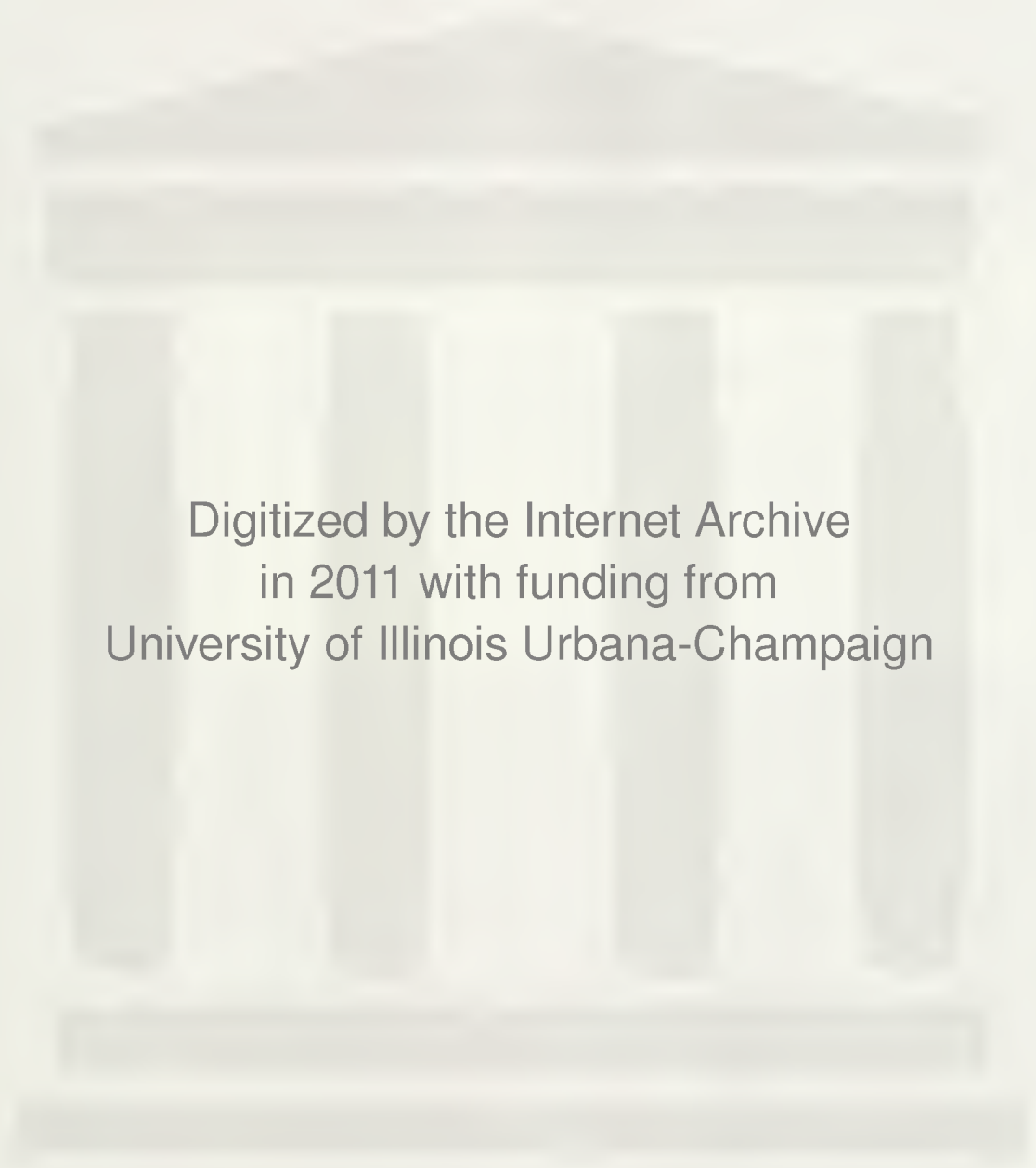

Faculty Working Papers

PRICING OF LIQUIDITY FOR PREFERRED STOCKS ON THE NEW YORK STOCK EXCHANGE

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#662

College of Commerce and Business Administration
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Faculty Working Papers

THE INFLUENCE OF THE IMPROVEMENT OF FIXED PRODUCTION ASSETS ON THE NATURE OF WORK IN THE USSR

Valeri Samuilov, Visiting IREX (International Research Exchange Board) Scholar, Department of Economics

#673

College of Commerce and Business Administration
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FACULTY WORKING PAPERS

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May 1, 1980

THE INFLUENCE OF THE IMPROVEMENT OF FIXED PRODUCTION ASSETS ON THE NATURE OF WORK IN THE USSR

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Summary

Professor Samuilov points out in this paper that changes in the composition of capital have social implications -- specifically for the nature of work -- that are as significant as those that derive from changes in capital intensity. These implications are illustrated empirically here in a serious and scientific fashion by Professor Samuilov.

