ECONOMIC GROWTH AND INVESTMENT CYCLES IN

EASTERN EUROPEAN SOCIALIST ECONOMIES

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ABSTRACT

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The thesis discusses different current views on the relation
between economic growth and fluctuations to establish a basis for
analysing medium-term fluctuations in investment and output in Eastern
European socialist economies. Evidence for recurrent fluctuations or
cycles associated with economic growth in these countries is presented.
Some analytical models of cyclic growth are reviewed and a model is
proposed based on technical and behavioural constraints on a dynamic
production function. In conclusion the applicability of the analysis
to industrial market economies and its relevance for stabilization
policy is discussed.

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LIST OF DIAGRAMS

LIST OF SYMBOLS

(Kalecki's Model) [1]

Y	national income per year
I	investment
S	changes in working capital, capital under construction and stocks per year
I + S	productive accumulation
C	consumption
i	$I + S / Y$
c	$C / Y = 1 - i$
a	depreciation ratio
u	the increase in national income owing to improvements in the utilization of equipment which do not require capital outlays
m	the capital-output ratio, i.e. the capital outlay per unit increment in national income
μ	ratio between the volume of inventories and the national income, the so-called 'average period of turnover of inventories'
k	$m + \mu$, the capital-output ratio for total capital, i.e. the amount of fixed capital and inventories required to produce a unit increment in national income
r	rate of growth of national income
α	the rate of increase in productivity of labour per year
β	the rate of increase in the labour force per year
ε	the rate of growth of employment

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1 Michal Kalecki, Selected Essays on the Economic Growth of the Socialist and the Mixed Economy, Cambridge: University Press, 1972, pp. 10-13 and 17-24.

CHAPTER ONE

INTRODUCTION

Growth Theory and Economic Fluctuations

The study of growth and development, and the study of
fluctuations are related areas of fundamental importance to
economic theory. However, relationships between them have not
received much attention. If such relations are significant,
that is if cyclic aspects of growth are important, then growth
and stabilization policies need to be coordinated so that
intervention in the economy can improve the operation of the
system rather than hinder it.

Growth is understood to include not only the extension of
presently produced goods and services to a larger segment of the
population or to a growing population, but also the production
of new goods and the installation of new processes. These two
aspects of growth have been called extensive and intensive growth.
In reality they occur more or less together. For example, in the
extension of health and social services to rural areas, up-to-date
hospitals would be built. However, the hospitals might not include
the more specialized equipment and staff, which would be reserved
to institutions serving larger regions.

Growth is analysed in terms of changes in saving, investment
and output, but economists are not unanimous about the dynamic role

of these variables. This thesis will take the view expressed principally by Keynes, Marx and Schumpeter that saving is relatively passive.[1] Investment depends on animal spirits, undistributed profits and the leverage they give on institutional savings, and on innovations.

Uniform growth will be considered, that is it will be assumed that the long-run growth rate is constant. This implies an exponential growth of absolute values of output over time. This uniform growth rate will be called the equilibrium growth rate. The question this thesis will consider is whether this equilibrium rate fluctuates in the medium term, and if so what are the causes of this instability.

Neo-classical Views

Duesenberry distinguishes two kinds of cycle theory: 1) systems with fixed behavioural and technical parameters which ignore autonomous investment or assume it takes place in a regular way; and 2) explanations of cycles which take into consideration changes in parameters resulting from changes in autonomous investment, speculation, changes of technique, and so on.[2] He concludes that a complete analysis of economic history requires an explanation of parameter changes themselves.[3] This thesis will be concerned with such parametric changes.

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1 Joseph Schumpeter, Business Cycles, New York: McGraw Hill, 1939, Vol. I, p. 90.

2 James Duesenberry, Business Cycles and Economic Growth, New York: McGraw Hill, 1958, p. 24 et seq.

3 Ibid., p. 201.

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Hicks offered two possible explanations of cycles: 1) an explosive accelerator, ceilings, and asymmetrical accelerator effects in the downswing; and 2) a rather damped accelerator with a cycle maintained by random shocks.[4] The second explanation seemed less likely to him but other economists have supported this view.[5]

Neo-classical growth theory has explained the long-term growth rate in output by models which consider the effects of capital-embodied or labour-embodied technical progress. All estimates of the elasticity of output growth with respect to the growth of capital and labour fail to explain a large proportion of actual growth. This residual has been attributed to technical progress. Branson notes, commenting on the work of Denison, Kendrick, Solow, Jorgensen and Griliches, to explain the fifty-percent residual factor in economic growth:

> In general, if inputs are being correctly measured and the production function at any given moment is homogeneous of degree one, then the residual would come from the existence of technical progress. In other words, the production function would be shifting up through time as a result of (a) improvements in organization, (b) improvements in capital goods, or (c) improvements in the labour force. Whether this technical progress factor augments specific inputs or simply shifts the production function in a neutral way, and whether it must be embodied in new inputs, as opposed to augmenting both old and new inputs alike, will affect both the rate of technical progress that is compatible with a residual factor of any given size, and the sensitivity of output growth to changes in input growth rates.[6]

4 John R. Hicks, A Contribution to the Theory of the Trade Cycle, London: Oxford University Press, 1950, p. 107.

5 Ragnar Frisch, "Propagation Problems in Dynamic Flows", reprinted in R.A. Gordon & L.R. Klein eds. A.E.A. Readings in Business Cycles, Homewood, Ill.: Richard D. Irwin, Inc., 1965, pp. 183-185.

6 William H. Branson, Macroeconomic Theory and Policy, New York: Harper & Row, 1972, p. 437.

He is suggesting here that the quality and phase of technical progress will affect the elasticity of output growth with respect to input growth. This thesis will assume neutral but embodied technical progress, because it is the simplest case and is closest to reality. It will also consider in particular technical progress which is embodied in new inputs, rather than that which is embodied in old and new inputs alike. Inclusion of technical progress which encourages capital intensity (or discourages it) because of a more than proportional increase in the rate of output growth when capital intensity is increased (or decreased), would not change the hypothesis.

A two-sector approach to growth has been adopted by some neo-classical economists in their exploration of the theoretical requirements for stability in a general equilibrium model. Harry Johnson, for example, shows that in a two-sector model the assumptions, that 1) there is a lower minimum rate of time preference for capital income than for labour income and 2) that the producer goods sector is relatively capital intensive, lead to a conclusion that

> . . . in the course of accumulative movement towards the steady state growth path, the economy may have to take a discontinuous 'jump' from one stable-equilibrium accumulative path to another, through an intervening unstable-equilibrium path, stability here being defined as stability of savings-investment equilibrium with a given stock of capital per head and the paths in question representing the effects on savings-investment behaviour of the accumulation of capital per head. 7

He finds that given these assumptions in a two-sector model,

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7 Harry G. Johnson, The Two-Sector Model of General Equilibrium, Yrjo Jahnsson Lectures, Finland; London: George Allen & Unwin, 1971, p. 84.

movements away from an equilibrium growth path involve passage
through an unstable equilibrium.

Keynsian Views

While Keynes found the economy was subject to severe fluctua-
tions, he thought it tended to remain at a low-level equilibrium
and that full-employment equilibrium was a rare occurrence. He
attributed the tendency to a low-level equilibrium to four factors:
1) a marginal propensity to consume greater than one, but not very
large; 2) a low elasticity of investment with respect to the interest
rate; 3) the elasticity of money wages with respect to employment is
less than one; and 4) a rising rate of investment over a medium-term
period tends to decrease in due course the marginal efficiency of
capital.[8]   He finds the fundamental cause of the trade cycle in
"a cyclical change in the marginal efficiency of capital, though
complicated and often aggravated by associated changes in the other
significant short-period variables of the economic system".[9] The
marginal efficiency of capital depends "not only on the existing
abundance or scarcity of capital-goods, but also on current expecta-
tions as to the future yield of capital-goods".[10] That is, it
depends on supply factors, which include technical constraints, as
well as on demand or behavioural factors.

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8 J. Maynard Keynes, The General Theory of Employment, Interest and
Money, New York: Macmillan and Co. Ltd., 1936, pp. 250-254.

9 Ibid., p. 313.

10 Ibid., p. 315.

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Marxian Views

An advantage of the Marxian paradigm over the neo-classical paradigm is that it assumes economic processes are dynamic. The dynamism results from the application of technology to production for the sake of profit, and from the behaviour of capitalists who, in order to maximize profit over time, accumulate ever larger and ever more efficient units of capital goods. The Marxian two-sector approach also draws attention to the interdependence in production and exchange of producer and consumer goods as a major source of disequilibrium in the system.

Marx saw fluctuations or cycles as the inevitable result of uncoordinated and excessive accumulation, or growth of the investment sector, under capitalism which led to a fall in the rate of profit and eventual crisis. The economy could revive when a decline in capital stock permitted the rate of profit to rise sufficiently to encourage investment. The integration of production units, particularly during depressions, meant that crises would become more severe. It also meant that the working class could become organized into larger units as well. This combination of an organized proletariat and social disorganization in a crisis would lead to revolution and the emergence of socialism. Marx expected that planned accumulation under socialism would eliminate cycles.

Kalecki, in his analysis of a capitalist economy, finds investment decisions to be an increasing function of gross savings of firms, that is of depreciation and undistributed profits, and of change in the rate of profit; and a decreasing function of the rate of change in the

stock of capital equipment. A decline in investment occurs when an increasing stock of capital equipment lowers the profit rate. Savings are not completely reinvested and the economy enters a recession.[11]

Similarities Among These Views

There are similarities to be found among these three points of view on growth and fluctuations. Kalecki would agree with all three in explaining the mechanism of cycles by an incomplete reinvestment of savings. Kalecki would replace the accelerator which uses changes in output as explanatory variable in determining investment, by a variable for changes in the profit level which operates in a similar way. He would also explain the downturn by a decline in the profit rate as capital stock increases unless the profit level increases sufficiently to maintain the profit rate.[12] This describes the same phenomenon as does Keynes' decreasing marginal efficiency of capital. The incomplete reinvestment of savings could be said to be a behavioural response to a decline in the marginal efficiency of capital reflected in a declining profit rate.

Kalecki, like Hicks and Keynes, questions the likelihood of replacement investment creating a floor to the cycle as disinvestment in inventories need not come to a halt.[13] Again, this is similar to Keynes' view that low-level equilibrium tends to continue. When Kalecki considers fluctuations in relation to growth he notes that

11 Michal Kalecki, Selected Essays on the Dynamics of a Capitalist Economy, 1933-1970, Cambridge: University Press, 1971, pp. 110-113 and 132-133.

12 Ibid., p. 112.   13 Ibid., p. 131.

when economic activity is expanding at the long-term growth rate, once the growth of capital equipment falls short of this in a recession, the rate of profit will increase. That is the length of the slump will depend on longer term factors of economic growth. However, Hicks finds an explanation of recovery based on an upward growth trend unsatisfactory as cycles and growth are closely related.[14]

Lonergan's View of Growth and Fluctuations

Bernard Lonergan, in his essay on Economics "Circulation Analysis" describes the processes of an industrial economic system in a way which integrates and illuminates the traditional approaches. He finds that economic dynamics can best be described in terms of a cycle of the productive process based on 1) the need to change or expand the producer goods sector as a result of technical change, which causes a lag in the expansion of that sector; 2) the increase in output of producer goods which can be followed by an increase in output of consumer goods; and 3) the variation in income shares which such changes require.

Lonergan uses a two-sector approach which helps to distinguish the relations between producer and consumer goods in production. He finds this distinction, as did Marx, important to an understanding of the mechanism of fluctuations.

Lonergan's view, not unlike that of the underconsumptionists, is that the capitalist economic system is overadapted to the accumulation phase of the productive cycle in the sense that the rate of saving does not adjust to the phases of the cycle. Saving

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14 Hicks, op. cit., p. 119.

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must increase in the accumulation phase, which is therefore anti-egalitarian. Consumption must increase in the subsequent expansion of output of consumer goods, and this phase is therefore egalitarian. The failure of saving to adjust leads to crises.[15]

The Relevance of A Study of Investment Cycles in Planned Economies

Lonergan's paradigm, as well as the views of economists described above, leads to an hypothesis that cycles are endogenous to the process of economic growth given certain technical and behavioural assumptions. The likelihood of this hypothesis can be tested by considering economic growth in centrally planned economies. In such economies changes in production are planned and do not respond principally to changes in profit rates as tends to be the case with production in a market economy. Thus a study of investment cycles in planned economies permits a focus on the causes of cycles related more to production factors and technical constraints rather than to market factors alone.

Also Eastern European economists often express the opinion that periodic excessive declines in investment may be avoided by modifying planning behaviour. This is similar to Lonergan's view that capitalists' behaviour is overadapted to the accumulation phase of the production cycle. Both suggest crises could be avoided by institutional and behavioural changes.

A third reason to study fluctuations in Eastern European economies is the use of a two-sector model by some economists in these countries.

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15 Bernard J.F. Lonergan, An Essay in Circulation Analysis, Boston, Mass.: Boston College, 1978, p. 68.

It appears to this researcher that a two-sector model is more useful to consideration of an hypothesis that cycles in growth rates of production are a function of a lag in the growth of output of producer goods, and the relation in production between producer and consumer goods. Following Marx, Eastern European economists have traditionally used a two-sector model, but this has tended to change. Kalecki, Goldmann and Kouba, and Horvat all use one-sector models. However, Nikola Cobeljic and Radmila Stojanovic of Yugoslavia use a two-sector model in their major study <u>The Theory of Investment Cycles in a Socialist Economy</u>.

The Purpose of the Thesis

This thesis will show from the literature and recent data that there is evidence that investment or production cycles exist in European socialist economies. It will also show that the analysis of these cycles supports the view that economic growth takes a cyclic form in the medium term.

Four possible explanations of economic fluctuations will be discussed: 1) that cycles under socialism have a technical basis, 2) that they are caused by planning errors or by behaviour rewarded by the socialist economic system, 3) that both behavioural and technical factors are at work, and 4) that fluctuations are not systematic but are maintained by random shocks to the economy.

Limitations to the Study

One difficulty encountered in studying production and investment cycles in Eastern Europe and the Soviet Union is that much of the

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literature is not available in English. This thesis considers only material available in English. Because of this limitation, some secondary sources are used as reference.

Another difficulty is that published statistics from these countries are insufficient for adequate statistital analysis.

The Use of Terms

Terms used in Marxian literature differ from those used in Neo-classical and Keynsian literature. Similarly statistical categories used in industrialized market economies differ from those used by planned economies. It is therefore necessary to state how terms are used in this thesis.

Productive accumulation includes investment in equipment and also in working capital, capital under construction and inventories, and is used in this thesis in this sense. Investment refers only to completed producer goods.

Producer goods or investment goods are those produced by the investment or capital goods sector, or department I. Consumer goods are the output of Department II. Services are assumed to be included in each sector. Some goods such as electricity can be included in either sector depending on its use.[16] However, such a distinction is not carried over into statistical categories.[17]

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16 Lonergan, op. cit., p. 12.

17 Nikola Cobeljic and Radmila Stojanovic, The Theory of Investment Cycles in a Socialist Economy, Belgrade, Institute of Economic Research, 1966, International Arts and Sciences Press, White Plains, N.Y., 1969, p. 128.

Net Material Product (NMP) is used interchangeably with Gross National Product (GNP) or National Income (NI). This is not precise but does not matter at the general level of the discussion. The analysis is in terms of a simple, closed economy.

In discussions of growth, distinctions are made between changes in absolute values $(GNP_t - GNP_{t-1})$, changes in growth rates of output or proportional changes in output $(dQ/dt\ /Q = \dot{Q})$, and the acceleration in the rate of growth $(d\dot{Q})$.

The terms planned or command economy are used interchangeably. All economies discussed are assumed to be developing or mature industrial economies.

The terms cycles, oscillations and fluctuations are used to describe recurring changes in rates of saving, investment, profits, consumption and output. The period and amplitude of these oscillations will vary. The term cycle is nevertheless used in the literature in the expectation that at least part of the fluctuations has a systematic explanation. The terms production cycle and investment cycle are used interchangeably.

CHAPTER TWO

EMPIRICAL EVIDENCE FOR THE EXISTENCE OF INVESTMENT CYCLES

IN EASTERN EUROPEAN SOCIALIST ECONOMIES

Description of the Investment Cycle in Socialist Countries

References to investment cycles are frequent in the literature
of Eastern European economics. They are understood to be variations
in the annual growth rate of investment which are also reflected
in the growth rate of industrial output. They are referred to
sometimes, as quasi-cycles either because there is no negative
acceleration or because it appears that they can be avoided by
improvements in planning. A normative investment cycle is also
mentioned as well as efforts to shorten the investment cycle.[1] An
investment cycle can be shortened if the lag between the investment
and the growth in output of producer and consumer goods which results
from it is kept to a minimum which is technically essential. The
cycle is also characterized by a lag between production of investment
goods and consumer goods where they are related in production. For
example, the development of new energy resources in Eastern Siberia
requires the production of petroleum apparatuses, infrastructure,
possibly new labour skills, and so on.

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1 Eugeniusz Rychlewski, "Investment System in a Socialist Country",
Eastern European Economics, Vol. XII, Fall 1973, p. 31.

In the expansion phase of the investment cycle the rate of investment increases, responding to planners' desire to achieve high levels of growth, usually after a successful planning period. As the expansion phase progresses, consumption becomes constrained. Also bottlenecks occur which delay completion of investment projects. In anticipation of bottlenecks producers accumulate inventories of working capital which on the whole aggravate excess investment demand, and create additional bottlenecks in supply. In order to ease excess investment demand and reduce downward pressures on real consumption levels, the rate of investment must decrease. Some authors find that political pressure to increase consumption exists as well. These factors mark the beginning of the contraction phase of the cycle. The rate of consumption is allowed to rise. In due course investment projects are completed, inventories are allowed to decline, and output rises as increased or more productive capacity comes into operation. Successful production encourages a new wave of investment as the surplus from economic growth and development remains a desirable goal for planners in socialist economies as for entrepreneurs in market economies.

Review of Empirical Studies of Investment Fluctuations in Eastern European Economies

Some economists in the Soviet Union and Eastern Europe, following Marx, deny the existence of cycles under socialism stating that growth of output proceeds smoothly, or that negative growth rates do not exist.[2]

2 Alexander Bajt, "Investment Cycles in European Socialist Economies: A Review Article", Journal of Economic Literature, 1971, Vol. 9, p. 53.

