Revised Indexes of Industrial Output in the Ukraine and in the USSR for 1937 (1928 = 100)

	Official		Revised	
	Ukraine	USSR	Ukraine	USSR
Total, all industry	452.1	445.5	344.2	248.7
Total, large-scale industry	552.0	533.9		
Producers' goods other than machinery	550.2	588.7	311.2	310.7
Machine building	1204.8	1188.3	611.5	601.5
Food industry	318.8	351.2	142.3	156.8
Light industry	569.9	321.4	299.4	171.1

Sources: Official indexes: Ukraine: large-scale industry, Table A.3; all industry, TsSU-Ukraine, 1963, p. 37. USSR: large-scale industry, Table A.3; all industry, TsSU, 1964, p. 34.

Revised indexes: Ukraine: Tables A.2 and A.4; weights from Table A.5. USSR: Kaplan and Moorsteen, 1960, Table 22, p. 235.

as official indexes for both the Ukraine and the USSR. As can be seen, the revised indexes for both are considerably lower than the official ones, thus illustrating vividly the degree of exaggeration of the latter. The table also shows that the growth of the Ukraine relative to the USSR was a shade faster according to official indexes but significantly faster according to the revised indexes. One could have expected that if deficiencies and biases had affected official indexes for the Ukraine and the USSR equally and had they been successfully eliminated in revised indexes, then the ratio of the Ukraine to the USSR, based on official indexes, should be equal to that based on the revised indexes.⁷ This is not the case, however. This ratio, based on official statistics, is equal to 1.01 for all industry and 1.03 for large-scale industry, while the ratio, based on revised indexes, is equal to 1.36. The reason for this divergence may be the inadequacy of the revised index for the Ukraine resulting from the utilization of certain assumptions and approximations, as was described previously. In addition, deficiencies and biases could have affected the official indexes of the Ukraine and the USSR differentially. Finally this

7. In other words, if the official index had shown that the Ukrainian industry grew faster by 10 per cent than the industry of the USSR for a given period, revised indexes should show the same relative difference (10 per cent), regardless of actual level of growth rates.

phenomenon can also be due to the difference in product coverage between official and revised indexes. Deficiencies will be considered first, then the differences in coverage, and finally biases.

Soviet indexes of industrial growth are constructed by aggregating the output at wholesale prices, excluding the turnover tax, at the factory level. They are gross-product indexes, and it is generally assumed that they are inferior to the net-product indexes. (The revised indexes are, of course, intended to be the net-product indexes.) As such, official indexes reflect not only changes in real output, but they can also be affected by changes in vertical integration, by double counting, and by changes in the contribution of nonindustrial sectors.⁸ Applying these factors to the present problem, it can be argued that the rate of integration could have been greater and that of double counting and of contributions of nonindustrial sectors smaller in the Ukraine than in the USSR. This would mean that the growth of net value added in industry could have been relatively higher in the Ukraine without being reflected in official indexes. Unfortunately, these propositions cannot be supported by empirical evidence and, as a result, it has to be assumed that the official indexes of the Ukraine and of the USSR are affected equally by these factors.⁹

An important difference between official and revised indexes is in their product coverage. The former are comprehensive, while the latter are based on a sample which must be assumed to be representative of all industry for the given period. The most important omission in the revised indexes is doubtless the munitions output which, of course, is not published by official sources.¹⁰ It is obviously impos-

8. See, for example, Seton, 1957, pp. 4-10.

9. Until recently it was generally assumed that as a result of continuous inflation, primarily before World War II, the introduction of new goods at current prices in the official index in 1926/27 constant prices tended also to inflate it. It has now been shown by the example of the machine-building industry that increases in efficiency in this branch were greater than increases in the prices of inputs (for example, see Moorsteen, 1962, Table 26, p. 138). As a result new products did not exert an upward bias on the official index. This might also be true for other industrial branches. The effect of quasi-new goods might have been noticeable in some instances, however. (Quasi-new goods were goods that because of small changes could have been included in the official index at a higher price than basically identical goods of base-year vintage.)