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Notes

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This paper presented at the Forty-fourth Annual Meeting of the Midwest Economics Association held in Chicago, Illinois, March 26-29, 1980.

The basic course of the development of the national economy of the USSR from 1976-1980 emphasizes the need to accelerate further the reconstruction and technical reequipment of working enterprises by utilizing the latest achievements of science and technology.[1] Historically this reequipment or development program has emphasized a relative growth in the active component of production assets (i.e., machinery and equipment) over the passive component (i.e., buildings and structures). In the period 1961 to 1979 the active component's share of fixed assets grew from 46.8 to 51.6%. In addition, the structural compositions of the active component changed. The 'core' of the active component, (i.e., manufacturing machinery and control equipment) grew relative to the 'non-core' inputs (i.e., power machinery and transmission and transport equipment). Over this same period 'core' inputs rose from 25 to 28.8%.

These changes have not only increased efficiency, but have also substantially changed the work environment, as the mode of production has progressed in some industries from workers with simple tools, through machinists with complex equipment, to skilled operators of automated production lines. This study traces some of the technical origins of this movement and also treats the changing relationship between the worker and his technical facilities. This is done by examining recent changes in the structural composition of the active components of plants producing electrical machinery.

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Achieving the prevailing level of technical development involves a transition from partial to complex mechanization and then to automation. This transition is also reflected in the development of

social labor. The complex structure of production gives rise to the complex structure of social labor that is expressed in the vast diversity of the spheres of its application which are notable for their specificity regarding the topic of work, the facilities of work, and the professional specialities of the workers who are engaged in these fields.

By 1979, technical progress in the USSR could be characterized by the following measures:

(i) The number of mechanized and automated lines reached 167,000.

(ii) The number of complex mechanized and automated sections or factors reached 85,000.

(iii) The state seal of approval had been awarded to 75,000 articles.[2]

The general application of the facilities of complex mechanization and automation, the reconstruction and modernization of production lead to essential changes in the structure of the fixed assets, and more particularly in their active components. Thus, from 1961 through 1979 the active components of the fixed assets grew from 46.8 to 51.6% and the share of the passive components which includes buildings and structures has decreased from 53.2 to 48.4% (see Table 1).

There are differences between the components of fixed assets in their relationship to the production process. Components such as buildings, structures and roads are preconditions for the production process, make this process possible and act, as it were as "passive" instruments of labour.

TABLE 1

CHANGES OF THE TECHNOLOGICAL STRUCTURES
OF THE FIXED ASSETS OF SELF-FINANCING ENTERPRISES AND ORGANIZATIONS

(January 1--%)[3]

	ALL INDUSTRY				
	1961	1971	1972	1976	1979
Total	100	100	100	100	100
A. Passive component--buildings and structures	53.2	50.9	49.8	48.9	48.4
B. Active component	46.8	49.1	50.2	51.1	51.6
I. Core of active component	25.0	26.4	27.6	28.0	28.8
1) working machinery and equipment	24.2	25.3	26.2	26.8	27.5
2) measuring and adjusting instruments and gear and laboratory equipment	0.8	1.1	1.2	1.2	1.3
control & management complex 3) computers	--	--	0.2	--	--
II. Power machinery and equipment	8.3	8.4	7.9	8.0	7.6
III. Transmission gear	8.0	8.8	11.6	11.5	11.3
IV. Transport equipment	4.0	4.4	2.1	2.1	2.1
V. Instruments and tools	1.5	1.1	1.0	1.5	1.8

Other components, primarily working machinery, computers and power machinery, participate directly in the production process and play an "active" role in it. For production to take place normally both types of instruments of labour are needed, but to different degrees. During the second World War, the equipment of evacuated plants was sometimes set up at first in unsuitable premises, or even in the open, and production was begun in the absence of "passive" instruments of labour. Without "active" ones, however, this would have been impossible.

Various sub groups of the active component of assets have a different influence on the effectiveness of its utilization. Therefore, the apportionment of the core into an active component is justified. It is considered necessary to include in the core working machinery and equipment which, from 1961 through 1979, grew as a fraction of total assets from 24.2 to 27.5%. The core of the active component of assets renders a decisive influence on the process of the creation of an industrial product. It is also necessary to include here the measuring and adjusting instruments, the gear and the computers, whose production is growing with a steady tempo. These factors form the controlling machinery and mechanisms, which allow man to be replaced to some extent in the production process.