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Among western economists, Kaplan and Moorsteen found fluctuations in the Soviet Union in the growth rate of output of consumer goods, machinery, other producer goods such as metals, fuels, power, chemicals, wood and wood products, and building materials; and also in total industrial output. The period of their study was from 1945 to 1958.[3]

Also Staller in 1964 found that fluctuations in Eastern Europe and the Soviet Union existed and sometimes exceeded those in OECD countries for the period 1950 to 1960. Comparing countries in each group at a similar stage in economic development, he found mean fluctuations were higher for total output, agriculture and construction but lower in industry in the planned economies.[4]

Nikola Cobeljic and Radmila Stojanovic studied investment cycles in the period of initial socialist industrialization in the U.S.S.R., Yugoslavia, Poland and Czechoslovakia. They characterize the first phase of the investment cycle by a deviation in the growth rates of output of Department I and Department II. In phase one of the cycle, the rate of growth of output of Department I increases at a faster rate than the rate of growth of output of Department II. In phase two of the cycle growth rates will converge because that of Department I declines and that of Department II increases. They found evidence for this in spite of the effect of changes in agricultural output on the growth rate of production in Department II. Using annual growth

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3 Norman M. Kaplan and Richard H. Moorsteen, "An Index of Soviet Industrial Output", American Economic Review, Vol. 50 Part I, June 1960, pp. 295-318.

4 George J. Staller, "Fluctuations in Economic Activity: Planned and Free-Market Economies, 1950-60", American Economic Review, Vol. 54, 1964, pp. 385-395.

rates of investment and output, Cobeljic and Stojanovic found that
investment cycles have a period of about five years in the Soviet
Union (1948-1954; 1954-1959), ten years in Yugoslavia (1948-1958),
five to seven years in Poland (1950-1957; 1958-1963), and six years
in Czechoslovakia (1950-1956; 1957-1963).[5]

K. A. Soos studied investment fluctuations in Hungary from
1950 to 1974 using annual growth rates of investment in constant
prices. He found a fast growth of the volume of investment for two
or three years followed by a slow growth, stagnation or even decline
for one or two years.[6]

Branko Horvat has observed changes in investment during the period
1948 to 1972 for Yugoslavia.[7] He used the ratio of productive invest-
ments in fixed assets to social product, both in current prices as
indicator. He found two-to four-year cycles. He also found long-
run cycles with a period of eighteen years by using four-year moving
averages of growth rates up to 1964 and six-year moving averages for
the subsequent period. Horvat judged that inventory accumulation was
a source of stability in the Yugoslavian economy as inventories
accumulated in the downswing cushioning the effects on production of

5 Nikola Cobeljic and Radmila Stojanovic, The Theory of Investment
Cycles in a Socialist Economy, Belgrade, Institute of Economic
Research, 1966, White Plains, N.Y.: International Arts and Sciences
Press, 1969, pp. 129-162.

6 Karoly Attila Soos, "Causes of Investment Fluctuations in the
Hungarian Economy", Kozgozdasagi Szemle, 1975 no. 1, Eastern European
Economics, 1975-6, Vol. XIII, Winter, p. 25.

7 Branko Horvat, Business Cycles in Yugoslavia, Belgrade: Institute of
Economic Research, 1969, White Plains, N.Y.: International Arts and
Sciences Press, Inc., 1971, pp. 230-231.

a decline in market demand, but allowing greater fluctuations in consumption.[8]

Josef Goldmann and Karel Kouba, using annual changes in growth rates for Czechoslovakia, Poland, and Hungary concluded that investment fluctuated systematically for the period from 1950 to 1966. They found that in Czechoslovakia investment gave rise to an echo effect in the increments to the flow of new industrial capacity with a time lag of eight or nine years. They also found a further echo effect in inventory formation. Inventories rise in the expansion phase of the cycle and decline as the rate of investment declines, thus reinforcing the investment cycle.[9]

Alexander Bajt, in 1971 reviewed the investment cycle in Eastern European countries and its causes. He presented graphs of industrial output, construction and investment for eight countries (The Soviet Union, The German Democratic Republic, Czechoslovakia, Poland, Yugoslavia, Bulgaria, Hungary and Romania). He used three-year moving averages of annual growth rates. Bajt found investment cycles with a period of at least eight years though his conclusion was tentative as the length of the period he studied, 1950 to 1965, showed only one complete cycle.[10]

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8 Branko Horvat, "Short-run Instability and Long-run Trends in the Yugoslav Economy's Development", Ekonomist, 1974, nos. 1-2, Eastern European Economics, 1975, Vol. XIV no. 3, p. 14.

9 Josef Goldmann and Karel Kouba, Economic Growth in Czechoslovakia, Prague: Academia, White Plains, N.Y.,: International Arts and Sciences Press, 1969, p. 47.

10 Bajt, op. cit., p. 57.

Recent Data on Fluctuations in Growth Rates of Output, Construction
and Investment in Eastern European Economics

Following Bajt, this researcher assembled data for the period from
1962 to 1976, for industrial production, construction and investment
in the Soviet Union and seven eastern European countries. Using
three-year moving averages of growth rates, fluctuations in aggregate
investment were found with periods of eight to eleven years (Tables I
to IV and Figure 2.1).

Fluctuations in construction and industrial output were much
smaller but were quite well synchronized with fluctuations in invest-
ment. The main exceptions were Hungary where industrial output dipped
slightly when investment increased in the 1967 to 1971 period; and
Romania where investment was low while construction and industrial
output remained steady in the 1967 to 1971 period. Also the rate of
growth of investment in Czechoslovakia fell between 1966 and 1969,
though the growth rate of industrial output remained the same.

The amplitude of fluctuations did not change significantly from
those in the period studied by Bajt, but were greater in less developed
economies or those with regional disparities such as Poland, Hungary
and Bulgaria. Negative growth rates did not appear in aggregates of
industrial production except in Czechoslovakia and the German Democratic
Repbulic in 1963 (between -2 and -3 percent). Negative growth rates
did appear in the two other aggregates of construction and investment,
but these negative rates did not appear in the three-year moving aver-
ages except in the case of Czechoslovakia in 1966, Hungary in 1965, and
Yugoslavia in 1966, when they were less than -2 percent. Fluctuations
in all three aggregates were least in the Soviet Union. It should be

TABLE I

NET MATERIAL PRODUCT[1]: INDUSTRIAL ACTIVITY (constant prices)
(annual growth rates)

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
U.S.S.R.	9.5	9.23	6.9	10.0	9.7	10.7	10.7	9.7	8.4	7.3	6.8	8.5	7.8	(7.6)	(4.8)[2]
		8.5	8.7	8.9	10.1	10.4	10.4	9.6	8.5	7.5	7.5	7.7	(7.7)	(6.8)	
G.D.R.	5.1	3.7	5.2	4.4	5.0	5.6	6.0	6.3	6.1	5.2	5.2	6.1	6.3	6.1	(5.9)
		4.7	4.4	4.9	6.5	5.5	5.0	6.1	5.9	5.5	5.5	5.9	6.2	(6.5)	
Poland	9.6	5.3	10.2	9.9	7.0	7.2	9.4	8.4	6.8	8.5	10.4	11.6	12.0	11.4	(9.8)
		8.4	8.5	9.0	8.0	7.9	8.3	8.2	7.9	8.6	10.2	11.3	11.7	(10.7)	
Czecho- slovakia	7.9	-2.7	1.5	5.5	6.8	4.0	5.6	6.6	7.9	5.6	4.4	5.1	7.0	8.5	(5.5)
		2.2	1.4	4.6	5.4	5.5	5.4	6.7	6.7	6.0	5.0	5.5	6.9	(6.3)	
Romania	14.1	11.6	14.8	14.5	10.1	13.0	12.4	10.7	18.2	7.7	14.3	18.7	15.8	11.5	(11.5)
		13.5	13.6	13.1	12.5	11.8	12.0	13.8	12.2	13.4	13.6	16.3	15.3	(12.7)	
Hungary	9.5	4.8	7.4	4.6	9.4	8.8	5.8	4.5	8.1	5.7	7.2	8.5	9.1	6.3	(4.1)
		7.2	5.6	7.1	7.6	8.0	6.4	6.1	6.1	7.0	7.1	8.3	8.0	(5.7)	
Yugo- slavia	6.8	14.6	16.1	7.5	1.6	4.2	6.6	11.2	9.4	10.4	7.3	5.3	10.8	3.0	—[4]
		12.5	12.7	8.4	4.4	4.1	7.3	9.1	10.3	9.0	7.7	7.8	6.4	—	
Bulgaria	6.3	10.6	12.0	9.9	11.3	13.3	15.2	13.2	9.4	9.1	7.7	10.0	(8.1)	(9.9)	(8.0)
		9.6	10.8	10.1	11.5	13.3	13.9	12.6	10.6	8.7	8.9	(8.7)	(9.0)	(8.6)	

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TABLE I (cont'd)

Notes:

1 Net Material Product is global product minus intermediate consumption of goods and services including consumption of fixed assets.

2 ( ) Bracketed data is in percentage growth rates of industrial output, and is from the United Nations Centre for Development Planning, Projections and Policies, op. cit.

3 Three-year moving averages of annual growth rates.

4 — data not available.

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TABLE II

NET MATERIAL PRODUCT[1]: NET FIXED CAPITAL FORMATION[5] (constant prices)

(annual growth rates)

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
U.S.S.R.[7]	—	—	—	—	—	9.4	7.5	3.8	10.6	5.1	6.7	5.2	6.7	8.2	(4.0)
				15.8	—	9.4	8.4	7.3	6.5	7.5	5.7	6.2	6.7	(6.6)	
G.D.R.	-1.8	1.5	10.6	9.2	9.0	14.3	10.7	21.3	4.5	-3.5	2.8	9.0	4.5	3.1	(8.0)
		3.4	7.1	9.6	10.8	11.3	15.4	12.1	7.4	1.3	5.6	5.4	5.5	(5.3)	
Poland	12.4	1.0	4.7	12.0	12.4	12.4	12.2	6.9	2.3	10.4	27.5	27.2	22.6	16.5	(3.0)
		6.0	5.9	9.7	12.3	12.3	10.5	7.1	6.5	13.4	21.7	25.8	22.1	(13.2)	
Czecho-slovakia	-2.2	-9.8	29.4	-2.3	-2.2	-0.7	3.4	0.2	30.5	7.3	5.9	17.7	7.8	14.6	(5.2)
		5.8	5.8	8.3	-1.7	0.2	1.0	11.4	12.7	14.6	10.3	10.5	13.4	(7.2)	
Romania[6]		—	—	—	—	—	11.1	4.4	3.7	11.4	13.0	12.1	8.5	9.7	(8.2)
		17.5		12.3		12.9	13.8	6.4	6.5	9.4	12.1	11.2	10.1	(12.2)	
Hungary	0.0	24.0	2.7	0.8	-4.5	30.2	-2.7	12.4	45.2	2.5	7.6	4.8	-5.7	35.5	—
		8.9	9.2	-0.3	8.3	7.6	12.3	18.3	20.0	18.4	5.0	2.3	11.5	(7.6)	
Yugo-slavia[8]	8.8	12.3	10.9	-11.8	4.3	6.4	8.1	6.2	17.5	6.5	3.4	2.9	8.8	8.9	—
		10.7	3.8	1.1	-0.4	-6.3	6.9	10.6	10.1	9.1	4.3	5.0	6.9		
Bulgaria	-0.7	57.7	19.5	-24.0	24.1	38.0	-1.4	28.5	-5.8	13.0	16.0	(6.9)	(7.8)	(17.3)	(2.6)
		25.5	17.7	6.5	12.7	20.2	21.7	7.1	11.9	7.7	12.0	(8.2)	(10.7)	(9.2)	

Sources: As for Table I.

Notes: 1 to 4 as for Table I.

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(cont'd....)

TABLE II (cont'd)

Notes (cont'd):

5 Net fixed capital formation equals the sum of completed goods added to stocks of equipment plus repairs minus consumption of fixed assets.

6 Growth rates derived from capital formation at constant 1966 prices as follows: $\frac{dK_t - dK_{t-1}}{dK_t}$

7 Growth rates derived from gross fixed capital formation at 1969 prices.

8 Gross fixed capital formation.

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TABLE III

NET MATERIAL PRODUCT[1]; CONSTRUCTION (constant prices)
(annual growth rates)

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976[4]
U.S.S.R.	1.5	3.9	5.6	8.0	5.7	10.9	9.1	3.8	8.6	8.0	4.7	4.5	8.7	—	—
	—	3.7	5.8	6.4	8.2	8.6	7.9	7.2	6.8	7.1	5.7	6.0	—	—	—
G.D.R.	3.8	-4.3	13.0	7.7	6.5	7.4	11.0	8.1	5.7	4.8	3.6	4.7	4.8	5.1	—
		4.2	5.5	9.1	7.2	8.3	8.8	8.3	6.2	4.7	4.4	4.4	4.9	—	—
Poland	4.8	4.1	8.7	5.0	8.9	12.0	9.3	6.5	3.4	4.9	21.4	16.3	13.7	11.0	—
		5.9	5.9	7.5	8.6	10.1	9.3	6.4	4.9	9.9	14.2	17.1	13.7	—	—
Czecho-slovakia	-0.4	-15.6	12.3	13.0	19.0	7.3	4.8	0.8	5.7	9.8	13.4	4.4	6.4	4.8	—
		-1.2	3.2	14.8	13.1	10.4	4.3	3.8	5.4	9.6	9.2	8.1	5.2	—	—
Romania	7.5	3.3	8.7	-5.3	7.9	14.4	13.7	7.3	14.7	10.0	9.1	8.3	0.0	9.1	—
		6.5	5.8	7.3	9.2	12.0	11.8	11.9	10.7	11.3	9.1	5.8	5.8	—	—
Hungary	2.0	3.8	4.2	0.5	6.1	13.8	7.5	9.7	9.9	6.5	1.5	5.1	8.0	8.9	—
		3.3	2.8	3.6	6.8	9.1	10.3	9.0	8.7	6.0	4.4	4.9	7.3	—	—
Yugo-slavia	10.9	15.6	14.9	-4.7	19.8	-4.1	7.5	8.0	9.2	2.5	3.3	-2.6	6.5	0.0	—
		13.8	8.6	10.0	3.7	7.7	3.8	5.3	6.6	5.0	1.4	2.7	1.6	—	—
Bulgaria	5.7	5.8	10.4	10.9	16.1	16.7	14.4	5.3	9.2	4.2	3.8	10.9	—	—	—
		7.3	9.0	12.5	14.6	15.7	12.1	9.6	5.5	5.7	6.3	—	—	—	—

Sources: As for Table I and Table II.

Notes: 1 to 4 as for Table I and Table II.

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Figure 2.1 - Fluctuations in Industrial Investment, Industrial Production and Construction, 1952-1975 (three-year moving averages of annual growth rates)
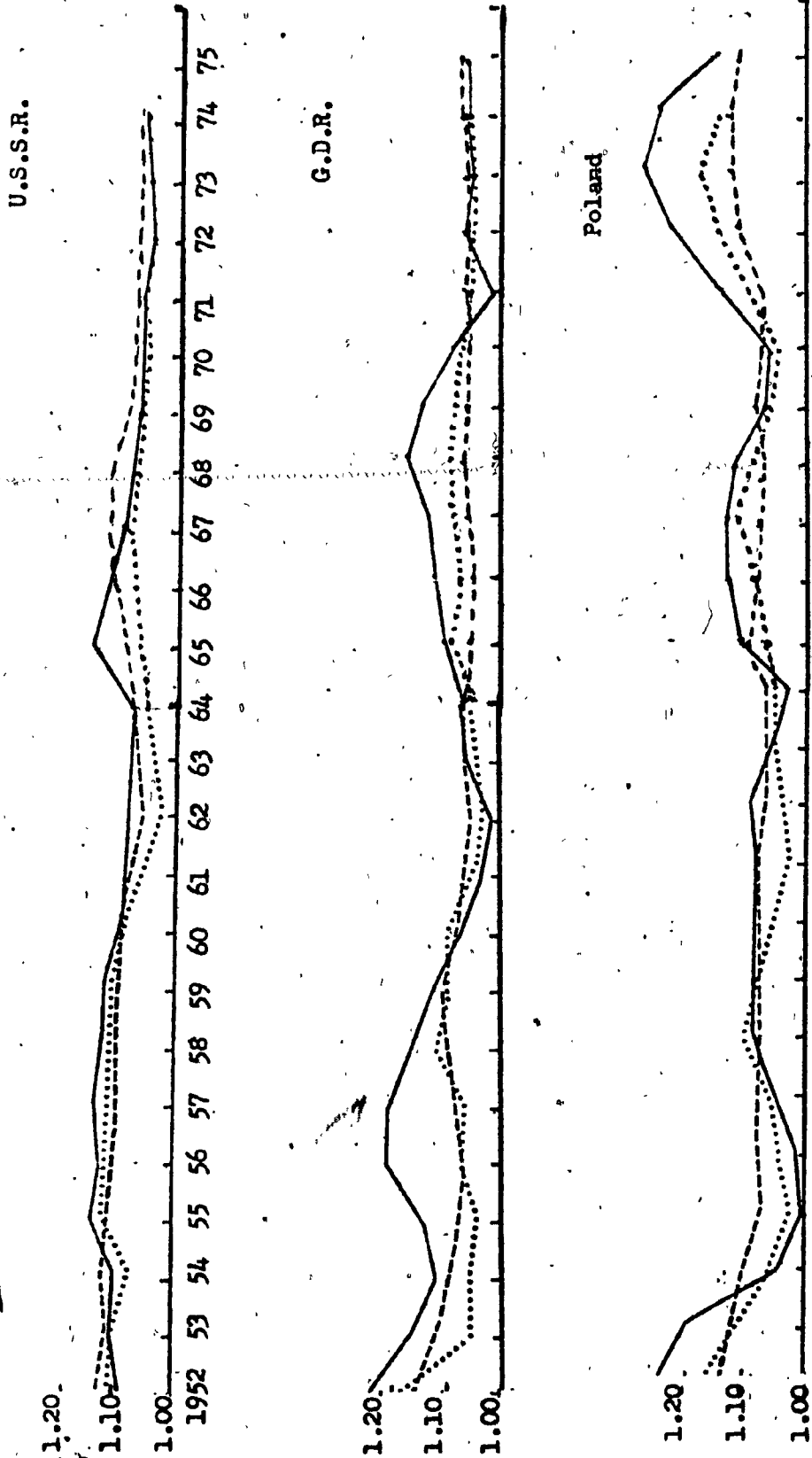
U.S.S.R.

G.D.R.

Poland

cont'd....