10. The treatment of munitions in official indexes is still a moot question for Western scholars. See Kaplan and Moorsteen, 1960, p. 82.

sible to answer the question whether the growth of munitions output was faster in the Ukraine or in the USSR and thus to what extent it has affected official indexes. The geographical location of the Ukraine—close to western borders—will argue against the faster growth of munitions output in the Ukraine than in the rest of the USSR. On the other hand, the well-developed Ukrainian heavy industry provided an excellent basis for the output of armaments. As far as civilian products are concerned, the revised index for the USSR is based on a larger sample than the Ukrainian revised index. Since it is generally agreed that it is Soviet policy to publish only favorable statistics,¹¹ this fact implies that the Ukrainian revised index is for this reason somewhat biased upward. One cannot judge from the present statistical information to what extent this is the case.

Finally, the biases inherent in Soviet official indexes will be discussed. Since they are most pertinent to the problem under investigation, they deserve special attention. These indexes were weighted during the period under discussion, and until 1950 with 1926/27 constant prices. There is a consensus among Western students of Soviet economy that the constant prices of 1926/27 biased the official index upward for the following reason. At the beginning of industrialization some manufactured goods are produced in small quantities, and their prices are high in relation to the prices of remaining industrial goods. The industrialization process usually means a faster growth of the former than of the latter group. After some time, as a result of changed scarcity relations, the prices of faster-growing commodities decline in terms of prices of the rest of industrial output. Obviously the use of the preindustrialization price structure as weights, in contrast to the price structure of an already advanced economy, imparts an upward bias on the aggregate index of industrial output.¹²

That Soviet 1926/27 prices had a preindustrialization character was convincingly argued by Naum Jasny. He divided the output of industry into two groups; consumers' goods, utilizing mainly relatively cheap agricultural raw materials, and other industrial goods. This assumption about the consumers' goods might be unrealistic today because of the increased importance of inputs supplied by the chemical

11. For example, see Cook, 1962, p. 195.

12. Gerschenkron, 1951, pp. 46ff.

industry, but it is certainly very appropriate for the neglected consumers' industries in the USSR before World War II. Subsequently, Jasny compared the 1926/27 prices of commodities in both groups with the corresponding prices of this year in the United States and Germany, the countries considered to be well industrialized in comparison with the USSR at that time. He concludes: "One can be confident that goods processed from agricultural products are unlikely to have been more expensive in the United States than in the USSR, while all other industrial products cost at most 60 per cent as much as in the USSR—let us say 55 per cent as much."¹³

Jasny's conclusions are supported by the recent findings of Warren Nutter. Similarly, Nutter finds that the ratio between unit value added, i.e., prices decreased by excise taxes, in the USSR in 1928 and in the United States in 1929, using Soviet output weights, was higher for intermediate producers' goods (3.07)¹⁴ than for consumers' goods (2.23); while for the whole sample of forty-five industries it was equal to 2.50.¹⁵ Both years used by Nutter are close enough to Jasny's 1926/27.

During the subsequent period of rapid industrialization, however, there was a tendency toward a change in the scarcity relations between producers' and consumers' goods in the USSR economy. Because of the well-known Soviet investment policy, increases in productivity were faster in producers' goods than in consumers' goods branches.¹⁶

13. Jasny, 1952, pp. 29–30. Jasny's sample is rather inadequate because it compares only twenty-one producers' and consumers' goods. See his Table II, p. 148. The median of percentages by which Soviet prices of producers' goods exceed American prices is equal to 54.6, while for six out of seven consumers' goods these percentages are well below the median. In support of Jasny's conclusions, the following considerations have to be borne in mind. Soviet 1926/27 prices were based on the prerevolutionary price structure. It is a well-known fact that strong monopolies controlled heavy industry in the czarist empire. As a result, the price level of heavy-industry products and of other goods, using these products as inputs, was relatively higher than the price level of other industrial goods, which utilized nonmonopolized inputs, chiefly those supplied by agriculture.

14. These are equivalent to producers' goods other than machinery, as used in this study.

15. Nutter, 1962, Table A-30, p. 379.

16. According to Kaplan and Moorsteen, 1960, p. 269, Table 46, the output per man-year between 1927/28 and 1937 increased in producers' goods other than machinery by 64 per cent, while in consumers' goods it increased only 14 per cent.