Nevertheless, the problem about optimal proportions between working machinery and control management complex has not yet been solved completely. To advance this solution, at least for one in industry, the author of this study has conducted a calculation for the cost of the manufacturing of the internal construction elements

of the automatic systems of machinery in the Khmelnitski factory of transformer substations which confirms the justification of the division of automatic systems of machinery into five elements (see table 2).[4] The cost of the working, the transport and the control machinery consists of the cost of all automatic lines accordingly: for the first line 66; 13; 19%; for the second: 70; 12; 16%; for the third and fourth lines: 42; 24; 32% and for the fifth line: 78; 13; 4%, i.e., the expenditures in the manufacturing of the working, the transport and the control machinery are commensurable and therefore each of them represents an independent element of the automatic system of machinery.

The appearance of the automatic system of machinery is preceeded by a complicated process of successive development of work facilities which, in my view, looks like this: instruments and the most simple mechanisms, fully developed machinery[5] and the system of machinery, fully developed system of machinery, an automatic system of machinery, fully developed automatic system of machinery (primarily in the future), fully developed automatic system of machinery in combination with an automatized system of control of an enterprise in the future (see schema 1). The appearance of controlling (cybernetic) machinery and mechanisms, which supplement and give rise to a change of other elements of fully developed system of machinery create the formulation of an automatic system. The rise and development of control machinery and equipment lead to replacement of fully-developed system of machinery by a 5-way automatic system: the engine, the transmission mechanism or machine, the working machinery, the transport machinery and the control machine.

Table 2

THE STRUCTURE OF EXPENDITURES IN THE MANUFACTURING OF ELEMENTS OF AUTOMATIC SYSTEMS OF MACHINERY AT THE KHMELNITSKI FACTORY OF TRANSFORMER SUBSTATIONS, %

LINE	MOTOR		TRANSMISSION MECHANISM/MACHINE		WORKING MACHINERY		TRANSPORT MACHINERY		CONTROL MACHINERY	
	TYPE	COST	TYPE	COST	TYPE	COST	TYPE	COST	TYPE	COST
The automatic line of zincification in drums	AOL-2 24-1 1,1KW	1	Reduction Gear	1	Baths, dryers	66	Goat-skin crane with an operators carriage	13	cupboard & desk	19
The automatic line of cadmium plating, and tinning	AOL-2 24-1 1,1KW	1	Reduction Gear	1	Baths, dryers	70	Goat-skin crane with an operator's carriage	12	cupboard & desk	16
Automatic line of the preparation of steel pieces	AOL-2 24-1 1,1KW	1	Reduction Gear	1	Baths, dryers	42	Goat-skin crane with an operator's carriage	24	cupboard & desk	32
The autoline of zincification on hangers	AOL-2 24-1 1,1KW	1	Reduction Gear	1	Baths, dryers	42	Goat-skin crane with an operator's carriage	24	cupboard & desk	32
The automatic line of painting tanks of power transformers	VAO-21-4 1,1KW	1	Reduction Gear	4	Washing machine, dryer & painting chamber	78	Conveyor	13	cupboard & desk	4

It is possible to reveal a few tendencies in the origin of technical facilities. The most essential tendency reflects the objective course of the development of the tools of work and it is essentially regular. It consists of a successive transformation of human working functions to technical facilities.[6]

In the work process the worker fulfills 4 functions: motor, technological, transport and control. The last function, in my view, can be divided into 3 subdivisions: the regulatory, the control-directory, and the function of decision-making.

The motor function consists of the man who acts as the motor power of the tools of work. Animals, wind, water etc. often fulfill this function. The technological function is more complicated. Its purpose consists of examining the work objective and determining how to achieve this objective more efficiently. These improvements are to be understood to include the most diverse changes of geometric form (processing by carving, processing by pressure etc.), technological structures (annealing, hardening, polymerization), the composition of material (cementation, oxidation, etc.) and others. The transport function is the displacement into space of solid, liquid and gaseous bodies. The controlling function provides the necessary flow of the work process and the given results of the work. In the early stages of the development of society all four indicated functions are fulfilled by man.

Mechanized production is characterized by the transformation of the technological function of the producer to the working machinery, and of the motorized function to steam and later to electricity.