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Figure 2.1 - Fluctuations in Industrial Investment, Industrial Production and Construction (cont'd)

Czechoslovakia

Romania

Hungary
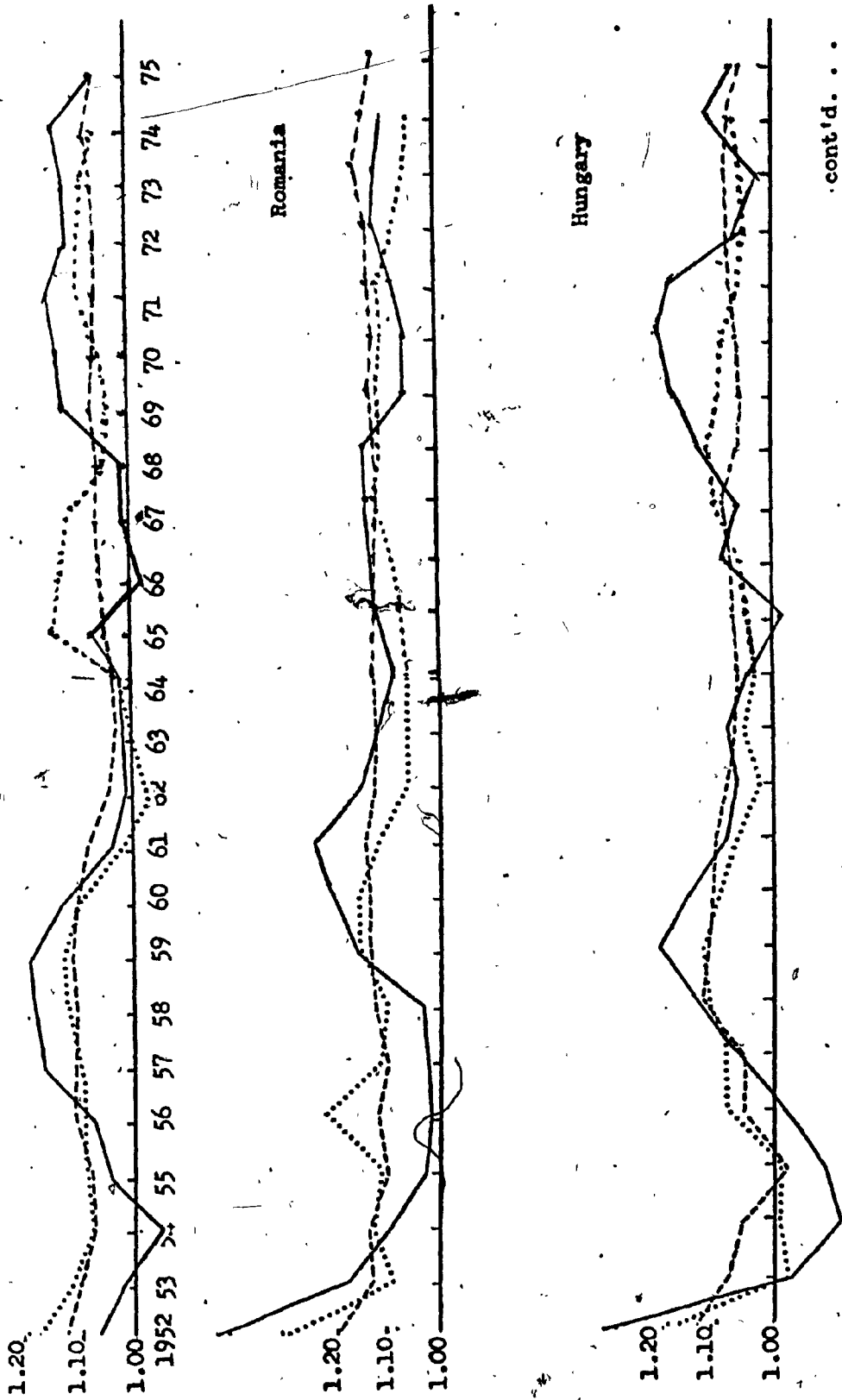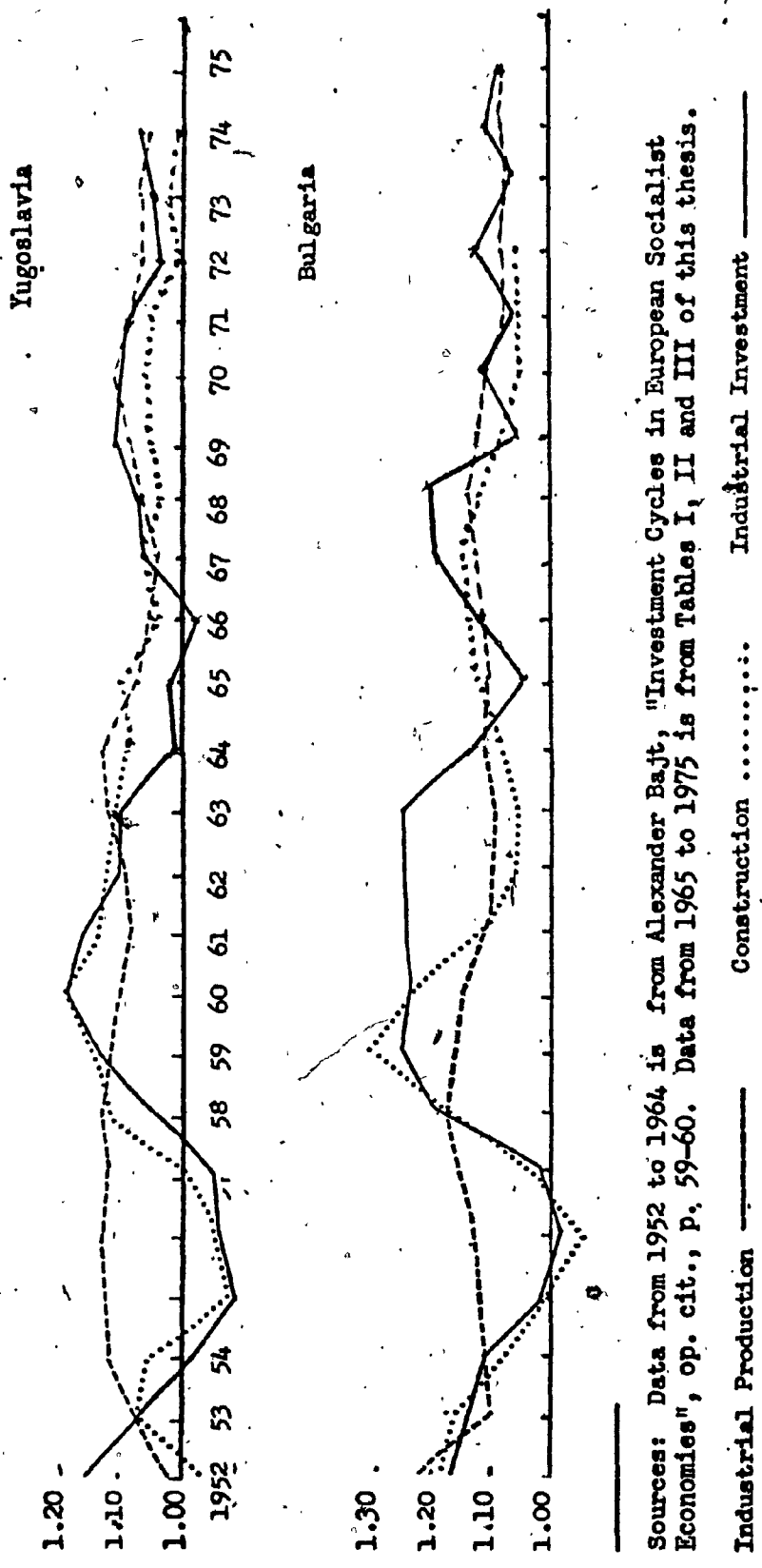
cont'd....

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Figure 2.1 - Fluctuations in Industrial Investment, Industrial Production and Construction (cont'd)

Sources: Data from 1952 to 1964 is from Alexander Bajt, "Investment Cycles in European Socialist Economies", op. cit., p. 59-60. Data from 1965 to 1975 is from Tables I, II and III of this thesis.

Industrial Investment ——— Construction ········· Industrial Production ———

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noted that the only data available on investment for the U.S.S.R. was for gross investment rather than net investment. The latter investment data was used for other countries.

The summary of this data in Table IV, listing peaks and troughs of investment cycles corresponds to descriptions of economic growth and development in eastern Europe and the Soviet Union for that period. Growth in the latter half of the sixties was higher than in the first half of the seventies, but the ratio of gross fixed capital investment to net material product increased in 1971 to 1975 with respect to the previous five-year period, except in Bulgaria. This corresponds to data collected by this researcher which indicates that an expansion phase of an investment cycle occurred generally in these countries in the 1971 to 1975 period. It also agrees with data showing investment growth peaked in Bulgaria in 1968.

Table V provides data on changes in ratios such as the capital-labour ratio (K/L), the capital-output ratio (K/Y), percentage change in gross fixed capital formation (GFCF), the ratio of GFCF to net material product (NMP), and real wages per capita for two consecutive five-year periods, 1966-70 and 1971-75. The fairly consistent rise in all these ratios with the exception of real wages which declined suggests that 1971-75 was the beginning of a new investment cycle. Similarly the fairly consistent decline in the percentage change in GFCF suggests a long-term downward trend in investment and production growth rates.

Planned investment for 1976 to 1980 stresses resource development (including fuels) and the completion of investment projects rather than the initiation of new ones. However, this has proven difficult to

TABLE IV

YEARS OF PEAKS AND TROUGHS OF INVESTMENT CYCLES

Country	Trough	Peak	Trough	Peak	Trough	Peak
U.S.S.R.	1954	1957	1962	1967	1972	[1]
G.D.R.	1954	1957	1962	1968	1971	—
Poland	1955	1957	1963	1968	1971	1973
Czechoslovakia	1954	1959	1962	1970	1975	—
Romania	1956	1961	1964	1968	(1970)[2]	—
Hungary	1954	1959	1965	1970	1973	—
Yugoslavia	1955	1960	1966	1970	1973	—
Bulgaria	1956	1959	1965	1968	(1971)	—

Source: Figure 2.1

Notes:
1 Turning point is not discernible.

2 Tentative owing to incomplete data.

TABLE V

FIVE-YEAR COMPARISONS FOR SEVEN EASTERN EUROPEAN COUNTRIES FOR THE YEARS 1966-70 AND 1971-75 (five-year average annual percentage change)

Country	GFCF[1]	GFCF/NMP[2]	RWAGE[3]	FI[4]	K/L[5]	K/Y[6]
Bulgaria						
1966-70	12.5	35.1	5.2	13.6	10.3	2.00
1971-75	8.6	35.1	2.8	9.7	8.5	2.23
Czechoslovakia						
1966-70	7.2	31.1	3.6	4.4	3.1	3.06
1971-75	8.2	33.7	3.4	5.6	4.8	2.98
U.S.S.R.						
1966-70	7.5	27.0	4.9	8.7	6.7	1.83
1971-75	6.9	29.9	3.7	8.6	7.2	2.03
G.D.R.						
1966-70	9.1	27.6	4.2	5.2	4.8	2.56
1971-75	4.1	28.7	3.7	6.3	5.7	2.57
Poland						
1966-70	8.1	25.3	2.1	8.0	4.0	2.82
1971-75	18.4	36.4	7.2	9.9	5.8	2.67
Romania						
1966-70	11.3	28.8	3.8	13.3	—	—
1971-75	11.5	34.1	3.8	13.2	—	—
Hungary						
1966-70	11.6	32.9	3.5	7.0	4.0	2.76
1971-75	7.1	35.9	3.4	8.0	7.4	2.84

Source: Economic Survey of Europe in 1976, Part II: Five-year Plans for 1976-1980 in Eastern Europe and the Soviet Union, New York: United Nations, 1978.

1 Gross fixed capital formation.   2 Net Material Product.

3 Real wages per wage and salary earner.   4 Fixed investment.

5 Capital-labour ratio in the material sphere.

6 Capital-output ratio in the material sphere.

achieve partly because investment demand carried over from the previous period remains high and the opening of new resources requires large investments. The goal of modernizing equipment also requires investment.[11]

In the first half of the decade investment in heavy industry tended to overfulfil the plan and decreases in investment were borne by consumer goods industries except in Poland and Romania. A relative lagging in the construction sector, which affected the efficiency of investment was also reported. The decrease in growth of consumer goods industries was partly owing to a poor harvest, which reduced output in the food processing sector.

Growth rates in heavy industry remain high. For example in the Soviet Union output of computer equipment and spare parts and of petroleum apparatuses grew in 1975 at a rate of 22 percent. In Poland there was a 20.7 percent growth in output of metalworking machine tools. In Germany there was a 17.7 percent growth in output of metal-cutting tools.

The expected growth rate for 1977 was about the same as for 1976. Although demand for investment in consumer goods industries is high, it may not be possible to narrow the gap between producer and consumer goods growth rates because of the plan to encourage engineering, electronics and chemical industries, considered crucial to technical progress. The implementation of technical progress has become

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11 Economic Survey of Europe in 1976, Part II, The Five-Year Plans for 1976-1980 in Eastern Europe and the Soviet Union; prepared by the Secretariat of the Economic Commission for Europe, New York: United Nations, 1977, pp. 90-92.

important as growth in the labour force is about zero in Czechoslovakia, Hungary and the German Democratic Republic. Only Bulgaria and Romania have underemployed agricultural labour to call on.[12]

In spite of these needs for new resources and more advanced technology, investment projects for the present planning period are to be constrained in order to permit concentration of efforts on projects already in progress and to reduce excessive gestation periods caused by the overloading of the construction sector and bottlenecks in building material supply especially in countries where very high investment rates have prevailed.

However, the relation between the proportion of unfinished investment projects in total investment is complex as cause and effect run both ways:

> Change in the stock of incomplete investments is not simply
> a cause of growing investments, but also a consequence
> to a certain extent, while it may be a cause of the
> increments of investment in the next period. Every
> experience proves that a dynamic increase of investments is
> accompanied by a growing stock of incomplete projects. This
> is related to some extent also to the absorptive capacity
> of the economy in a given period. 13 -

In addition a better balance is being sought between the construction of new plant and smaller, so-called modernization investment projects in existing plants which tend to obtain low priorities when the system is operating under high pressure. For example, in the Soviet Union a new bonus system has been introduced to overcome the

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12 Supplement to World Economic Survey, 1976, Recent Trends in the World Economy, New York: United Nations, 1978.

13 I. Berend, "Long-range Development Policy - Interrelations Between Economic Development and Capital Intensity", Acta Oeconomica, No. 3/4, 1974, p. 348. Cited in Economic Survey of Europe, 1976, op. cit., p. 98.

lack of coordination between demands for high levels of output and
the desire to modernize plant and equipment, as in the short-run
implementation of new investment, may have a depressing effect on
current output performance.[14]

Efforts have been made to reduce the gestation period for
investment, to limit excess demand for investment resources, to
make executive organizations less orientated to purely quantitative
results, and to control investment by intermediate planning bodies.
This was done by concentration of investment, centralization as a
means of rationalization and the implementation of financial con-
straints and procedures. However, excess demand for investment
continues to increase, and changes in management hierarchy and plan-
ning may be required to adequately separate micro- and macro-economic
investment decisions. Cost efficiency was also seen as a problem.[15]

Methods Used for the Analysis of Fluctuations.

This researcher has followed Bajt in plotting three-year moving
averages of growth rates in output, investment and construction.
Oscillations in these variables were found similar to those found by
Bajt. The use of moving averages instead of annual data will be
explained, and the possible significance of such cycles will be
considered.

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[14] World Economic Survey 1975, Fluctuations and Development in the
World Economy, Department of Economic and Social Affairs, New York:
United Nations, 1976, p. 97.

[15] Economic Survey of Europe, 1976, op. cit., p. 92.

The moving average smooths the data over the period used being
the same as fitting a trend line for that period. Thus the use of
moving averages will suppress cycles with a period the same as the
length of the trend-line moving average used. A three-year moving
average will suppress three-year cycles, but longer cycles will remain
visible. This procedure is then helpful in disc___ing cycles in
production and investment caused by technical changes which will
require such major changes as new tooling, new equipment, new skills,
infrastructure, resource changes.

The disadvantage of using a moving average is that oscillations
will be induced if the series is random because of the Yule-Slutsky
effect. Slutsky induced fluctuations which fitted historical data
for the U.S.A. by using ten-year moving averages of random number
series. Such distortion can be minimized by averaging over short
periods and by using unweighted averages. This is an unavoidable
problem in much statistical work in economics, where autoregressive
schemes are used, as the recurring error terms also produce a Yule-
Slutsky effect and create oscillations.

The time series of growth rates in industrial production and
investment in Tables I and II were tested for serial correlation
using the von Neumann ratio. The results are given in Table VI.
Of the 16 series tested, seven were found to be random and nine
exhibited positive or negative serial correlation. It is, therefore,
not possible to reject the hypothesis that time series of annual
growth rates in industrial production and investment are random.
As a result part of the oscillations observed when three-year moving
averages are used may be induced because of the Yule-Slutsky effect.

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TABLE VI

MEAN SQUARE SUCCESSIVE DIFFERENCE TEST[1] OF INDEPENDENCE OF
SUCCESSIVE OBSERVATIONS IN THE TIME SERIES OF TABLES I & II

	n[2]		NMP: Industrial Activity	n		NMP: NFCF
U.S.S.R.	15	SC+[3]	0.8818[4]	10	R[5]	2.9279
G.D.R.	15	SC-	1.0188	12	R	1.8901
Poland	15	R	1.4488	15	SC+	0.9224
Czechoslovakia	15	SC-	3.7102	15	SC-	3.5962
Romania	15	R	2.9306	9	R	1.6256
Hungary	15	R	2.1902	14	SC-	3.1742
Yugoslavia	14	R	1.4944	14	SC-	5.8592
Bulgaria	15	SC+	0.9369	15	SC-	4.3297

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1 Test was done for the 5 percent significance level.

2 Number of observations in the series.

3 Serial correlation (positive or negative) exists.

4 K value.

5 Series is random.

von Neumann Ratio: $K = \dfrac{\delta^2}{\sigma^2} = \dfrac{\sum (X_{i-1} - X_i)^2 / n-1}{\sum (X_i - X)^2 / n}$

However, this distortion is also present in any time series of output and investment growth rates as any real economy experiences stochastic shocks which will be propagated through the system creating oscillations. This does not deny the existence of fluctuations owing to systematic factors, but points to the difficulties encountered when aggregate data are used for the study of fluctuations.

Branko Horvat has studied business cycles in Yugoslavia extensively using a variety of statistical techniques. Because the method assumes a cycle will have both systematic and random components, he simulated observed cycles by using an autoregressive scheme. As data he used yearly moving averages of quarterly growth rates. His results are then subject to distorting oscillations from two sources: the moving averages, assuming some of his growth rates series are random, and the autoregressive scheme.

Using his autoregressive equation he found,

> .... industrial cycles in Yugoslavia can be described in a
> satisfactory way by the sum of two sine waves. The period
> of the longer sine wave corresponds to the visible period
> of the cycle of empirical magnitudes, and the amplitude is
> constant. Therefore the longer sine wave can be understood
> as the basic wave, which moves regularly. On this basic
> wave are then superimposed irregular shorter waves with
> periods of some 3-9 quarters with significant damping. The
> regular basic wave can be interpreted economically as
> periodic structural refractions, and the superimposed short
> fluctuations - as stochastic shocks (disturbances) which
> constantly occur in every real economy. 16/

However, he cautions that "almost nothing is known about the systematic characteristics of the economy" and that his results should not be interpreted mechanically.