As a result, the prices of the former increased much less than the prices of the latter, as it is shown by the following indexes for these groups in the USSR for 1937 (1928 = 100):

Basic industrial goods (1937 weights) ¹⁷	222
Machinery (1927/28 weights) ¹⁸	143
Machinery (1937 weights) ¹⁹	71
Industrial inventories of finished consumers' goods (1928 weights) ²⁰	714

In view of the lack of data for consumers' goods, the closest substitute, the index of prices of industrial inventories of finished consumers' goods had to be used. As can be seen, the price increases of the latter group exceed by far the price increases either of basic industrial goods, which are equivalent in coverage to producers' goods other than machinery, or of machinery.

The preceding discussion shows that the use of the preindustrialization price structure pulls the Soviet official index upward during the period under discussion, because faster-growing branches of industry, like producers' goods other than machinery, are weighted with prices which are high relative to the prices of consumers' goods when compared with developed economies. On the other hand, the slower-growing food and light industries are weighted with relatively low prices. According to Abram Bergson, having a choice between an index based on the preindustrialization price structure and one based on more recent prices for the same period, the presumption is that the latter is more indicative of changes in production potential. This is particularly true when the change in price structure is more pronounced and the change in production structure less pronounced, as was probably the case in the USSR before World War II.²¹ Also Simon Kuznets states that the use of "a nonindustrial price structure,

17. Bergson, 1961, p. 416, Table G-12. According to Bergson, p. 415, there is no difference in the index of basic industrial goods if the 1928 weights are used. Obviously, the prices of consumers' goods are net of turnover taxes.

18. Moorsteen, 1962, p. 72.

19. *Ibid.*

20. See n. 17 above.

21. Bergson, 1961, pp. 33-34.

while of interest for some special purposes, is hardly relevant to the measurement of the rate of industrialization and economic growth.”²² Therefore, it seems reasonable to conclude that, disregarding all other differences between the official and revised indexes, the revised indexes, because of the use of 1950 price weights, are superior to the official indexes, based on 1926/27 prices, in reflecting the differential growth of industry between the Ukraine and the USSR during the period under discussion.

This rather lengthy discussion of a familiar index-number problem was necessary because of its decisive importance to the problem under consideration. During the period under discussion, according to the official information in Table A.3, the aggregate industrial output grew slightly faster in the Ukraine than in the USSR, 5.5 and 5.3 times, respectively. Its components behaved somewhat differently, however. In both cases the output of producers' goods increased faster than the output of consumers' goods; but the relative growth of producers' goods was faster in the USSR, and that of consumers' goods relatively faster in the Ukraine. Machinery and producers' goods other than machinery increased 7.1 times in the Ukraine and 7.6 times in the USSR, while light industry and the food industry increased 3.6 and 3.3 times, respectively. Applying the previous discussion to these developments, the following conclusion is justified. The faster growth of consumers' goods in the Ukraine was relatively undervalued and the faster growth of producers' goods in the USSR was relatively overvalued in 1926/27 prices in official indexes. As a result the official index for the total Ukrainian industry was pulled downward relative to the corresponding index for the USSR for this period.

The argument that producers' goods grew relatively more slowly and consumers' goods relatively faster in the Ukraine than in the USSR was based on official statistics in value terms. It is useful to support such derived results with data in physical units. Columns 3 and 5 of Table A.1 present Ukrainian percentages in the total output of the USSR for selected producers' goods other than machinery and for products of the food industry and light industry for the

22. Kuznets, 1963, p. 334.

benchmark years.²³ A virtually complete lack of data for Ukrainian machine building during this period makes it impossible to undertake a similar analysis for this branch. It has to be assumed that Soviet statistics, showing an almost identical growth of machine building in the Ukraine and the USSR, indicate the actual trend. The slower growth of Ukrainian producers' goods other than machinery relative to the USSR is confirmed by the decline of Ukrainian shares, as shown in this table. These shares declined for sixteen out of twenty-three products. Relatively significant declines can be observed in the iron and steel, coal, and chemical industries, which are quite important in the structure of Ukrainian industry. Also the faster growth of consumers' goods industries in the Ukraine relative to the USSR, as is shown by official value statistics, is evident in a rather small sample of these products in the above table. In regard to the food industry alone, its relatively slower growth in the Ukraine is primarily caused by the sugar industry. Because the sugar industry is of great importance in the total Ukrainian food industry,²⁴ the decline of its share outweighed the increase in most of the other commodities of this branch. Another component of consumers' industries, light industry, shows marked gains in Ukrainian shares for all commodities in the sample.