THE MAIN STAGES OF THE ORIGIN OF AUTOMATIC SYSTEMS OF MACHINERY, THE WORKING FUNCTIONS OF MAN, FULFILLED BY TECHNOLOGY*

THE METHOD OF PRODUCTION

MECHANICALLY MANUAL	MECHANIZED	COMPLEX-MECHANIZED	PARTIALLY AUTOMATED	COMPLEX AUTOMATIZED	COMPLETELY AUTOMATIZED
CORRESPONDENCE OF MACHINES & MACHINE SYSTEMS TO FORMS OF PRODUCTION					
Instruments and the simplest mechanisms	Fully developed machinery, system of machinery/3 ways: motor, transmission, working machine/ universal machine tools, unmechanized and mechanized production lines	Fully developed system of machinery/4-way: motor, transmission mechanism or machine, working machine, transport machine/complex mechanized production line, complex mechanized factory /shop, section/	Automatic system of machinery/5-way motor, transmission mechanism or machine, working machine, transport machine, control machine/ separate automatic machines and groups of machines, automatic lines, automatized factory/shop, section/	Fully developed automatic system of machinery-- complex automatized lines, complex automatized factory /shop, section/	Fully developed automatic system of machinery in combination with automatized system of control of enterprise-- completely automatized factories /amalgamation/
HUMAN LABOR FUNCTIONS, FULFILLED BY TECHNICAL MEANS					
1. Motorized (partially) 2. Technological (partially)	1. Motorized 2. Technological	1. Motorized 2. Technological 3. Transport	1. Motorized 2. Technological 3. Transport 4. Controlling 1) regulatory	1. Motorized 2. Technological 3. Transport 4. Controlling 1) regulatory 2) control-guiding	1. Motorized 2. Technological 3. Transport 4. Controlling 1) regulatory 2) control-guiding 3) decision-making (partially)
DIVISION OF WORKERS ACCORDING TO THE LEVELS OF THE TECHNICAL EQUIPMENT					
Those who work with the help of mechanically manual instruments.	Those who work with the help of machinery, machine tools and mechanisms.		Those who work with the help of automatic apparatuses, equipment and machine tools.		Those who fulfill the building & repair of automatic systems of machinery.

Thus, with mechanized production the motorized and technological functions of man are transferred to the machine (machine tools) or to the system of machinery. The worker retains immediate control over the means of production, the supervision and control of the production process and the work of the mechanisms, over additional work of separate manual mechanisms, the repair of the machinery and the immediate fulfillment of the complex of manual auxilary operations. The fulfillment of these functions demands various expenditures of work with respect to quantity, the nature and qualifications of the work.

Complex mechanization of the industrial process includes all basic and auxiliary operations. In this situation the division of technological processes into primary and secondary categories, based on the content and the equipment, loses its meaning. Fully developed system of machinery of complex mechanization fulfills the motorized, the technological and the transport functions of man. The workers retain immediate control, supervision, addition of the work of manual mechanisms and their repair. The transformation into complex mechanization alters the function of the technological maintenance of production. The auxilary operations which were formerly fulfilled by poorly qualified workers and which were associated with the displacement of raw materials, processed materials and half-finished products, are now carried out to a significant degree by in corresponding transport machinery and mechanisms, or by quality control and maintenance personnel who operate the machines. The tendency toward the unification of the primary and secondary functions into a single process is, on the whole, being

developed in complex mechanization and, typically, progress is occuring in the professional structure of the workers. The demands are rising for technical training and general education of personnel. Research, conducted on the level of the general education of the workers in mechanical manufacturing and mechanical assembly shops, indicates that more than half of the workers among machine operators, metal crafts repairmen and metal crafts engine fitters have an education of 8-10 years. Among the quality control operators, more than one third have this same level of education. With the rise of the technical organization level of production and the growth of qualified workers, a tendency is developed simultaneously toward an extreme division and merging of the functions of the immediate control of a technological process.

The growth of complex mechanization and automation in enterprises of the Ministry of Electrical Industry of the USSR which build high voltage apparatuses (and in mechanical engineering enterprises in general) has led to a relative reduction of the number of workers who are engaged in manual labor, and to an increase in the share of those who work with mechanical and automatic machines. The transformation of workers from manual to automatized labor occurs very rapidly. Another significant increase is expected during the tenth 5-year plan. Across the country the share of workers engaged in mechanized labor will grow from 45% in 1975 to approximately 50% in 1980. This will permit several million industrial workers to be freed from the predominately manual labor. In 1978 alone more than 500,000 men were transferred from manual to mechanized labor.