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16 Horvat, Business Cycles in Yugoslavia, op. cit., p. 219.

Horvat rejects the use of the reference cycle in rapidly growing economies as it does not allow for trend values increasing during the cycle. The National Bureau of Economic Research in the U.S.A. uses the reference cycle for forecasting business cycles. He also rejects the use of such tools as the periodogram as such a model requires peaks and troughs to appear at regular intervals, which is not the case with economic series.

Cobeljic and Stojanovic use data to show as far as possible that the rate of growth of output of Department I increases relative to that of Department II in phase one of the investment cycle, while the two rates converge in the second phase of the cycle. This approach shows the changes in the structure of production over the cycle and is thus very helpful. However, it was not possible to obtain adequate data to use their approach for recent data. Further, if data were obtainable it would not fit the theoretical categories used by Marx or Lonergan for the two departments of production.

Bajt's approach of using three-year moving averages of annual growth rates has the advantage that the data is readily available. However, it is subject to the above criticisms.

Data such as that given in Table V, the capital-output ratio, the real wage rate per capita, the ratio of gross fixed capital formation to net material product, all of which would be expected to vary over a production cycle, may be more informative than time series of annual growth rates in the study of such cycles.

Review of Interpretations of Investment Cycles

Cobeljic and Stojanovic think that investment cycles have a technical basis, that is cycles follow from the necessity of enlarging

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or recasting the capacity of Department I before achieving increased output of Department I and Department II. The increase in capacity of Department I requires a relative decline in the rate of growth of Department II in the first phase. This phase could be described as a movement away from equilibrium. This disequilibrium is gradually overcome as bottlenecks are fed and the process of expansion and recasting is completed. Cobeljic and Stojanovic think that economic development always leads to distortions and they find that R. Chelinski and Oskar Lange support their views:

> The mechanism that sets this phenomenon in motion is based, according to Chelinski, simultaneously on heavy productive investment and on a large share of construction which is necessarily involved in such investment. During the gestation period, investment cannot contribute to a parallel development of the production of goods at the necessary rate. Structural equilibrium is distorted, which is evident, among other signs, from the corresponding distortion of conditions in the normal exchange of goods. The situation changes when the gestation period is brought to a close. We obtain an additional amount of inputs through which it is possible to commence and accelerate the production of consumer goods. Investments made now are aimed at the overcoming of bottlenecks and disproportions due to the nature of the investment wave in the earlier period. Such investments are highly productive, and the increase in final output that relies upon them is a sizable and rapid one. These factors create conditions for the increase of consumption in the short run and for the reestablishment of equilibrium. 17

While the period of gestation can be shortened and overinvestment can be avoided, the technical characteristics of growth and development cannot be eliminated.

Lange, in his Theory of Reproduction and Accumulation held that distortion of equilibrium was only characteristic of the early stages of economic development and that later investment fluctuations were

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17 Cobeljic and Stojanovic, op. cit., p. 25.

echoes of this first wave of investment. Such reinvestment cycles would gradually disappear.[18] Cobeljic and Stojanovic find that in his later work, Wholes and Parts, Lange views the alternate distortion from and return to equilibrium as a constant law of variation of economic activity.[19]

Goldmann and Kouba find that traditional systems of directive management under socialism are the dominant factor in investment cycles, though they see that it is difficult to isolate and quantify the influence of this factor just as it is difficult to quantify the influence of technological advance in the capital-output ratio.[20] While the traditional system of planned management enabled large investment funds to be assembled in the period of initial industrialization, in a more complex and developed economy with production not linked to markets, it led to relative growth of inventories and capital under construction with respect to output.

Soos agrees with Goldmann and Kouba that investment cycles result from inadequacies of planning. Periodic restraint in investment becomes unavoidable because further investment would endanger the growth of consumption and because investment efficiency begins to deteriorate. He looks to a greater separation of investment decisions by enterprises (microecohomic decisions) from control by the state

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18 Oskar Lange, Theory of Reproduction and Accumulation, Oxford: Pergamon, 1969, p. 107.

19 Cobeljic and Stojanovic, op. cit., p. 28. Reference is to Oskar Lange, Wholes and Parts: A General Theory of System Behaviour, Oxford: University Press, 1965.

20 Goldmann and Kouba, op. cit., p. 101.

(macroeconomic decisions) as a way of reducing the pressure of investment demand and increasing the efficiency of investment. This he hopes will result in the disappearance of investment fluctuations.[21]

Bajt also thinks that cyclical growth can be eliminated by changing the institutional set up or decreasing the rate of investment, as both are ways of increasing the consumption efficiency of investment. But on the one hand he thinks the second solution is not likely to be chosen, and on the other that decentralization of decision-making will lead to a different cycle which is demand-related.[22]

Horvat finds that investment policy or its absence is a major source of instability in the Yugoslavian economy. For example, the period of self-management from 1952 to 1960 led to rapid economic expansion with which, in his view, the required changes in social organization could not keep pace.[23]

Thus, in the group of economists reviewed, Chelinski, Lange, and Cobeljic and Stojanovic tend to emphasize the technical basis of investment cycles, while Goldmann and Kouba, Soos, Bajt and Horvat emphasize the role of the planning system or the behaviour of planners. In the following chapter analysis of some explanatory models will consider the role of these factors in investment cycles.

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21 Soos, op. cit., p. 27.

22 Bajt, op. cit., p. 62.

23 Horvat, Business Cycles in Yugoslavia, op. cit., pp. 61 and 64.

CHAPTER THREE

EXPLANATORY MODELS OF INVESTMENT CYCLES
IN EUROPEAN SOCIALIST ECONOMIES

Introduction

As outlined in the previous chapter, explanations of investment
cycles can be divided broadly into those which emphasize technical
bases and those which give more attention to behavioural patterns
which occur in a planned economy. Firstly, the models of Kalecki
and Cobeljic and Stojanovic will be presented and compared. Both
these models stress technical factors. The views of other economists
who use a similar approach will also be summarized. Secondly,
models emphasizing behavioural factors will be described. In
conclusion, a model synthesizing some basic insights of both groups
is proposed. How available data supports such an hypothesis is shown
for the Soviet Union, Yugoslavia, Poland and Czechoslovakia.

Technical Bases for Investment Cycles

Kalecki's Model and a Cyclic Growth Process

In his book Essays on the Economic Growth of the Socialist and
the Mixed Economy, Kalecki presents a model of economic growth which
assumes constant parameters of the capital-output ratio (m), the ratio

between the volume of inventories and the national income (μ), depreciation (a), and increases in output resulting from "learning by doing" in the use of new equipment (u). With such assumptions his model shows that a rise in the rate of growth of output results from increases in the ratio of productive accumulation (I + S) to national income (Y). It also shows that this would involve a consequent decrease in the ratio of consumption to national income.

The equations of his model are as follows:

(1) $Y = I + S + C$

(2) $\Delta Y = 1/m \cdot I - aY + uY$

Dividing equation (2) by Y we obtain:

(3) $\Delta Y/Y = r = 1/m \cdot I/Y - a + u$

A constant rate of investment will ensure a constant rate of growth of national income. If the proportion of productive investment in national income is rising, the rate of growth of national income will accelerate. However, this implies a declining proportion of consumption in national income, though consumption may not decline absolutely.

Kalecki defines the relation between changes in national income (Y) and changes in working capital, capital under construction and stocks (S) as follows:

(4) $S = \mu \Delta Y$

Dividing equation (4) by Y and adding equation (3) we obtain[1]

(5) $I + S/Y = (m + \mu)r + (a - u)m$

or $r = 1/m + \mu \cdot I + S/Y - m/m + \mu (a - u)$

Allowing $i = I + S/Y$ so that

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[1] Michal Kalecki, Selected Essays on the Economic Growth of the Socialist and the Mixed Economy, Cambridge: University Press, 1972, pp. 14-15.

41

(6) $C/Y = 1 - i$

and letting $k = m + \mu$ i.e. the capital-output ratio for all
of capital, we have

(7) $r = i/k - m/k(a \leq u)$

    With the assumption of constant parameters Kalecki explores the
process of economic growth when the rate of growth is constant. He
then proves that given his assumptions, the stock of fixed capital,
with a given life-span will also grow at a constant rate (r).[2] In
an analogous way he proves that if the productivity of labour in new
plant increases at a constant rate (α), then the overall productivity
of labour increases from year to year in the proportion $1 + \alpha$.[3]

    Then the rate of increase of employment can be expressed as

(8) $1 + \varepsilon = 1 + r / 1 + \alpha$

that is, it equals the ratio of the proportional rise in output per
year divided by the proportional overall rise in productivity. If
the fraction is greater than one, then employment increases at a rate
ε . With the assumption of full employment, it follows that

(9) $\varepsilon = \beta$

the rate of growth of manpower or the labour force.

Then from equation (8) it follows that

      $1 + r = (1 + \alpha)(1 + \beta)$

or approximately

(10) $r = \alpha + \beta$

Equations (7) and (10) can be depicted diagrammatically:

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2 Ibid., pp. 17-20.

3 Ibid., pp. 22-23.
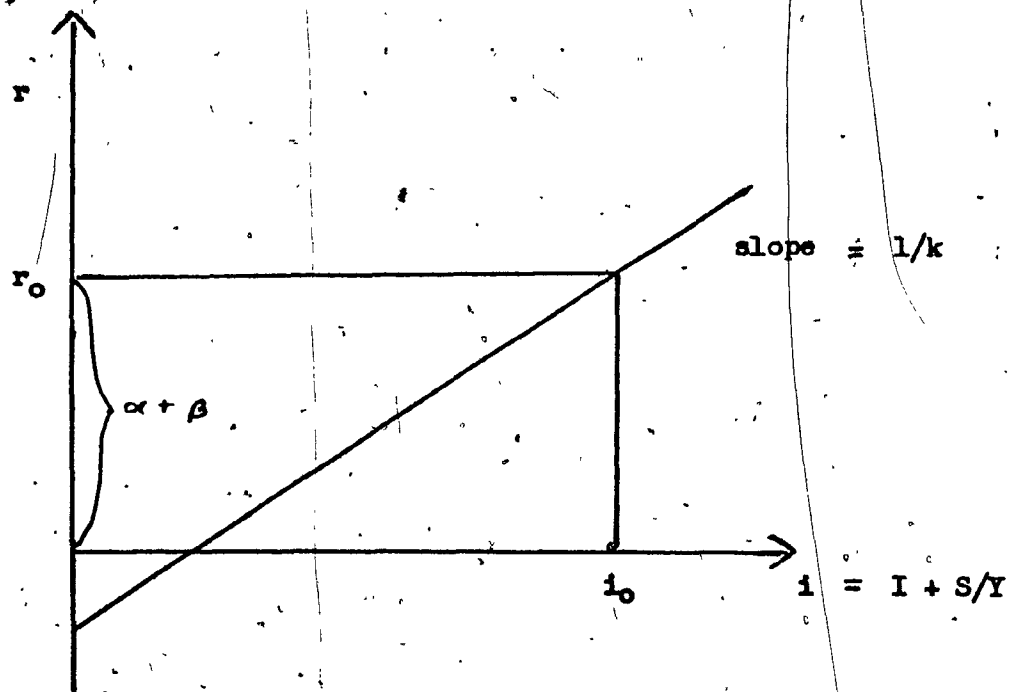
Figure 3.1 – The Relation Between the Growth Rate of National Income (r) and the Rate of Productive Accumulation (i) When the Capital-Output Ratio is Constant. 4

However, in his chapter on <u>The Structure of Investment</u>, in footnotes on the transition period and in his chapters on changing the capital-output ratio (Chapters 7, 8 and 10) a more complex view of economic growth emerges. According to this view the process of growth, which need not lead to an increase in the rate of growth of national income and so can be considered uniform growth, can be divided into three phases: the construction or gestation phase, the transition phase and the phase of recasting. It is also possible to consider the construction and transition phases as two aspects of a phase of growth in productive accumulation greater than growth in national income.

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4 Ibid., p. 25.

Construction Phase

If one assumes that qualitatively different equipment is required to produce more, or more productive, capital equipment, investment in the producer goods sector must increase first. This occurs first as an increase of capital under construction and not of productive investment. Kalecki notes that the shift from consumption to investment leads to a period of absolute stability and therefore of relative decline in real wages or consumption.[5] The rate of growth of national income increases very little as α is used for accumulation and new producer goods are not delivered until the transition phase.

In his constant parameter model, as capital under construction increases, inventories of consumer goods decrease. In such a case the structure of production does not affect the ratio of inventory volume to national income (μ), and real wages continue to rise. However, in that case real wages will decline in the transition phase when productive accumulation shifts from capital under construction to investment goods. In reality real wages decline from the beginning of the gestation period as μ does not remain constant.

The following inequalities exist in the construction phase:

$$I_i/I > m_i/m \ . \ I/Y \qquad m_i > m \qquad i > i_o$$
$$\text{so that } (1 - i = c) < (1 - i_o = c_o)$$

where I_i/I is the proportion of investment in the producer goods sector and m_i is the capital-output ratio in the same sector.[6]

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5 Ibid., p. 34 footnote.

6 Ibid., pp. 105-107.

The construction phase ends when the rate of increase in productive accumulation is at a maximum.

Figure 3.2

Figure 3.3

Construction   Transition   Recasting
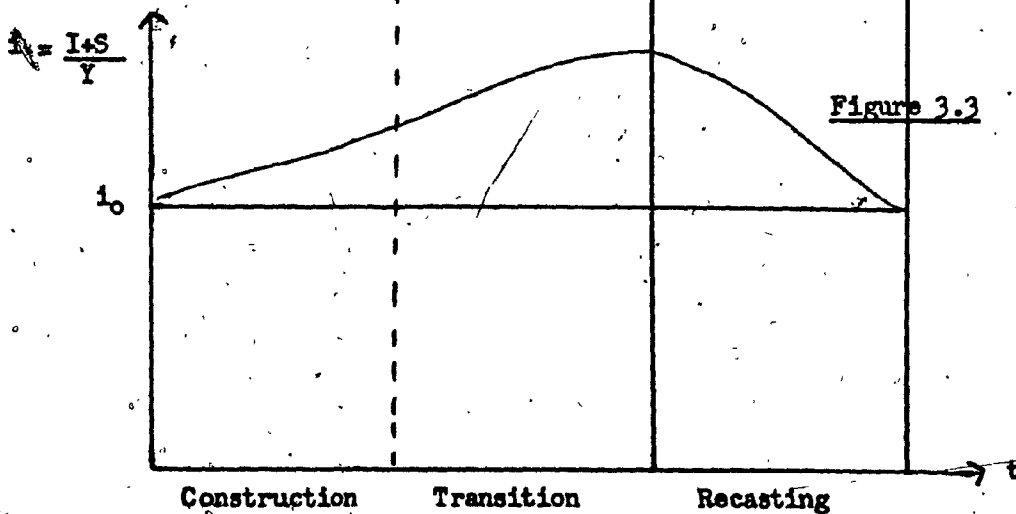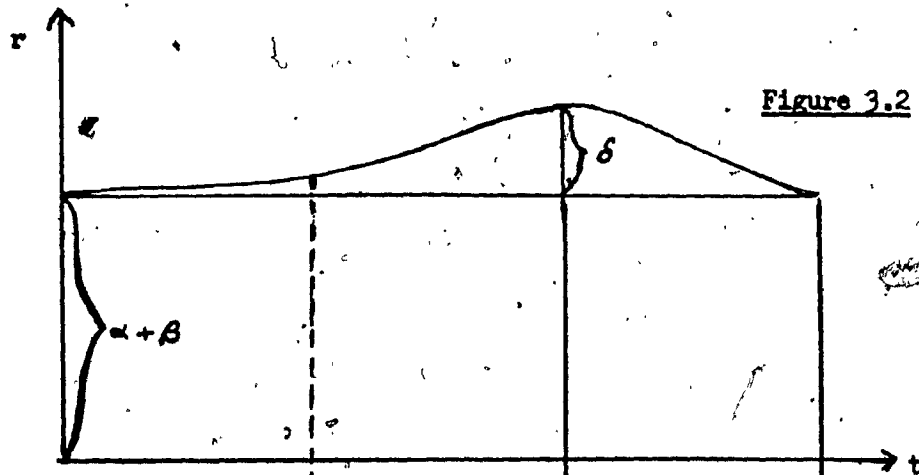
Figure 3.2 – Changes in the rate of growth of national income (r) owing to variations in the rate of growth of productivity during the investment cycle.[7]

Figure 3.3 – Changes in the ratio of productive accumulation to national income during the investment cycle.

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7 The length of the phases will vary with each cycle, and will depend on technical and behavioural factors.

Transition Phase

As capital under construction is completed and the capacity of the producer goods sector is enlarged or transformed, the relative share of productive accumulation, particularly of fixed capital and equipment, in national income continues to increase but at a slower rate. As capital equipment is delivered r begins to rise more rapidly and reaches a maximum at the end of the transition phase (Figure 3.2). As Y increases as well as I, the ratio i will rise less rapidly (Figure 3.3).

In the transition phase two effects on real wages can be distinguished. Firstly, insofar as capital equipment is more capital intensive, labour productivity in new plant is increased. This increase can be called δ which is in addition to α the normal rate of increase in productivity owing to technical progress (Figure 3.2). α will go to productive accumulation while δ can be divided between accumulation and consumption in the same proportion so that consumption may rise and real wages too to this extent. However, the whole of δ as well as α could go to productive accumulation. This would depend on planners' behaviour.

In the transition phase m_1 approaches m and vice-versa, as they are not distinct. The change of output in the investment sector is the same as the change in capital equipment for the whole economy.[8] National income increases, but productive accumulation increases more

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8 Kalecki, Selected Essays on the Economic Growth of the Socialist and the Mixed Economy, op. cit., pp. 107-108.

rapidly than national income.[9] The following equalities and inequalities apply:

$$I_1/I < m_1/m \cdot I/Y \qquad m_1 \rightleftarrows m \qquad i > i_o$$

$$\text{so that} \quad (1 - i = c) < (1 - i_o = c_o)$$

I_1/I decreases as I increases. m_1/m decreases as m_1 and m approach each other. I/Y increases as I increases more than Y during this phase.

Recasting Phase

In this phase old equipment is gradually replaced by new more productive equipment. The increment to national income due to new investment is raised while loss of national income resulting from the scrapping of old equipment is unchanged. This difference decreases as higher productivity pervades the stock of capital equipment. New equipment contributes proportionally less to the increase in overall productivity and the overall capital–output ratio. At the end of this phase the rate of increase of labour productivity returns to its normal level resulting from technical progress, and the rate of growth of national income returns to its normal level. It is to be noted that national income increases throughout the recasting phase, at more than the equilibrium rate. Once capital equipment is completely recast and the productivity of all equipment has been raised, the loss of national income owing to scrapping increases again to its normal level with respect to national income.[10]

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9 Ibid., p. 70.