In conclusion, the following can be stated. In addition to Soviet official indexes not being useful for international comparisons because of their exaggerated rates of growth, they are also not reliable indicators of the differential growth between the Ukraine and the USSR as a whole for the period of prewar five-year plans. The main reason for this phenomenon was the use of a preindustrialization price structure, which in view of the faster growth of consumers' goods and the slower growth of producers' goods in Ukrainian industry relative to the USSR understated the aggregate index of the former to that of the latter.²⁵

23. In cases for which the data for 1928 are unavailable, those for the nearest years to 1928 are listed.

24. See Table 12.1.

25. This is not applicable, however, to postwar period. See Koropecy, 1965.

A P P E N D I X B

Donbas Versus the Ural-Kuznetsk Combine

In the late 1920's and the early 1930's a very important discussion about the geographical distribution of Soviet economic development and of the location of the iron-and-steel industry in particular took place in the USSR. The problem was whether in the future industrialization effort to depend on the existing center of this industry in Donbas and, of course, concomitantly with the general growth of industry to expand it or to begin the construction of another one in the eastern regions of the USSR. In the latter case, the inputs to be used were iron ore from the eastern slopes of the Ural Mountains and coal from the Kuznetsk Basin, which were removed one from another by more than 2300 km. The final decision favoring the construction of what became known as the Ural-Kuznetsk Combine profoundly affected the economic development of the USSR as well as the iron-and-steel industry and all Ukrainian industry in particular. An understanding of these developments will be facilitated by a review of the debate which preceded this decision. Since its history has largely been told elsewhere,¹ only the views of the main spokesman

1. Clark, 1956, chap. xii; Holzman, 1957, pts. 2, 3, 4.

for the further development of Donbas, Ya. Dimanshtein, will be analyzed here.² This is necessary because Dimanshtein's views, having been defeated, are much less known than those of the proponents of the official line. Moreover, his critics sometimes distort his views.³ The summary account of the official attitude is based on the comprehensive article by Berezov,⁴ who is well qualified to represent it, as he subsequently wrote a book on the theory and practice of the location of the Soviet iron-and-steel industry.⁵

There are basically three arguments Dimanshtein employs in his defense of the further development of the Donbas iron and-steel industry:

(1) The development of this or of any other industry should take place at that location in which the production cost, including the transportation cost of inputs as well as outputs to consumers, is lowest. In order to prove that the cost as defined was actually lowest in the production of pig iron in the Ukraine, he cites data for two locations in the Ukraine, Kryvyi Rih and Donbas, one on the Kerch peninsula in the Crimea, which was not yet a part of the Ukraine, and two locations in the Urals, Alapaevsk and Magnitnaia Gora. As can be seen in Column 1 of Table B.1, as a result of favorable mineral conditions, the cost of iron ore was lowest in the Urals.⁶ For the same reason the cost of coal mining in the Kuznetsk basin was about half of the average for the USSR.⁷ But the cost of coke to the Urals pig-iron mills was higher than in the Ukraine, with the preferred freight rates for Kuznetsk coal (Column 2)⁸ and even more with the uniform freight rates on coal for the whole USSR (Column 3).

2. He wrote a great deal on this subject, but very little is available in the West. The following account of his views is based on Dimanshtein, 1928; Dimanshtein, 1928a; Dimanshtein, 1929, Dimanshtein, 1930.

3. Cf. Probst, 1962, p. 132, n. 1.

4. Berezov, 1928.

5. See Livshits, 1958, p. 5.

6. After the 1936 price reform, when prices reflected fairly closely the cost of production, the cost of iron ore was about twice as high in Kryvyi Rih than in Magnitogorsk. See Clark, 1956, p. 216.

7. *Ibid.*

8. The freight rate of Kuznetsk coal was equal to approximately one-third of the freight rate on coal from other regions; on Magnitogorsk iron ore it was equal to about one-half of the average for the country. See *ibid.*, p. 219.