Automation of production is the highest stage of machine production, qualitatively differentiated from mechanization and complex mechanization of production. In my view, automation is the introduction and utilization of applied machinery and mechanisms capable to some degree of replacing man in the function of immediate control and management of machinery and production processes. In the economics literature of the USSR there are many uses of the word "automation." These uses can be divided into three groups.

Partially automatized production is the method of production in which the primary and secondary processes of regulation are carried out by an automatic system of the machinery. Mechanized and manual labor is permitted only in those processes in which automation is unsuitable. Partially automatized production is based on the application of the automatic system of machinery which is represented by separate automatic machines or groups of machines and automatic lines, and which fulfills the motorized, technological, transport and first controlling function, i.e., the regulatory function. The duty of the worker in partially automatized production is to supervise the flow of raw materials and output of the finished product. In addition he is to set up; monitor and, when necessary, repair the automatic lines.

The general tendency of the transformation of work into work regarding control, maintenance and management of production processes finds its completion in an automatic system. When this is achieved there is a further change in the required skill and education level of the worker. Thus, the installation of automated facilities in

mechanical engineering enterprises has decreased the duties of the machinists from 80 or 85% to 20 or 25%. The number of skilled operators grows from 5 or 8% to 40% and the number of electricians from 1 or 2% to 8 or 10%, and the number of repairmen from 5 to 25%. In the Ural car-building plant as a result of the installation of an automatic line for the processing of stamped out pieces, the share of manual workers was reduced from 95% to 50% and the quantity of quality controllers grew from 7 to 50% in comparison with the number of workers on the production line who used specialized and universal machine-tools for the manufacturing of those same pieces. The fulfillment by the workers of the functions of control, maintenance and management, which are altered and complicated in conditions of partial automatized production, acquires to a great extent the character and qualification of technical-engineer work.

The complex automation of production completely eliminates the performers work in all three of its forms (immediate control of the machine, supplement of work of the machine by hand, and purely manual labor). The general supervision of the production process, the setting-up and the repair of the system is preserved for the worker. But even these functions, following the development and complication of production are centralized to a greater degree, becoming functions of corresponding general production services.

CONCLUSION

Thus, the change in the active component of the fixed production assets which are called forth by the spreading scientific technological revolution, leads to essential reforms in the nature of work.

The labor of the worker becomes more mechanized and automized and acquires a creative character. Therefore it is important that we keep a close watch not only on the growth in fixed assets, but also on the composition of the fixed assets.

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FOOTNOTES

[1]See, L. I. Brezhnev. Otchet Tsentral'nogo Komiteta KPSS i Ocherednie Zadachi Partii v Oblasti Vnutrenney i Vneshney Politiki. XXV s'ezd Kommunisticheskoy Partii Sovetskogo Soyuza. Stenograficheskiy Otchet. (M., 1976) pp. 63-73.

[2]See, TsSU, Narodnoe Khozyaistvo SSSR v 1978 (M., 1979), p. 97, 98, and "Pravda," Jan. 26, 1980.

[3]Counted by the author: TsSU, Narodnoe Khozyaistvo SSSR v 1960 (M., 1961), p. 86; TsSU, Narodnoe Khozyaistvo SSSR v 1972 (M., 1973), p. 65, 66; TsSU, Narodnoe Khozyaistvo SSSR v 1975, (M., 1976), p. 220; TsSU, Narodnoe Khozyaistvo SSSR v 1978, (M., 1979), p. 130.

[4]Counted by the author at the Khmelniski Zavod Transformatoraich Podstantsi.

[5]"All fully developed machinery consists of three essentially different parts, the motor mechanism, the transmitting mechanism, and finally the tool or working machine." Karl Marx, Capital, vol. 1, International Publishers, New York, 1972, p. 373.

[6]"technical progress is expressed precisely in the fact that the work of machines pushes human labour more and more into the background." V. I. Lenin. Collected Works, Vol. 1, Foreign Languages Publishing House (M., 1963), p. 85.

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Faculty Working Papers

THE EFFECT OF THE TIME HORIZON ON THE RELATIVE ABILITY OF DIFFERENT TIME-SERIES MODELS TO FORECAST QUARTERLY EARNINGS PER SHARE

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Notes

[1]We required the firms to be listed during the entire sample period. The Center for Security Price Research (CRSP) monthly tape was used to select NYSE listed firms. A firm was considered listed if it had monthly stock returns available for the entire sample period.

[2]The absolute percentage error is computed as the average of $\left|\frac{\text{Actual EPS - Predicted EPS}}{\text{Actual EPS}}\right|$. Since this error metric can be explosive when the denominator approaches zero we truncated errors in excess of ten to a value of ten. This operation was done for a very small percentage of the cases.