10 Ibid., p. 57.

A fall in the rate of productive accumulation occurs throughout this phase. There is a fall in the rate from i to i_o and the increase in the rate of consumption c is proportional to this fall. Both occur because of a rise in output in the recasting phase relative to capital equipment and because of some shift in the use of the rate of increase in output, due to the rate of growth in productivity $\alpha + \delta$), from productive accumulation to consumption. This allows the rate of increase in productivity to decline to α as shown in Figure 3.2.

The following relationships apply in the recasting phase:

$$I_i/I = m_i/m \cdot I/Y \qquad m_i = m \qquad i = i_o$$
$$\text{so that} \quad (1 - i = c) = (1 - i_o = c_o)$$

$m_i/m = 1$ and $I_i/I = I/Y$ as Y increases and the long-run equilibrium proportion of investment in national income is reached for the whole economy and for the producer goods sector as well.

Kalecki refers to the phases of construction, transition and recasting in the context of increasing the rate of growth either by raising the capital-output ratio permanently in order to overcome a labour shortage, or by extending the capital stock when employment can be increased because there is a labour reserve. In reality any increase in the rate of growth will result from rises in both α and β unless the rate of growth in the labour force is constant or decreasing as occurs in the later stages of industrialization. However, here the model is applied to explain the implementation of technical change in the productive process, which can occur without changes in the rate of growth of output in the long run.

Kalecki's notion of technical change includes organizational changes as well.[11] He assumes that technical progress and therefore the rate of increase in the productivity of labour is the same for the investment sector and the consumption sector. In his uniform growth model, technical progress is the only source of increase of labour productivity as the capital-output ratio is constant.[12] Thus labour productivity (Y/N) increases 'pari-passu' with the capital-labour ratio (K/N). He further notes that increases in productivity do not occur at the same rate for all industries. Increases in productivity in resource industries may be limited by supplies of a resource. Long construction periods, for example in the extension of a resource base, may delay increases in productivity. He also notes that the length of construction phases can become excessive if the volume of construction becomes beyond the technical and organizational capacities of those concerned, as the length of the construction period is proportional to the volume of construction given the rate of productive accumulation. This tendency to excessive investment in capital under construction is also owing to the fact that new projects require greater technical and organizational abilities than the continued management of established plants.[13]

It follows from Kalecki's analysis as outlined in three phases that there is a technical basis for viewing the process of growth as cyclic. The wave-like pattern of growth in different industries

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11 Ibid., p. 17.

12 Ibid., p. 35.

13 Ibid., p. 44

will lead to oscillations in aggregate variables insofar as industries are related in production and exchange, and insofar as innovations are applicable in unrelated industries.

Cobeljic and Stojanovic's Model and Cyclic Growth

Nikola Cobeljic and Radmila Stojanovic in their book The Theory of Investment Cycles in a Socialist Economy also take the view that the application of innovations resulting from technical progress is an important cause of investment cycles in socialist countries. They describe the period of the application and introduction of new technology as follows:

> . . . (it) covers laboratory research and the preparation
> of laboratory projects up to their final implementation
> in industry. It covers, further, the time of the
> production of elements that make up the new technology
> and, finally, the time of their large scale application
> in different industries. This complex process of the
> introduction of new technology has been stressed because
> all these periods involve the use of new capital and
> require corresponding adjustments in production and demand
> for new factors of production. 14

They find that investment cycles are most intense in the period of initial industrialization because of the extent of the technological revolution that is occurring. However, investment cycles continue with smaller amplitudes as the application of technical change continues to be the basis for their occurrence.

To illustrate their theory, they present a model which shows the effects on production of changes in the capital-output ratio.

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14 Nikola Cobeljic and Radmila Stojanovic, The Theory of Investment Cycles in a Socialist Economy, Belgrade, Institute of Economic Research, 1966; White Plains, N.Y.: International Arts and Sciences Press, p. 58.

Their model is a two-sector model. They make the following assumptions:

1. Accumulation is produced in Department I, so that the requirements of consumer goods needed for development are ignored.

2. The supply of labour is unlimited.

3. Technological progress is uninterrupted and is expressed in terms of changes in the capital-output ratio.

4. Technical progress is equally intensive in both departments.

5. The share of national income in total output is constant and so is the share of accumulation in national income.

6. The rate of depreciation is constant and the same in both departments.

7. Growth rates in each department are taken as averages of all sectors of each department. In reality growth rates in different sectors will vary over the cycle but differences among growth rates of different sectors will be less in periods of equilibrium than during the cycle.[15]

It follows that changes in the growth rate of the economy depend solely on technological progress, i.e. on changes in the capital coefficient or capital-output ratio (K/Y), because a constant rate of accumulation is assumed. Coblejic and Stojanovic ignore explicitly the period of construction or gestation and divide their cycle into two phases. They use the following symbols:

P   aggregate output P^I output of Department I

P^{II} output of Department II   K· capital

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15 Ibid., p. 80.

k	capital—output ratio	B	consumption
r_w	growth rate of aggregate output	r_w^I	growth rate of Department I
r_a	total accumulation rate	r_w^{II}	growth rate of Department II
r_a^I	accumulation rate of Department I	r_a^{II}	accumulation rate of Department II
A	accumulation fund	R	replacement fund
γ	replacement rate of fixed assets	β	share of Department I in aggregate output
t_o	beginning of cycle	ρ	share of Department II in aggregate output
t_1	end of phase one	t_2	end of phase two

The equations of their model explain the relationship between
the overall average growth rate of social output over the whole cycle
as follows:

(1) $\quad r_w \; = \; P_2^I + P_2^{II} \;/\; P_o^I + P_o^{II}$

or expressing production as a ratio between invested resources and the
capital coefficient, we have

(2) $\quad r_w \; = \; K_2^I + K_2^{II}/\, k_2 \Big/ K_o^I + K_o^{II}/\, k_o$

$$= \; k_o/k_2 \, . \, K_2^I + K_2^{II} \;/\; K_o^I + K_o^{II}$$

Expressing the average quantity of invested resources as a function of
invested resources at the beginning of the cycle and of the accumulation
and replacement rates

$$K_2^I + K_2^{II} \; = \; (1 + r_a)(K_o^I + K_o^{II}) - \gamma(K_o^I + K_o^{II})$$

or $\quad K_2^I + K_2^{II} \;/\; K_o^I + K_o^{II} \; = \; 1 + r_a - \gamma$

Therefore from equation (2) we have

(3) $r_w = (1 + r_a - \gamma) \cdot k_o / k_2$

The authors then develop an expression for the growth rates of the
two departments. They also prove that their model expresses the basic
relationship of changes between Departments I and II in spite of the
exclusion of raw materials from their production model.[16] Social
output can be divided into the accumulation fund, the replacement fund
and consumption so that

$$P = A + R + B \qquad P^I = A + R \qquad P^{II} = B$$

As material elements of accumulation are produced in Department I in
their model, they express the growth rate of Department I at the end
of the first phase as follows:

$$r_{w_1}^I = k_o/k_1 \; (1 - \Delta A/A)$$

then expressing the accumulation rate $\Delta A/A$ in the usual manner and
incorporating the replacement rate we obtain

(4) $r_{w_1}^I = k_o / k_1 \; (1 - r_{a_1}^I - \gamma)$

and for the second phase

(5) $r_{w_2}^I = k_1 / k_2 \; (1 - r_{a_2}^I - \gamma)$

Then from the overall rate of growth and rate of growth of Department I,
we obtain the rate of growth of Department II from the following
equation:

(6) $r_w = r_w^I \cdot \beta + r_w^{II} \cdot \rho$

allowing for the proportions of output in Department I and II.

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16 Ibid., p. 75.

Substituting for r_{w1} and r_{w1}^I from equations (3) and (4) we have

$$(7) \quad r_{w1}^{II} = \frac{\left[k_0/k_1 \, (1 + r_a - \gamma)\right] - \left[k_0/k_1 \, (1 + r_{a_1}^I - \gamma)\right]\beta}{\rho}$$

Cobeljic and Stojanovic point out that the growth rate in Department II then depends on the accumulation rate in Department I in relation to the accumulation rate in the whole economy. Because this rate has been assumed constant in the model, the rate of accumulation in Department II must decline when the rate increases in Department I. They note the sequence of changes in the capital-output ratio and the accumulation rates will occur in an investment cycle whether or not the capital-output ratio, the accumulation rate, or the growth rate of social output increases or decreases in the long run. They find it obvious that the capital-output ratio will increase in the first phase of the cycle because of the increased investment in Department I or what they prefer to call the "temporarily insufficient utilization of capacity" in that Department. Department II must develop in order to absorb surpluses of capital goods generated by Department I. Thus in the second phase of the cycle output of Department II increases lowering the capital-output ratio.

They conclude that the application of new technology leads to a rise in the rate of accumulation in Department I, which is causally related to its decline in Department II and vice versa

$$(8) \quad r_a^I = (\gamma - 1) + \frac{(1 + r_a - \gamma) - (1 + r_a^{II} - \gamma)\,\rho}{\beta}$$

$$(9) \quad r_a^{II} = (\gamma - 1) + \frac{(1 + r_a - \gamma) - (1 + r_a^I - \gamma)\beta}{\rho}$$

Such variations in the rates of accumulation lead to changes in the structure of material production, i.e. in the capital-output ratio, which affect the growth rates of the Departments in each phase of the cycle. The capital-output ratio rises in phase one as a result of a rise in the rate of accumulation in Department I and declines in phase two as the rate of accumulation and therefore the rate of growth of output in Department II rises.

Cobeljic and Stojanovic conclude from their investigation that "steady technological progress (if all other reasons for variation in economic activity offset each other) brings about changes in basic aggregates of material production and takes the form of fluctuations".[17] Spelling out their conclusion further, they add:

> One can hardly suppose a transition to a higher level of production caused by the introduction of new technology without any successive development of all industries. This means, for instance, that Department II can introduce new technology and expand total output thanks to the fact that mining has already increased the supply of raw materials, metallurgy the supply of metals, and machine-building the supply of machine tools for Department II. During the same period, however, mining continues to expand its production, which will supply metallurgy in some period t_2 with a larger amount of raw materials, thereby making an increased output possible, while in the period t_3 machine building will expand still more on this basis, transmitting its impact in the period t_4 to the output of Department II. 18

They see the need for temporal disaggregation as the period of gestation or construction will not be the same for all sectors of an industry. Temporal priority in production can be expressed by a coefficient of temporal priority obtained by dividing the entire length of production processes by the length of expansion of production in each sector.[19] Similarly they note the necessity of disaggregating

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17 Ibid., p. 77.   18 Ibid., p. 80.   19 Ibid., p. 81.

"horizontally" over various branches of production, as not all branches will be affected simultaneously by technological progress, nor to the same degree. They suggest that this relationship can be measured by a coefficient of dependence (of some types of investment on others).

While their model assumes both Departments have the same level of technological progress and the same capital-output ratio, they note that in reality the capital-output ratio and organic composition of capital (K/L) are higher in Department I and the level of labour productivity is also therefore higher. This applies to the branches producing capital goods such as machine-building, metal-fabricating and the chemical industry rather than the branches of Department I which produce material resources. Therefore adjustment to technological change occurs most notably in these branches of industry and they are most important in the adaptation of the economy in the investment cycle. The longer the period of construction, the greater the difference between capital investment and newly-created manufacturing facilities. In such long gestation periods phase one of the cycle will be longer and the disproportions greater. They stress the importance for social policy of minimizing these disproportions.[20]

They also refer to writings of Strumilin, Karpinski, Chelinski and Mikhalevskii which support their views on the appearance and disappearance of economic disproportions resulting from the implementation of technical change in productive processes.

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20 Ibid., p. 86.

Comparison of Kalecki's Model With That of Cobeljic and Stojanovic

A comparison of Kalecki's model with that of Cobeljic and Stojanovic indicates that they are basically similar.

$$r = i/k - m/k(a - u) \qquad\qquad r_{w1}^{I} = k_o/k_1 (1 + r_{a1}^{I} - \gamma)$$

For both the rate of growth of output is a function of the capital-output ratio, the rate of depreciation and the rate of productive accumulation. Kalecki allows the rate of accumulation to vary, while Cobeljic and Stojanovic keep the overall rate constant while allowing it to vary between Departments of production. Both models assume the rate of productive accumulation constant in the long run. Both show how the rate of growth of output and the rate of productive accumulation change in the transition and recasting phases.

Cobeljic and Stojanovic use a two-sector model. This approach has two advantages: 1) It distinguishes between the outputs of producer and consumer goods, which draws attention to the time priority of the former in production. The consideration of time priority seems to be significant in a model describing as dynamic a process as the growth of output or national income, 2) A two-sector model avoids the overlapping of categories which occurs when investment and national income are used. A major disadvantage of such an approach is that national statistics are not collected in such a way that the hypothesis can be tested fully.

Their model is descriptive rather than behavioural. This is so because they assume the rate of accumulation for the whole economy to be constant although it can vary between the two departments. This approach brings out the technical relationships.

Kalecki's model is behavioural so that the rate of productive accumulation (i) can be a decision variable. The relation of i to the rate of consumption (c) can also be considered. His model makes possible a weighting of i by planners in order to maintain c at satisfactory levels. His cyclic model as described in this thesis also shows the technical constraints on the structure of production.

The fact that Kalecki uses a one-sector model is a disadvantage as attention is focused away from technical constraints and so from cyclic aspects of growth.

Both models use the rate of accumulation and the capital-output ratio as distinct variables, which in a dynamic context they are not. A clear distinction between outputs of producer and consumer goods would seem to be more informative, that is a capital-consumption ratio, being the ratio of outputs of producer and consumer goods, should be used. Such a distinction is used, for example, in Marxian analysis and by Lonergan in his economic essay.[21]

Other Views on the Technical Bases of Investment Cycles

Oskar Lange offers another explanation of investment cycles in socialist economies. He suggests that they are the echo of the massive investment which occurred in the initial period of industrialization. This wave repeats itself with decreasing amplitude as the replacement of old equipment occurs at intervals. Bajt criticizes

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21 Bernard J.F. Lonergan, An Essay in Circulation Analysis, Boston: Boston College, 1978, p. 15.

this explanation as not fundamental enough in that it does not explain the initial wave of investment and why it could not occur smoothly. Lange agrees with Cobeljic and Stojanovic that the nature of the productive process is universal and independent of any social system.[22] The amount of means of production and labour required to produce a unit of a given product is expressed by the technical coefficients or technical norms determined on the basis of techniques used. He thinks that planning in a socialist economy will prevent disproportions between the two main sectors of production, or among many sectors in his more elaborate analysis. He relies on improved information handling to refine the planning process. The decrease in the amplitude of fluctuations since the period of initial industrialization in different countries would support his views on re-investment cycles.

Cobeljic and Stojanovic describe the views of several Eastern European and Soviet economists who support their hypothesis that investment cycles have a technical basis.[23] B. N. Mikhalevskii thought that the order of priority of investment must be chosen. This needs to be done on the basis of technical progress which leads to the appearance and disappearance of economic disproportions. Boiarskii's model shows that the rate of growth in Department I peaks in phase one of the investment cycle, while the rate of growth in consumption peaks in phase two. Boiarskii sees such phenomena as occurring as a result of initial industrialization and also of technical

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22 Oskar Lange, Theory of Reproduction and Accumulation, Oxford: Pergamon Press, 1969, p. 1.

23 Cobeljic and Stojanovic, op. cit., pp. 16-21.

progress. W. Sadowski investigates the effect of an increase in
the rate of population growth on investment when the rate of increase
in productivity due to technical progress is assumed to be constant.
He found "the cause of instability and investment fluctuation may lie
in technological conditions of production and in the change in these
conditions". B. Minc studied a cyclical movement in the capital-
output ratio which he saw occurred in both capitalist and socialist
economies. S. G. Strumilin noted that economic growth occurs as a
series of accelerations and decelerations in the growth rate of
Department I. He sees the cause of this in the structure of produc-
tion as well as in the growth of productivity and consumption.
A. I. Notkin found that the rates of growth of the two departments
of production must necessarily change from time to time, though the
amplitude of the periodic deviation and convergence in the growth
rates of the two departments decreased after the period of initial
industrialization was over. Notkin also raised the question of the
time period for the optimal rates of accumulation and consumption.
He concluded that the logical time period must be the length of the
reproduction cycle, and that it was over this period that optimal
ratios of variables significant in the process of production on an
enlarged scale, that is the growth process, must be established.
Notkin thought that one reproduction cycle lasted about nine or ten
years, but that the period was not fixed and depended on the character
of technological progress and on the pace of structural changes in a
given country. Notkin's reproduction cycle describes the same pheno-
mena as the investment cycle. While he sees the possibility of
fluctuations, he concludes they can be avoided by adequate planning.

Behavioural Bases for Investment Cycles

Julio H. Olivera's Analysis

Many Eastern European economists have analysed investment cycles
from the viewpoint of the influence of the planning system on invest-
ment and production. Some criticize the inflexibility of central
administrative planning. Others correlate investment cycles with
inept planning reforms. Others attribute fluctuations to the failure
of decentralized planning to reduce excess investment.

Julio H. Olivera's framework of analysis will be used to consider
the behavioural bases of investment cycles. In his study of cyclical
growth under centralized collectivism he finds that the most signifi-
cant consequence of the structure of such an economy is the "disequili-
brium it generates between the production and consumption time-preference
schedules".[24] He finds the average and marginal time preferences of
planners and consumers depend on four influences: 1) agio factors,
2) investment-opportunity factors, 3) investment-risk factors, and
4) planning-technique factors.

Agio factors refer to the fact that planners will discount the
future less than the consuming population either because planners feel
a responsibility to plan for the future of society or because of the
prestige and power inherent in sustained, vigorous growth or what Horvat
refers to as the chronic hunger for investment in a country with
complete faith in rapid and long-term economic expansion.

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24 Julio H. G. Olivera, "Cyclical Growth Under Collectivism", Kyklos,
XIII, 1960, p. 233.

The investment-opportunity factor draws attention to the fact
that consumers have little or no opportunity to invest in socialist
economies.

Investment-risk factors refer to the fact that the two main
sources of risk in a capitalist economy, technological and market
risks, are borne by the consumer in a socialist economy but are less
important for planners. The market is more transparent for planners
than for entrepreneurs in capitalist economies. Planners can set
prices and the market is a less important criterion of the success
of investment.

The planning technique factor refers to the tendency for state
planning to be growth-oriented rather than welfare-oriented, so that
planning is investment-biased.