TABLE B.1. The Cost of Production of One Ton of Pig Iron by Regions in 1928^a

Region	Cost of Iron Ore per Ton of Pig Iron (in rubles)	Cost of One Ton of Coke ^b at Existing Freight Rate ^c	Cost of One Ton of Coke at Uniform Freight rate	Cost of One Ton of Pig Iron at Uniform Freight Rate
	(1)	(2)	(3)	(4)
Kryvyi Rih	10.37	17.45	17.75	32.70
Donbas	17.08	12.20	12.20	33.85
Kerch	1.59	(d)	(d)	38.95
Alapaevsk	6.86	21.05	30.37	42.40
Magnitnaia Gora	6.22	23.79	31.96	42.70

a. Dimanshtein explicitly states that the data are not exact, but that he believes they are in a significant order of magnitude.

b. The price of coke is assumed to be 12.20 rubles per ton in Donbas and 9.15 rubles in Kuznetsk. For the production of one ton of pig iron, 1.1 tons of coke is needed in Kryvyi Rih and 1.3 tons in Magnitogorsk and Alapaevsk, because of transportation losses.

c. The existing freight rate for Kuznetsk coke was at that time 0.382 kopek per ton per kilometer and for Donbas 0.72 kopek.

d. Not given.

Source: Dimanshtein, 1928, pp. 258-59.

Obviously better mineral conditions in the Urals and Kuzbas than in the Ukraine were outweighed by the great distance between them and the resulting high transportation costs. The effect of these factors is summarized in Column 4, which indicates that if the freight rates were uniform, the production and transportation costs would be considerably lower in the Ukraine than in other locational alternatives. From this it becomes clear why the problem of freight rates was for Dimanshtein central to the whole issue. As long as the differential rates exist, they obscure the advantage of Donbas over other locations in the production of iron and steel. Therefore he argued vigorously that the preferential rates for certain regions should be abolished and a uniform one for the whole country should be introduced. Otherwise, the explicit cost of ferrous metals would in no way express their real cost to the national economy. In this he was supported by some transportation economists, who rightly feared that the artificially

low rates must eventually lead to an excessive demand for transportation services.⁹

Another side of the transportation problem was the distance between the metallurgical plants and the metal-consuming industries. At the time of the debate, most of the latter were concentrated in the regions near Moscow and Leningrad, except some agricultural, mining, and transportation machinery plants, which were located in Donbas and in adjacent regions. The distance to these manufacturing centers was greater from the Urals than from Donbas. Assuming the freight rate of 0.3 kopek per ton per kilometer, the cost of a ton of pig iron produced in Magnitogorsk would amount to 61.66 rubles for the consumers in Moscow and to 64.66 rubles for those in Leningrad. The cost of Donbas pig iron would be equal to 45.75 and 53.07 rubles, respectively.¹⁰ As can be seen, Dimanshtein convincingly demonstrated the advantage of Donbas over the Urals for the location of the iron-and-steel industry if the production and transportation costs are realistically and uniformly accounted for.

(2) As another argument for the preference of Donbas over the Ural-Kuznetsk Combine, Dimanshtein used the discussion of differential investment productivity between the expansion of existing facilities and the construction of new ones. Being already attacked by the party-line economists at that time, he was forced to hide his true intentions. In his discussion in the relevant article, he argues that investment was more productive when used for the expansion and reconstruction of existing mills in Donbas than for the construction of the proposed new one in Kerch in the Crimea. But at the end of this article, in the numerical examples, are included also the projects of new plants in Magnitogorsk and Kuznetsk, against which this argument was probably intended.¹¹ It is shown that the investment requirement per unit of output in both was significantly higher than in the case when the investment was used for the expansion of Donbas' capacities.

9. Cf. Bessonov, 1929, p. 46. In regard to the undesirability of differential rates for the coal industry in general, see Probst, 1929, p. 162.

10. Dimanshtein, 1928, p. 260.

11. Dimanshtein, 1930, p. 8.

His argument goes as follows. In view of the relative scarcity of capital to labor, the available funds should be invested in the locations in which the output increases would be highest and quickest. This will take place if these funds are directed to the expansion of existing plants, primarily for the elimination of bottlenecks and the introduction of new technology, comparable to that of new plants. The advantages of the existing plants are due to the following factors: they are more diversified, they have their own repair and construction facilities, their value as a going concern has to be considered, and their labor force and management are skilled and experienced. On the other hand, new plants, in addition to the investment in the plants, require additional funds for transportation, urbanization, and construction of complementary industries. Finally, expenses for new construction are always higher than planned,¹² and the time of construction and gestation longer than expected.¹³ In order to prove the advantage of the existing plants, Dimanshtein cites the average capital-output ratios for 1928/29, in the prices of that year, for the existing metallurgical plants in Donbas on the average and the planned plants in Kuznetsk and Magnitogorsk.¹⁴ They are as follows (average capital-output ratios, including the necessary residential building, are given in parentheses): average for the existing plants in Donbas, 1.58 (1.81); Kuznetsk, 2.24 (2.46); and Magnitogorsk, 1.80 (1.97).¹⁵ As can be seen from the above figures, the advantage of the expansion of the iron-and-steel industry in Donbas over the proposed construction in the Ural-Kuznetsk Combine is obvious.

(3) The third argument used by Dimanshtein was one of common sense. If the whole national economy under socialism is to be managed most efficiently, he argued, then each enterprise must be run profitably.

12. For example, the cost of a machine-building plant in Sverdlovsk was calculated at 38 million rubles, and it actually cost 350 million rubles. See Rozenfel'd and Klimenko, 1961, p. 236.

13. Complaints about overly long construction periods are a standard feature of the speeches of Soviet leaders.

14. Instead of using investment to increase output ratio, Dimanshtein prefers to use average capital-output ratio, because in the case of investment in old plants a part of it will be used for reconstruction, which does not add to the increase in output.

15. Dimanshtein, 1930, p. 21.

If the capitalists before the Revolution found that the iron-and-steel industry was most profitable in Donbas, this remains also true under socialism. The argument often heard that a country as large as the USSR should have more than one iron-and-steel base Dimanshtein dismissed as being dogmatic in nature. What would happen, he asks, if there were only one region with suitable mineral resources? His answer is that economic rationality and no other consideration should guide the country's economic development. In order not to be accused of favoring the economic development of the Ukraine only, he advised the concentration of industrialization of the Urals on commodities that can be produced economically.¹⁶ The availability of huge timber resources and iron-ore deposits offers a good prospect for the development of quality charcoal metallurgy. The extensive deposits of many minerals could serve as an excellent basis for the development of nonferrous metallurgy and chemical industries. The presence of timber should encourage wood processing and the paper industry. Under existing conditions the iron-and-steel industry in the Urals cannot profitably supply any consumers beyond a 200-km range and accordingly should not be developed beyond the required capacity.¹⁷

Since there was unanimity among the participants of the debate that the mining cost in the Urals and Kuzbas was lower than in Donbas and Kryvyi Rih, all that the proponents of the combine had to do was to prove that the preferential freight rates for its inputs were economically justified. They therefore argued that the Siberian railroad should become a shuttle train, carrying coal from Kuzbas to the Urals and iron ore in the opposite direction. As a result of a stable demand for transportation services, the cost per unit of hauling would decline. The expected technological progress should act in the same direction. Furthermore, they believed that the capacity of the line was such that an additional million tons could be handled without new investment.¹⁸ In regard to the other side of the transportation problem, the party-line economists foresaw the construction of a large number of machine-building plants in the eastern regions of the USSR, which would become the consumers of the locally produced

16. Dimanshtein, 1928a, p. 3.

17. Dimanshtein, 1930, p. 8.

18. Berezov, 1928, p. 297.

metal. According to them, in the absence of the Ural-Kuznetsk Combine, the transportation cost of the needed iron-and-steel products from Donbas to these projected plants would be prohibitive.¹⁹

The debate was terminated by the decision of the Central Committee of CPSU of May, 1930, which later in that year was confirmed by the Sixteenth Party Congress. In a speech to the congress, Stalin justified this step partly by the argument, called dogmatic by Dimanshtein, that a country the size of the USSR ought to have two metallurgical bases and partly by the plans to construct a large number of metal-consuming plants in the east.²⁰ As was discussed previously, there is no doubt that the main reason for this decision was military considerations.²¹

19. Rikman, 1931, p. 49.

20. *Kommunisticheskaia Partia*, 1930, p. 42.

21. It was argued after World War II by Academician Bardin (see Bardin, 1950) that the construction of this base in a remote area of the country was one of the decisive factors in the winning of the war by the USSR.