Olivera concludes that because of these factors there is a
disequilibrium between time preferences of planners and consumers
in a planned economy. Further he finds that such economies tend to
a state of disequilibrium as the margin between time preferences will
be increasing, insofar as this can be predicted.[25] As income rises
it is just as likely that planners will increase the rate of invest-
ment because the rate of consumption becomes less critical. Thus the
marginal as well as the average rate of time preferences of planners
and consumers will be diverging. In terms of value this implies

> that the aggregate output of consumption goods valued
> at supply prices will be increasingly lower than the
> monetary value of total consumption expenditure, as
> income expands; and, conversely, that the aggregate
> amount of capital formation valued at supply prices will

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25 Ibid., p. 238.

be increasingly higher than the monetary value of total
saved income. 26

In other words, real wages are declining or at least the share of
real wages in national income is declining.

Olivera sees two effects occurring eventually. The increasing
lag in real wages will lead to social dissatisfaction. This will
tend to increase the propensity to consume thus aggravating the
economic situation, and it will have political effects which may
create problems of social control.[27] Secondly, the increasing rate
of accumulation resulting from the low marginal rate of time pre-
ference of planners will lead to a low or even negative marginal
efficiency of capital. Bajt questions both these conclusions
arguing that it is short-run changes in 'per capita' income that are
important in psychological and political processes; and that the low
marginal efficiency of investment is caused by the inefficiency of
the planning system rather than the high rate of investment.[28]
As the rate of investment in European socialist economies is high,
it may be difficult to show that investment efficiency is not low
because of a technical barrier as Olivera suggests, rather than
owing to inefficiency of the planning system. Olivera notes that
the distortions in prices, which reflect the decline in real wages,
make it difficult for planners to gauge efficiency. Also the marginal

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26 Ibid., p. 242.

27 Ibid., p. 245.

28 Alexander Bajt, "Investment Cycles in European Socialist Economies:
A Review Article", Journal of Economic Literature, 1971, Vol. 9,
pp. 61-62.

productivity of capital investment will decline because of the law of diminishing returns as capital investment is increased relative to the labour supply.

These two factors, the technological and the political and social, will lead to a modification of the time priorities of planners. The contribution of investment to growth will tend to zero. To remedy the situation the marginal rate of time preference of planners must be greater than consumers' marginal rate, and the average rate of planners must approach that of consumers. Olivera describes this phase as follows:

> (a) the rate of increase of consumer goods output rises relatively to that of the capital goods output;
> (b) the level of prices of consumer goods falls relatively to that of capital goods; (c) the price system improves from the viewpoint of its relative adjustment to the "law of value". 29

(b) and (c) imply a rise in real wages and an increase in the share of consumption in national income.

Olivera does not think that the average rate of time preference of planners will become as high as that of consumers but will tend to level off when technical and social factors are mitigated.

> A new shift to investment will follow, the marginal disequilibrium will be positive again and the average disequilibrium will become greater. Therefore (a) the rate of increase of the consumer goods output will fall relatively to that of the capital goods output; (b) the level of prices of consumer goods will rise relatively to that of capital goods; (c) the price system will deteriorate from the point of view of the law of value. 30

Olivera distinguishes this essential cycle of collectivism from what he calls adventitious factors such as planning errors and

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29 Olivera, op. cit., p. 247

30 Ibid.

exogenous changes which can affect the essential cycle. Olivera follows the Austrian tradition, in particular Böhm-Bawerk, in conceiving the fundamental cycle as lying in the change in relative proportions of output and employment corresponding to consumption and investment, rather than in the absolute levels of production and employment. He finds that fluctuations in aggregate levels are the product of secondary waves superimposed on the fundamental cycle; that is fundamental and adventitious factors combine to produce fluctuations in growth rates.[31]

Olivera attributes to adventitious factors the mid-1953 turning point in Eastern Europe and still more so the 1957 contraction. He finds that the fundamental cycle is still observable in the Soviet Union although fluctuations in aggregate output and employment have much smaller amplitudes.

The Views of Goldmann and Kouba

Josef Goldmann and Karel Kouba see the fundamental source of disequilibrium in a socialist economy in the fact that the planning authority wishes to define the rate of growth of national income as well as its structure. Using Kálecki's model they show that the structure is necessarily derived from the rate of growth:

> From the planned overall growth in national income
> over the plan period we obtain the target structure of
> consumption by means of coefficients of income elasticity
> of demand. Then, from the target structure of consumption
> we get, through technical coefficients and the input-
> output table, the target structure of production. [32]

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31 Ibid., p. 250.

32 Josef Goldmann and Karel Kouba, Economic Growth in Czechoslovakia, White Plains, N.Y.: International Arts and Sciences Press, 1969, pp. 36-7.

Failure to understand this relation between the rate of growth and the structure of production leads to bottlenecks, surpluses and increasing waste of social labour. When these disproportions become severe, a fall in the rate of growth and in the volume of investment occurs. Unlike Horvat they see that disproportions lead to radical economic measures. Horvat sees the causal relationship moving in the opposite direction: radical economic measures disrupt production.[33] Goldmann and Kouba see economic fluctuations as avoidable as they result from the choice of an excessively high growth rate. This behaviour is owing to insufficient knowledge of the economic laws of socialism and shortcomings in their application.[34]

For Goldmann and Kouba the turning points in the investment cycle are brought about by the echo effect in the inventory cycle which aggravates the bottlenecks because of speculative demand in view of the supply situation. Also rising import requirements lead to pressure on the foreign trade balance, particularly in a small country. These two factors bring about the down-turn in the cycle. The up-turn is encouraged by low inventories which decline when the supply situation improves; and by an improved foreign trade balance, which makes a rise in imports feasible.

In applying Kalecki's model to Czechoslovakian data, they first discuss values chosen for parameters, in particular the capital-output ratio. They suggest that increases in the capital-output

33 Branko Horvat, "Short-run Instability and Long-run Trends in the Yugoslav Economy's Development", Ekonomist, 1974, nos. 1-2, Eastern European Economics, 1975, Vol. XIV no. 3, Fall, p. 10.

34 Goldmann and Kouba, op. cit., p. 56.

ratio can be broken down into 1) effects of changes in the structure
of production, 2) effects of the traditional system of planning,
and 3) the effect of a given type and rate of technological advance.
They conclude, however, that it is preferable to use a constant
capital-output ratio on the assumption that factors tending to
increase the ratio, such as the rising trend evoked by the tradi-
tional management system, will be offset by those tending to decrease
it, such as the falling trend noticeable in highly industrialized
countries.

They then concentrate on the u factor. They distinguish in the
u factor a positive component resulting from technological and organiza-
tional improvements (u_1), the negative effects of the traditional
planning system (u_2), a negative component of excessive accumulation
in circulating assets, i.e. inventories and capital under construc-
tion (u_3), and the influence of quasi-cyclical and chance fluctuations
(u_4). [35]

The results of such an approach would appear not to be different
from assuming the u factor constant and assuming that u_1 and u_3
affect the capital-output ratio, with a given rate of productive
accumulation. Only components u_1 and u_3 can be obtained from statis-
tical data, and u_2 and u_4 are obtained residually.

Goldmann and Kouba acknowledge the importance of proportionality
in the structure of investment and production but deny that any grand
reform is what is needed. They find that continuous and flexible
adjustment of the structure of production to the needs of the productive·

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35 Ibid., p. 103.

process requires flexibility in planning, attention to calculations
of cost, and anticipation of price movements by examining the
elasticities of supply and demand. Thus, they focus on the need
for changes in the planning system, but it seems to this researcher
that they give insufficient attention to the technical constraints
of cyclic growth on the structure of production, i.e. to the changing
relations over time between the rate of growth of output of producer
and consumer goods. A better understanding of the productive process,
which they note is needed, with the statistical information to discern
its operation must be part of a reform in the planning system.

Other Views on the Behavioural Bases of Investment Cycles

Branko Horvat also takes the approach that in a planned economy,
once a correct diagnosis is drawn up, there always exists in principle
the possibility of conscious correction and control. However, he
finds that economic theory, general economic organization and the
preparedness of the administrative apparatus appear to be behind the
needs of the stage of economic development in Yugoslavia and other
socialist economies. That is, there is a lack of understanding of
the growth process and of how to plan in relation to it.[36]

Eugeniusz Rychlewski suggests a fiduciary system of investment
which would increase the efficiency of investment by encouraging
the introduction of programs to modernize existing facilities. The
fiduciary system would provide incentives to innovate which are

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[36] Branko Horvat, Business Cycles in Yugoslavia, op. cit., p. 60.

lacking under the traditional planning systems.[37]

Karoly Attila Soos finds that overinvestment is encouraged by
the great appetite of enterprises for investments, the weakness
of profitability requirements, and the continuing role of the
government in the vast majority of investment decisions.[38]

Dragomir Vojnic sees that fluctuations in investment and produc-
tion result from planning errors, which cause a deformation in the
structure of investment "with respect to the relationships between
investments in fixed and working capital".[39]

Jerzy Kleer sees the cause of fluctuations in incomplete planning
reforms which fail to allow adequate development of economic mechanisms
and categories to encourage economic decision-making at the enterprise
level. Economic crises such as poor harvests, excessive investment
and difficulties in foreign trade require a return to central admini-
strative planning procedures. He thinks decentralized decision-
making with suitable motivations could effectively introduce technical
change if it were freer from administrative intervention for a period
sufficient to develop its own procedures.[40]

37 Eugeniusz Rychlewski, "Investment System in a Socialist Country",
Eastern European Economics, 1973, Vol. XI, Fall, p. 31.

38 Karoly Attila Soos, "Causes of Investment Fluctuations in the
Hungarian Economy", Eastern European Economics, 1975-6, Vol. XIII,
Winter, pp. 30-31.

39 Dragomir Vojnic, "Three Aspects of Development Policy in the Social
Plan for 1971-75", Eastern European Economics, 1972, Vol. X, Summer,
p. 425.

40 Jerzy Kleer, "Economic Reforms in the Socialist Countries in the
Sixties", Eastern European Economics, 1974-75, Vol. XII, Winter,
pp. 12-13.

Explanation of an Investment Cycle Based on Technical and Behavioural Constraints on a Production Function

Cycles of three to four years that have been observed by Horvat, Soos and Goldmann and Kouba, among others, are too short to be the cyclic changes described by Kalecki, and Cobeljic and Stojanovic as the phases of gestation, transition and recasting. The eight to ten-year cycles found by Bajt and this researcher are more likely to be investment cycles. The cycles should be visible in changes in growth rates of aggregate output and investment, but would be clearer in data disaggregated into the two departments of production. The normal cycle, that is the cycle caused by the technical constraint on production can be illustrated in relation to the abnormal cycle caused by planning errors which distort the behavioural constraint.
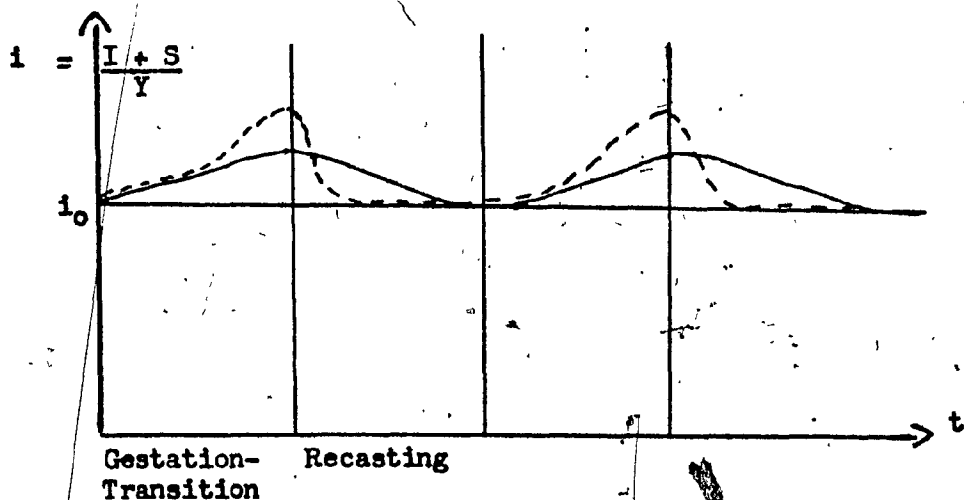

Figure 3.4 - Changes in the ratio of productive accumulation to national income in the normal and the abnormal investment cycle. 41

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41 In the abnormal cycle (---) the decline in i results from a decrease in productive accumulation. After the crisis both productive accumulation and output rise together. In the normal cycle (___) (cont'd)

The Technical Constraint on the Production Function

The technical constraint can be expressed in relation to the customary static production function:

$$Y_t = f(K_t, L_t)$$

Differentiating the function and dividing through by Y, then multiplying the right hand terms by K/K and L/L respectively we obtain:

$$\frac{dY/dt}{Y} = \dot{Q} = \frac{\delta F}{\delta K} \cdot \frac{K}{Y} \cdot \frac{\delta K}{\delta t} \cdot \frac{1}{K} + \frac{\delta F}{\delta L} \cdot \frac{L}{Y} \cdot \frac{\delta L}{\delta t} \cdot \frac{1}{L}$$

$$\dot{Q} = \eta_k \dot{K} - \eta_1 \dot{L} \qquad \qquad \text{A} \qquad 42$$

where η is the elasticity of output with respect to each input. The proportional rate of growth in output is a function of the elasticity of output with respect to capital input multiplied by the rate of growth of capital and the elasticity of output with respect to labour inputs multiplied by the proportional growth rate of labour. If we assume constant long-term growth rates of capital and labour as we have throughout this thesis, and a constant long-term rate of increase in productivity due to technical progress, we have a long-run constant rate of growth of output. Medium-term variations in the growth rate of output will occur if there are changes in the elasticity of output when changes occur in capital stock. This is the case in the production cycle. In the transition phase the output elasticity of

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the decline in i results from the increase in output owing to the rise in productivity in the transition phase.

capital η_k is low, and in the recasting phase it is high. This
can be expressed as two constraints, one applying to phase one
and the other applying to phase two as follows:

$$\text{I} \qquad \delta K / K > \delta Y / Y$$

$$\text{II} \qquad \delta K / K < \delta Y / Y$$

Behavioural Constraints on the Production Function

In a command economy where plan fulfillment measured in quanti-
tative terms is rewarded, and where there is complete faith in rapid
and long-term expansion as Horvat remarked, Olivera's view that
planners have a lower average and marginal rate of time preference
than consumers seems justified. There would be constant pressure to
maintain or increase the rate of productive accumulation. Instead
of permitting a shift in productive accumulation from capital under
construction to production of finished capital goods, the gestation
period is extended until a crisis occurs because of bottlenecks in
supply as described above.

The mechanism of the abnormal cycle would be as follows:
following a successful planning phase such as occurred in the Soviet
Union in 1948, conditions are suitable for a new investment phase.
Then because of planners' low marginal rate of time preference
described by Olivera and by others implicitly, and outlined in
detail in this thesis, there is a tendency to invest excessively or
to attempt to overdetermine the structure of production, as suggested
by Goldmann and Kouba, resulting in inefficiencies and imbalances.
This leads to bottlenecks and their obverse, inventory accumulation.
These tendencies work in favour of additional accumulation of

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inventories as a hedge against supply problems. These factors intensify the crisis in supply until the only solution is to reduce the rate of productive accumulation. As Olivera mentioned the relative or absolute decrease in real wages is also important in causing a downturn in productive accumulation.

Capital investment must decline to overcome bottlenecks and allow capital goods to be delivered as well as to ease pressure on consumption for political reasons. That is the ratio of consumption to income can rise as the rate of productive accumulation declines. As a result the marginal rates of time preference of planners and consumers converge. The crisis comes to an end, delivery of investment goods increases and the recasting phase begins. In the recasting phase the presence of a rate of growth of output or income which is above the long-term rate encourages a new rise in the rate of productive accumulation as the marginal rate of time preference of planners probably decreases as income increases. Thus a new cycle can begin.

.The behavioural constraint on the production function can be expressed diagrammatically using a production feasibility frontier to illustrate the technical constraint and the same equation weighted according to planners' intentions to illustrate the behavioural constraint.

Initial Position	End of Phase I	End of Phase II

Technical constraint:

$$C_0 + I_0 = Y_0 \qquad C_0 + I_1 = Y_1 \qquad C_1 + I_1 = Y_2$$

Behavioural constraint:

$$w_c C_0 + w_i I_0 > Y_0 \qquad w_c C_0 + w_i I_1 > Y_1 \qquad w_c C_1 + w_i I_1 = Y_2$$
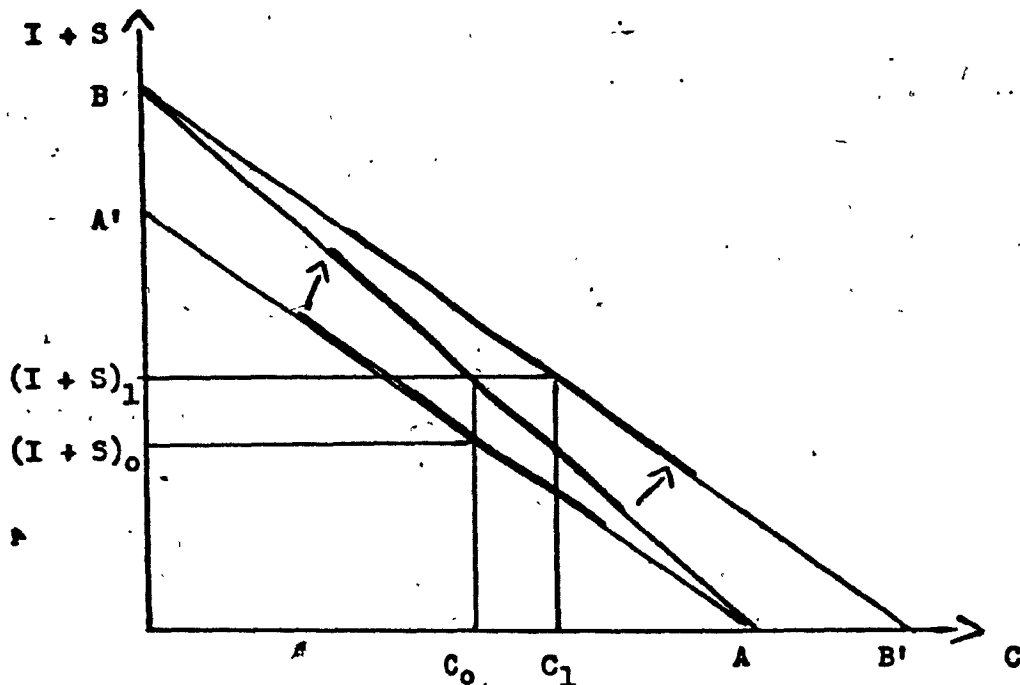
Figure 3.5 - Changes in the Technical and Behavioural Constraints on the Production Function during the Investment Cycle.

In the gestation-transition period the technical constraint shifts from AA' to AB. If the behavioural constraint is in equilibrium, the weighting on producer and consumer goods in the national plan will move accordingly. At the end of a cycle $w_c = w_i = 1$. For a new cycle to begin, w_i must be greater than one, that is the marginal rate of time preference of planners must be low as described by Olivera. $I + S$ begins to increase. As $I + S$ increases w_i must at some point begin to decline again to one. In other words as $I + S$ increases, the marginal efficiency of investment decreases and the marginal rate of time preference rises.