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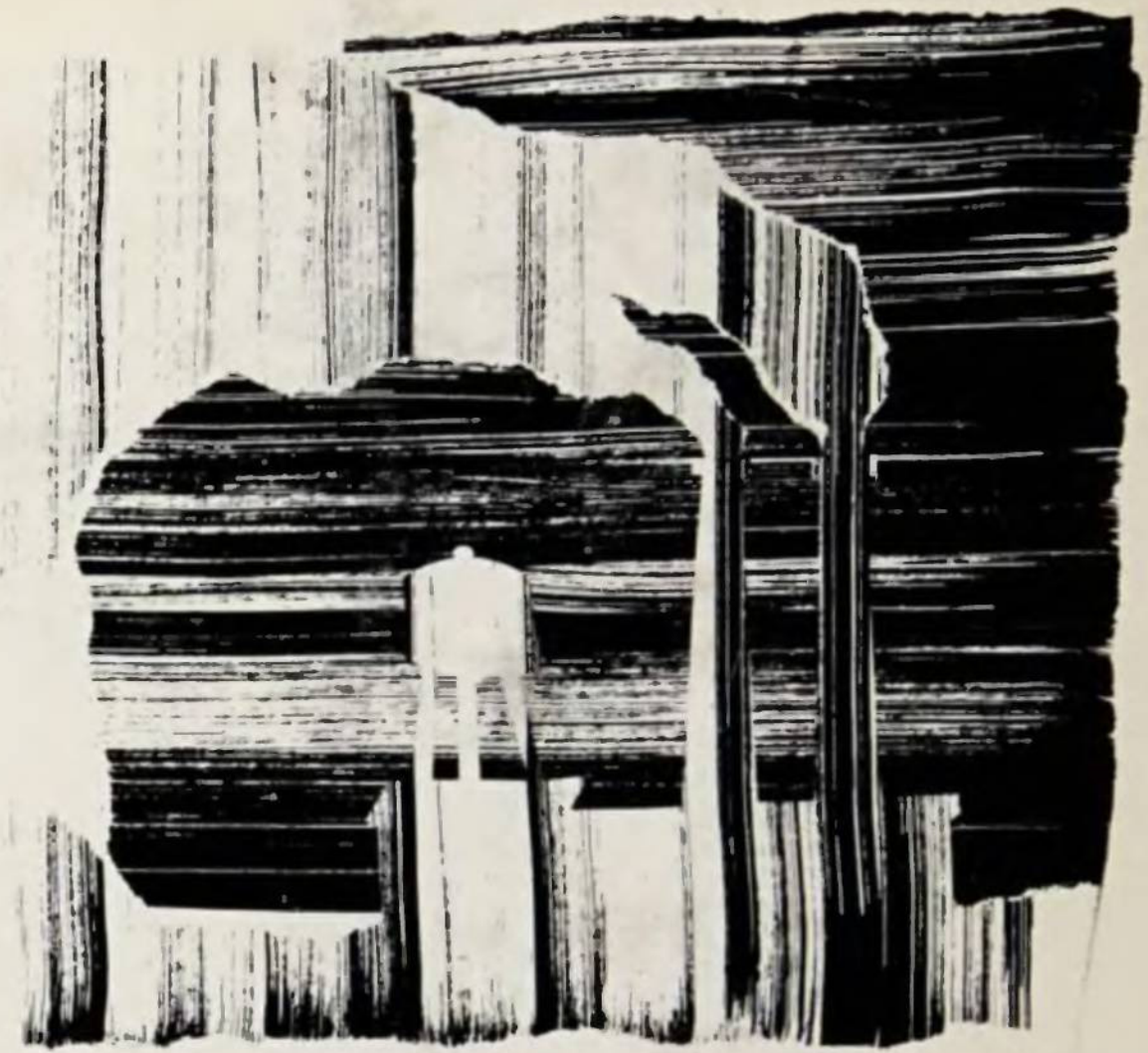
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painstakingly assembled and carefully processed, the author concludes that the purely economic factor—maximizing output—was not decisive for the geographical distribution of investment. He also shows that long-range defense considerations were of primary importance for the structurally unbalanced development of backward regions in the east, to the detriment of more intensive development of the Ukraine and other western regions. The result of the study is a solid contribution to our knowledge of Soviet location theory and practice, an important but underinvestigated aspect of the economic development of the USSR.

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