In an abnormal cycle, w_i does not decline to one at the end of the gestation-transition phase, so that investment becomes excessive and w_c must become less than one in a crisis. The process in a crisis has been described already in this thesis.

At the beginning of the recasting phase w_c must be greater than one so that C can increase to C_1. As C increases w_c declines to one. The system is in equilibrium and a new cycle may begin. w_i may again rise as planners have experienced a successful planning period and are encouraged to undertake a new expansion. Consumption levels have returned to normal. New possibilities for innovation raise the marginal efficiency of investment and the marginal rate of time preference declines in Olivera's terms.

The use of linear equations means that the analysis is compatible with any initial combination of producer and consumer goods in production. The analysis also assumes that there is no growth in output of consumer goods in the transition phase, and no growth of output of investment goods in the recasting phase, which is an over-simplification for the purposes of illustration.

Evidence for the Existence of Such Investment Cycles

Such a view of cycles would be supported by the data of Bajt and this researcher as well as the data of Horvat, Cobeljic and Stojanovic, and Goldmann and Kouba. A summary of the data is given for four countries. Sources of the data are given in Appendices at the end of the thesis.

Yugoslavia

In Table 3 of his article "Short-run Instability and Long-run Trends in the Yugoslav Economy's Development", (Appendix I, no. 1) Horvat gives the ratio of gross productive investment to social product for the period 1948 to 1972. Although agriculture is

included in social product the changes characteristic of phase one and phase two of the investment cycle are still evident. The ratio peaks in 1951, 1961, and 1970, while it is low in 1957 and 1965. This synchronizes quite well with Horvat's graph illustrating industrial cycles which indicates a peak in the growth of industrial output in 1957. This would mark the high growth rate of industrial output in the second phase, which then encourages an increase in productive accumulation. This in turn led to a decline in the growth rate of industrial output in 1961 (Appendix I, no. 2)

In Table 22 of Cobeljic and Stojanovic's study, which gives the basic variables in annual growth rates for the period 1948 to 1963 (Appendix I, no. 3), the cycle is evident particularly in the rate of productive investment for industry and the growth rates of industrial output for Department I and Department II. Phase one of the cycle, with generally higher rates of industrial investment and of output of Department I lasts from 1948 to 1952. Phase two has lower rates of industrial investment and the rates of growth of output in the two departments converge. This phase lasts from 1953 to 1958. Phase one of a second cycle begins in 1959 with a rise in industrial investment.

Cobeljic and Stojanovic's tables of capital coefficients in Yugoslavia (Appendix I, no. 4) also show that the rate of gross fixed investment is higher in the first phase of the investment cycle while the growth rate of national output is higher in the second phase, when the capital coefficient also declines.

Although Horvat discerns fifteen-year cycles in his graphs of chain indices of economic movements in Yugoslavia (Appendix I, no. 5),

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it is also possible to discern nine-to ten-year cycles with the peak

of the second cycle coming in 1969-70. Horvat's data goes to 1966,

when the rate of growth of investment is low in the "crisis" at the

end of phase one.

The change in the rates of growth of capital under construction

in phase one and phase two of the cycle is clear in Vojnic's data on

net and gross investment (Appendix I, no. 6). The rate of growth

of working capital is higher from 1964-66 and lower from 1967-70

after which it rises again. The decline in the 1967-70 period is

less for fixed capital. The variation in net productive accumulation

is also lower from 1967-70.

Union of Soviet Socialist Republics

Both Cobeljic and Stojanovic's table of annual growth rates of

investment and output in the Soviet Union (Appendix II, no. 1) and

Bajt's and this researcher's data in this thesis support the view that

the Soviet Union experienced two cycles of industrial production and

investment: the first from 1948 to 1958 and the second from 1958 to

1968.[43] This would measure the cycles from peak to peak. Total

investment reaches a low in 1953, 1963 and 1973. Also growth rates

in Departments I and II converge from 1954 to 1958-9 indicating the

period of phase two of the cycle. The low total investment growth

rates of 4.9 percent in 1953 and 3.9 percent in 1963 would mark the

slump at the end of phase one of the cycles.

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43 It should be noted that Cobeljic and Stojanovic find two cycles
in the period 1948 to 1959: the first 1948-53 and the second
1954-59.

Moderation in the rates of growth of investment in the second postwar cycle in the early sixties may result from a growing awareness of the disadvantages of excess investment in capital under construction. However, this was still a major concern in the early seventies as reported in the United Nations surveys. Control of excess investment demand was not yet sufficiently effective. Cycles of production and investment in the Soviet Union are of low amplitude and are part of a long term declining trend in growth rates which began at the end of the war in 1945. This pattern may be explained by the fact that in the early fifties the Soviet Union placed among the developed industrial countries. The period of initial industrialization marked by exceptionally high growth rates of investment and output had been completed. In addition more balanced growth was possible because of the size of the economy of the Soviet Union and the consequent size of its investment fund and immense investment potential. Increases in output and investment could be allocated more evenly.[44]

A difficulty in studying cycles in the Soviet Union is the dearth of statistics on industrial investment.

Poland

The hypothesis of a cycle of production and investment with a crisis marked by a decline in the growth rate of investment at the end of the first phase is also supported by data from Poland

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44 Cobeljic and Stojanovic, op. cit., p. 134.

presented by Cobeljic and Stojanovic and by Goldmann and Kouba (Appendix III, nos. 1 to 3). High levels of investment and output in 1950 encouraged a new wave of investment which peaked in 1952 and declined to a trough in 1956. This was followed by a phase of moderately increasing investment and a convergence of growth rates of Departments I and II. The latter began to diverge again in 1959 when investment again took a leap forward. This would mark the beginning of a new cycle of industrial production. This cycle appears to have been moderate with a decline in investment in 1963-4 and a second phase with a moderate rise in investment rates and fairly even growth rates of industrial output. A third cycle of rapidly rising investment rates began in 1969-70.

Czechoslovakia

For this country we have data from Cobeljic and Stojanovic (Appendix IV, no. 1), Goldmann and Kouba (Appendix III, no. 3 and Appendix IV, nos. 2 and 3), as well as from Bajt and this researcher. High investment growth rates drop dramatically in 1954 which would mark a crisis. Prior to 1954 growth rates of output of Department I are high and diverging from rates in Department II. After 1954 these rates tend to converge with rates for Department I diverging again after 1959, which marks the beginning of a new investment and production cycle. This second cycle appears to have reached its crisis in 1962 followed by a second phase which ends in a new wave of investment marking the beginning of another cycle at the end of the sixties. The drop in investment between 1965 and 1969 is not explained by this hypothesis. It is remarkable that the period is marked by

high levels of inventory accumulation which is not usually typical of periods with low investment levels. The second phase of the cycle in the latter half of the sixties is marked by lower growth rates in producer goods industries as expected. Accumulation of inventories is more noticeable in phase one of the cycles: 1950 to 1953 and 1961 to 1963.

Other Eastern European Economies

Because of the lack of data, particularly on inventory accumulation and the rate of growth of outputs in the two departments of production, the basis for a description of cycles in the other four Eastern European countries is somewhat narrow. However, the evidence from Bajt and this researcher suggests that cycles in those countries can be explained in a similar way.

CHAPTER FOUR

CONCLUSION

Medium-term Growth in European Planned Economies: A Cyclic Process

Economic growth in the medium term can be described as a cyclic process in which the dynamic production function is influenced by two constraints, one technical and one behavioural. These constraints are determined by the convergence of various factors. The technical constraint, which implies a low elasticity of output with respect to productive accumulation in the transition phase, depends on the extent of technical innovation and therefore on the extent of the gestation period. The behavioural constraint depends on an under-standing of the technical constraint. If this is lacking the behavioural constraint will distort production leading to a crisis.

While the technical constraint is determined once innovation occurs, the successful occurrence of innovation is a probability. Also the behavioural constraint has a probability attached to it which depends on a correct understanding of the production possi-bilities in the economy. Olívera found that the behaviour of planners was determined by the fact of a planned economy. It is not necessary to take such a deterministic view, though the bias of a planning system would be as Olivera described. One may expect that planners will learn from their errors and the behavioural constraint need

not distort production. Such learning may account in part for the lower amplitude of fluctuations in the Soviet Union. However, the communication of information required by a fully planned economy remains an unsolved problem.

W. W. Rostow has described the complex interrelationship between technical and cultural-behavioural factors in How It All Began.[1] Schumpeter has also referred to the interrelationship between what he calls external factors or a new situation, and internal factors or the response of the business community to new possibilities for business activity.[2]

Empirical Support for the Thesis

As shown in Chapter Two, it is not possible to reject the hypothesis that fluctuations in annual data for growth rates of investment and output in eastern European countries and the Soviet Union are random (Table VI). However, there is also evidence gathered from several sources (Tables I to V and Figure 2.1, and Appendices I to IV) to support the hypothesis that investment cycles are endogenous to the growth process and are the result of technical and behavioural constraints on a dynamic production function.

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1 W. W. Rostow, How It All Began, Toronto: McGraw Hill, 1975, pp. 134-145.

2 Joseph A. Schumpeter, Business Cycles, New York: McGraw Hill, 1939, Vol. I, p. 98.

Applicability of the Analysis to Market Economies

Cobeljic and Stojanovic and Lange and others have noted that
technical relations in an expanding industrial economy are the same
in planned or market economies. Thus the analysis of the technical
constraint will be similar for both kinds of economy.

There are parallels and differences in the operation of the
behavioural constraint. Entrepreneurs in market economies can also
be said to have a lower marginal rate of time preference than consumers
as far as their behaviour represents the behaviour of recipients of
capital income. This also implies the assumption that the propensity
to save out of capital income is greater than the propensity to save
out of labour income, or that the latter is zero. Capital income
would include surpluses in some salaries and some rentier income,
institutional saving in pension funds, insurance policies, investment
certificates and savings accounts, as well as undistributed profits.
On these assumptions we can use the same framework to analyse the
behaviour of planners in command economies and entrepreneurs in market
economies, though their responses will be different.

The process can be illustrated by the use of a time difference
equation which uses output in a given period as dependent variable
and consumption and investment as explanatory variables. Investment
resulting from the accelerator effect, autonomous investment result-
ing from implementation of technical change (H) and replacement
investment (R) are distinguished. The consumption variable shows
the multiplier effect. The coefficient v is behavioural. It
reflects the desired capital stock owing to changes in output and

the rate at which the entrepreneur responds to this.

$$Y_t = A + cY_{t-1} + v(Y_{t-1} - Y_{t-2}) + H_t + R_t \qquad 3$$

Autonomous investment H expresses the investment responding to the technical imperatives, that is investment to innovate in new fields with new products, or investments to modernize equipment to keep up with competitors. In reality these distinctions are difficult to make as replacement investment will be for up-to-date equipment, and so will induced investment resulting from accelerator effects. However, the implementation of technical changes tends to occur in waves because of technical constraints on production, and a separate variable is needed to distinguish the effects of such investment on output.

Following the analysis of the investment cycle in Chapter Three, in the transition phase H will increase leading in due course to increases in output. This will be followed in the subsequent period by accelerator and multiplier effects. The proportion of consumption in income c will also decline as H rises, because real wages tend to decline. This will occur mainly through price increases in a market economy. Once the process has begun, it proceeds cumulatively until v or H declines. These changes will occur when the marginal rate of time preference increases as desired levels of capital stock are reached and the innovational elan, typified by the S curve of growth is spent. Pressures decreasing v and H may also come from consumer dissatisfaction with the decline in real wages or consumption. As can be seen from the above equation, the accelerator-multiplier leads

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3 D. C. Rowan and Thomas Mayer, Intermediate Macroeconomics, New York: W. W. Norton & Company, Inc., 1972, p. 173.

to cumulative recessions once a decline in output occurs. The existence of accelerator-multiplier effects makes the system unstable whether the accelerator is believed to respond to output changes or profit changes, though the latter formulation is more exact as output changes are a proxy for changes in profit.

The decline in profits in the recasting phase owing to the decline in v and H can be partly offset by the increase in replacement investment to its equilibrium value as recasting is completed. It may be noted R is an absolute value unlike the coefficient of depreciation in Kalecki's formulation.

The decline in profits in the recasting phase can also be offset by decreasing or increasing output. The tendency in a market economy, because of risk and uncertainty is to limit output growth, thus limiting the recasting phase.[4] In terms of the simple equation used here increasing output, or more precisely output of consumer goods, would imply an increasing marginal rate of time preference and consequently decreasing v and H. It would also lead to a rise in real wages expressed by a rise in c which would offset the decline in v and in H.

The behavioural constraint on the production function in market economies usually operates to augment fluctuations in output of the production cycle. The accelerator-multiplier can be said to explain the operation of the behavioural constraint. But the mechanism does not explain satisfactorily the initiation of an expansion, though

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4 Martin Bronfenbrenner and Yutaka Kōsai, "On the Marxian Capital-Consumption Ratio", Science and Society, 1967, p. 472.

it can explain crises.[5] Horvat found the accelerator did not operate in Yugoslavia.[6]

In the recasting phase of the normal production cycle the ratio i to c should decline, that is saving declines and real wages rise as output increases. If this occurs smoothly the rate of return or profit will not decline excessively and saving and investment will stabilize at a high level of output. If this does not occur smoothly the economy moves to a low-level equilibrium output. The end of the transition phase, when capacity has been increased but not
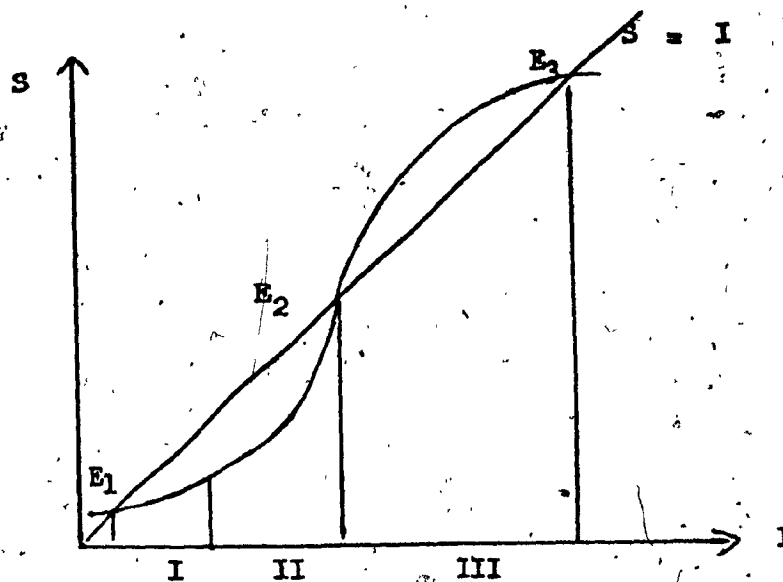
Figure 4.1 — Relationship Between Desired Saving and Investment over the Investment Cycle.

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5 Michal Kalecki, Selected Essays on the Dynamics of the Capitalist Economy 1933-1970, Cambridge: University Press, 1971, p. 131. Also in Rowan and Mayer, op. cit., p. 321.

6 Branko Horvat, "Short-Run Instability and Long-Run Trends in the Yugoslav Economy's Development", Eastern European Economics, Fall 1975, Vol. XIV, no. 3, p. 12.

yet fully utilized, requires a shift from the output of producer goods
to the output of consumer goods. This in turn, requires a behavioural
change which tends not to occur. As noted above excess saving,
implying below equilibrium aggregate demand, usually leads to a
reduction in output of the overproducing sector, in this case the
capital goods sector, rather than an increase in output of the under-
producing sector in a market economy.[7]

   This can be described in terms of the relationship between
saving and investment shown in Figure 4.1. In section I of the diagram
the situation in a gestation period is illustrated. Desired saving
is less than investment and the ratio of investment or productive
accumulation to income is increasing faster than the ratio of saving
in income. The investment is maintained by the innovational elan
which has begun.[8]

   In section II of the diagram the situation in the second part
of the transition phase is illustrated. As capital goods output
increases, profits rise until saving equals investment as the invest-
ment elan levels off. The accelerator-multiplier behavioural effect
tends to cause the economy to overshoot this equilibrium. Thus the
equilibrium is unstable. The movement to E_3 will occur if real
wages are allowed to rise in the recasting phase and the proportion
of saving and investment in income returns to long-run equilibrium
levels. However, it may be noted that absolute saving and investment
have increased. This would be the case in the normal production

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7 Bronfenbrenner and Kosai, op. cit., p.473.

8 Schumpeter, Business Cycles, op. cit., p. 96. The passive role of
ex-ante saving as a determinant of investment in a dynamic model is
described.

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cycle. If there is a crisis because output is cut to maintain profit levels, the economy will move back to E_1, where saving equals investment but these are at low levels because output is low.

This section is intended to draw parallels between the operation of the behavioural constraint in command and market economies. It is not intended as a complete analysis of deviations from the normal production cycle in market economies. Lonergan, for example, finds the possibility of three crises of different severity in the course of a normal cycle.[9] The discussion abstracts from structural effects which are bound to result from shifts in production in a growing economy. The assumption in doing so is that in the aggregate these effects are not dominant when the production cycle is normal. The discussion has also abstracted from price effects, though these may be expected to increase the deviations owing to the behavioural constraint in both command and market economies.[10]

Extensions of the Analysis

In this thesis we have considered only a closed economy and have assumed that employment of excess labour was not an issue so that attention could be given to the effects of changes in investment or in its rate of change owing to the implementation of technical change in the economy. Investment was taken to include investment in human capital.

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9 Bernard J. F. Lonergan, <u>An Essay in Circulation Analysis</u>, Boston: Boston College, 1978, pp. 94-102.

10 Julio H.G. Olivera, "Cyclical Growth Under Collectivism", <u>Kyklos</u>, 1960, XIII, p. 242.

Inclusion in the analysis of variations in β, the rate of growth of the labour force would not fundamentally change the conclusions, as the process of equipping a rapidly growing labour force would be confronted by the same technical and behavioural constraints as modernization of capital stock.

Extension of the analysis to consideration of an open economy would lead to prolonged expansions in the case of a favourable balance of trade because demand and profits would be maintained. In the case of an unfavourable balance of trade expansion would be curtailed by material barriers increasing the technical constraint on the production function. In a market economy adding a variable for net foreign trade would increase instability in output, which would in turn augment the effects of the accelerator. The behavioural constraint would thus be increased. As in command economies, material barriers would add to the technical constraint on the production function.[11] In a command economy the behavioural constraint would be increased because a failure of export demand would increase inventories, lowering the equilibrium marginal rate of time preference of planners. The effectiveness of the transition phase would be reduced.

Relevance of the Analysis to Stabilization Policy

It can be concluded from the thesis that there is sufficient evidence to show a relation between economic growth and fluctuations in the medium term for Eastern European socialist economies. Further confirmation requires collection of data disaggregated into

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11 Josef Goldmann and Karel Kouba, Economic Growth in Czechoslovakia, White Plains, N.Y.: International Arts and Sciences Press, 1969, pp. 52-53.

inputs and outputs of the producer goods sector and consumer goods sector. This disaggregation should apply to services such as electricity, transportation, and so on.

Such data would help economic analyses 1) by using categories which do not overlap as do investment and gross national product or national income; 2) by drawing attention to changes in consumption which over the production cycle are important economically and politically; 3) by pointing to the fact that expansion or modernization of the output of investment goods usually requires a corresponding expansion in saving and decrease in consumption, or in their rates of growth, by forced or voluntary saving; and 4) by drawing attention to the time sequence of the cycle in growth of output.

If further statistical study also supports the hypothesis of a production cycle which is part of the medium term growth process, then collection of data in this way is necessary to determine the timing of its phases for the purposes of growth and stabilization policy.

The use of a two-sector model in economic theory appears to be waning in Eastern European countries. Such a model was used by Cobeljic and Stojanovic but not by Kalecki or by Goldmann and Kouba. However, it has been used recently by several growth theorists in the West.[12]

12 K. Inada, "Stability of Growth Equilibria in Two-sector Models", and Nicholas Kaldor and J. A. Mirrlees, "A New Model of Economic Growth", both in F. H. Hahn, ed., Readings in the Theory of Growth, New York: Macmillan, 1971.

Harry G. Johnson, "The Two-Sector Model of General Equilibrium", Yrjo Jahnsson Lectures, Finland, London: George Allen & Unwin, 1971.

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Growth in Some Socialist Countries", <u>Economics of Planning</u>, Vol. 4,
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APPENDIX I

No. 1

Gross Productive Investment (Excluding Private)
As a Percent of Social Product, 1948-1972

1948 - 23.2	1957 - 20.1	1966 - 18.0
1949 - 22.6	1958 - 21.6	1967 - 21.1
1950 - 18.2	1959 - 22.5	1968 - 21.1
1951 - 31.3	1960 - 23.2	1969 - 21.5
1952 - 27.0	1961 - 23.8	1970 - 22.9
1953 - 27.3	1962 - 23.1	1971 - 22.3
1954 - 25.4	1963 - 22.2	1972 - 22 (est.)
1955 - 23.4	1964 - 21.6	
1956 - 22.6	1965 - 16.5	

Source: Yugoslavia 1945-1964, SGS 1972. Cited in Branko Horvat,
"Short-Run Instability and Long-Run Trends in the Yugoslav Economy's
Development", op. cit., p. 9.
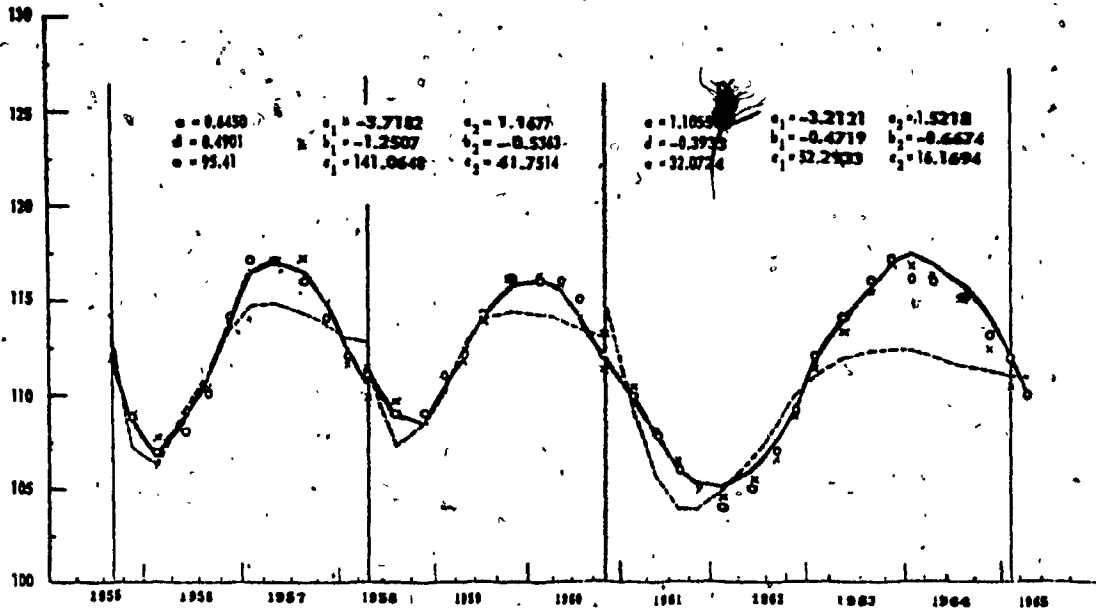
No. 2

Approximation of Industrial Cycles by Autoregression Equations

o o o o o Empirical Data

——————— $y_{t+4} = a y_{t+3} + d y_t + c$

x x x x x $\Delta^4 y = a_1^2 y_{t+1} + b_1 y_{t+2} + c_1$

- - - - - $y_{t+2} = a_2 y_{t+1} + b_2 y_t + c_2$.

Source: Horvat, Business Cycles in Yugoslavia, op. cit., p. 218.

Trends in the Basic Variables in the Yugoslav Economy, 1948-1963
(Annual growth rates)

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Total investment	36.9	11.3	-10.2	2.2	-15.4	-12.2	13.0	0.2	1.9	16.6	12.1	14.3	18.5	6.7	7.0	9.2
Productive investment	36.1	5.5	-8.2	11.9	-9.3	5.6	7.0	4.3	-1.7	10.2	7.8	18.2	15.7	1.0	2.9	8.5
Of which: industry	27.3	33.7	-1.0	13.0	11.2	-4.8	4.4	2.9	-6.3	-3.3	18.2	32.2	10.0	6.5	10.0	
agriculture	73.7	2.6	-27.1	-8.0	5.1	12.3	22.0	-15.7	39.5	31.4	31.9	24.2	-7.2	-6.7	-0.8	9.6
Fixed capital stock	7.9	7.8	5.9	6.5	5.1	5.0	5.2	5.0	4.3	4.8	5.0	6.2	7.2	6.5	6.7	...
Of which: Industry	29.3	33.1	23.7	21.9	20.2	15.2	11.8	10.5	6.5	5.4	4.6	5.8	8.8	8.9	9.4	...
Industrial output	24.6	11.4	2.9	-3.6	-1.1	11.1	13.7	16.4	10.3	16.7	10.9	13.3	15.4	7.2	6.8	15.5
Of which: Department I	25.4	15.8	5.4	-3.0	3.5	10.9	12.0	17.4	10.4	14.9	11.3	12.8	14.3	7.0	4.9	14.7
Department II	26.1	4.3	-3.3	-1.7	-13.0	13.0	15.0	12.3	11.0	21.6	9.6	14.8	16.5	8.0	10.9	17.0
Agricultural output	15.1	0.0	-27.1	41.0	-29.1	41.0	-21.8	23.7	-16.7	45.0	-11.7	31.0	-10.0	-3.0	4.0	10.0
National product	22.9	7.1	-9.6	8.7	-14.8	19.2	3.2	12.8	-0.3	23.0	2.2	17.2	5.9	4.3	12.1	
Consumer spending	...	6.8	-9.2	2.1	-6.9	2.2	6.9	9.1	0.0	13.8	4.2	18.1	6.5	11.6	2.1	9.0
Employment in production	30.1	31.1	-2.3	-5.2	-5.9	9.2	10.5	-0.9	7.9	6.7	7.0	8.9	9.1	2.3	2.2	

Source: Čobeljić and Stojanovic, op. cit., p. 142-3.

APPENDIX I

No. 4

Change in the Capital Coefficient in Yugoslavia 1948-1963

	1948-1952	1953-1958	1959-1963
Rate of gross fixed investment	22.2	19.7	25.0
Growth rate of the national product	2.0	9.7	8.6
Capital coefficient	11.1	2.0	2.9

Source: Cobeljic and Stojanovic, op. cit., pp. 149 and 152.

Note: The capital coefficient is the ratio between the investment rate (the share of investment in the national product) and the growth rate of the national product, that is the incremental capital-output ratio.

Chain Indices of Economic Movements in Yugoslavia, 1949-1967
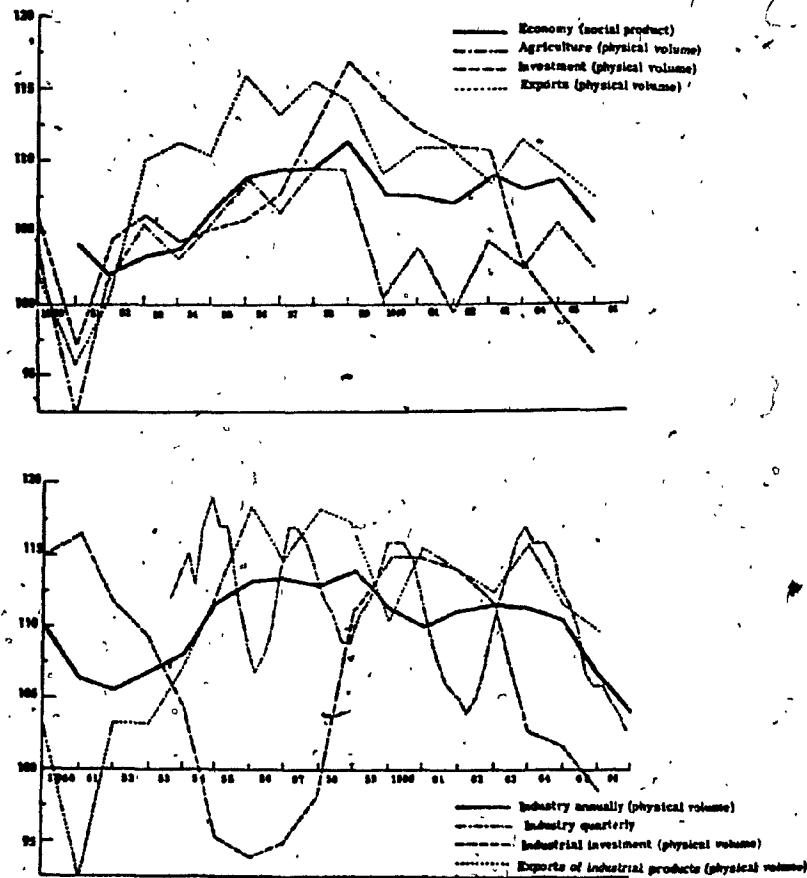
Source: Horvat, _Business Cycles in Yugoslavia_, op. cit., p. 222.

Note: For "economy" and "industry annually", six-year averages are used until 1957 and four-year averages from 1957 on. Four-year averages are used for the other series.

APPENDIX I

No. 6

Yugoslavia
(Growth rates; constant prices)

	1964	1965	1966	1967	1968	1969 esti- mate	1970 plan	1970 5-year plan
Gross economic investment	31.2	30.8	29.4	21.7	23.0	24.4	24.8	26.5
in fixed capital	19.7	17.3	16.0	15.2	17.7	17.5	17.6	16.9
in working capital	11.5	13.5	13.4	6.5	5.3	6.9	7.2	9.6
Net economic investment (accumulation)	25.9	25.4	23.8	15.2	16.7	18.1	18.4	21.0
in fixed capital	13.5	10.8	9.4	8.3	10.9	10.6	10.6	10.6
in working capital	12.4	14.6	14.4	6.9	5.8	7.5	7.8	10.4

Source: Vojnic, op. cit., 422-423.

Annual Growth Rates of Investment and Output in the Soviet Union (1948-1963)

	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Total Investment	21.2	22.2	18.7	12.6	11.9	4.9	17.8	9.6	16.2	12.8	13.6	11.7	12.4	6.3	6.4	3.9
Fixed capital productive investment	...	...	16.0	10.3	5.2	17.8	11.7	14.3	5.2	13.7	14.3	8.2	6.2	6.7	7.4	7.4
Industrial output	27.6	19.0	22.7	16.5	11.5	11.9	13.2	12.4	10.6	10.0	10.2	11.4	9.5	9.1	9.7	8.1
Of Which: Department I	28.8	25.4	25.8	16.7	12.2	11.5	13.5	14.8	11.3	11.0	11.3	12.1	10.3	10.8	10.8	9.5
Department II	20.8	8.4	15.3	16.1	10.5	12.4	12.5	8.5	9.2	8.3	10.0	8.0	7.1	6.8	7.4	5.1
Agricultural Output	11.1	2.0	0.0	-6.0	9.2	2.8	4.8	11.1	12.5	3.0	10.6	1.0	2.3	2.7	1.3	-7.3
National Income	...	...	20.0	12.2	10.8	9.8	12.0	11.9	11.4	6.7	12.6	7.4	7.7	6.9	5.6	4.3
Capital Coefficient	...	...	...	1.1	1.3	1.4	1.5	1.3	1.4	2.2	1.3	2.2	2.1	2.4	2.8	3.9

Source: Cobeljic and Stojanovic, op. cit., p. 135.

APPENDIX III

No. 1

Basic Economic Variables in the Economy of Poland During the Period 1950-1963
(Annual growth rates)

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Total Investment	38.0	11.8	19.0	15.5	6.5	3.9	4.4	7.2	9.8	16.9	6.0	7.4	10.9	3.9
Productive Investment	...	7.6	30.1	13.8	4.1	2.2	2.9	5.3	7.0	16.9	6.1	9.6	15.5	5.6
Of which:														
Industry	63.6	19.0	44.1	15.3	2.7	-6.3	6.0	3.0	8.3	16.9	2.9	10.3	15.7	5.6
agriculture	...	-36.6	38.0	15.7	24.0	41.0	5.8	4.1	4.0	6.6	9.5	10.8	8.8	11.2
Industrial output	27.7	22.2	18.8	17.5	11.4	11.4	9.0	9.5	9.9	9.2	11.1	10.3	8.5	5.3
Of which:														
Department I	28.5	24.9	22.7	19.2	13.3	11.2	10.6	7.8	9.1	13.2	13.5	11.7	9.8	...
Department II	27.0	19.1	14.6	15.3	9.0	11.7	7.2	12.3	10.8	5.0	8.3	8.3	6.3	...
Gross agricultural output	5.2	0.0	-1.1	3.6	5.3	4.6	4.7	2.1	2.5	5.0	2.1	1.6	...	...
National Income	13.8	7.6	7.0	10.5	9.5	8.7	7.0	11.2	5.0	5.6	4.5	8.0	2.0	6.6
Capital coefficient	0.9	1.7	2.1	1.5	1.6	1.7	2.0	1.2	2.9	2.8	3.6	...	...	...
Material goods consumption per capita	7.1	5.3	1.3	16.0	6.4	9.0	9.2	0.8	4.2	0.8	-4.8	1.5	...	...
Total Employment	18.4	9.2	4.7	6.4	3.9	4.1	4.5	2.8	0.6	1.8	0.9	4.0	4.5	4.3

Source: Cobeljic and Stojanovic, op. cit., p. 155

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APPENDIX III

No. 2

Poland
(1,000 million zloty at current prices)

	1956	1957	1958	1959	1960	1961	1962	1963	1964
Increment in inventories	14	26	24	21	27	32	31	34	36
Total accumulation	51	74	78	87	90	102	101	113	120
National income formed	257	301	321	346	375	411	426	460	497

Source: Goldmann and Kouba, op. cit., p. 69.

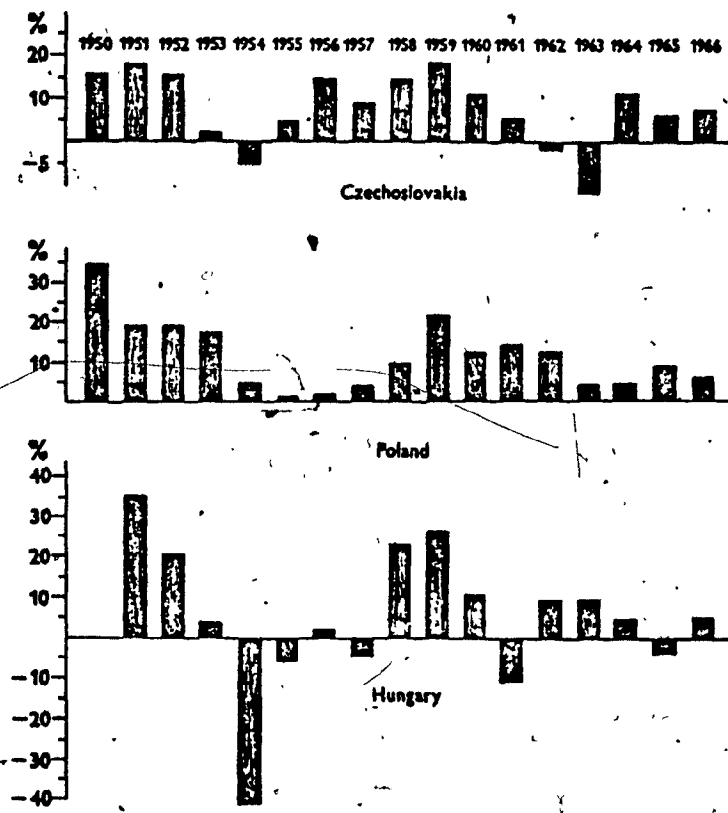## No. 3

Rate of growth of investments in Czechoslovakia, Poland and Hungary 1950-1966

(Annual increments or decrements in percent;
constant prices except for Hungary)

Czechoslovakia

Poland

Hungary

Source: Goldmann and Kouba, op. cit. p. 42.

APPENDIX IV

No. 1

Basic Economic Variables in the Economy of Czechoslovakia During the Period 1950-1963
(Annual growth rates)

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
Total Investment	20.8	21.0	18.1	3.5	-2.0	7.6	13.6	9.3	13.1	19.3	12.4	7.0	-2.7	-11.0
Productive Investment	...	21.6	17.0	-3.0	-3.8	6.4	17.1	12.1	20.0	20.7	12.3	8.5	-5.0	-11.2
Of which: industry	...	25.0	21.2	-13.7	-1.5	-1.0	22.5	5.0	31.0	17.9	8.8	6.9	8.0	...
Fixed capital stock of the economy	...	6.6	7.3	5.6	18.0	14.4	6.6	17.4	0.0	32.4	1.7	8.8	-2.7	-1.4
Industrial output	14.5	14.7	16.7	8.7	4.0	11.5	9.5	10.0	10.3	10.8	11.9	8.9	6.2	-0.6
Of which: Department I	16.0	18.0	24.2	12.8	3.7	8.7	10.9	10.0	11.5	13.2	13.0	9.2	7.3	-0.4
Department II	15.0	9.9	11.0	3.7	4.9	13.2	7.6	10.4	10.7	8.1	9.6	8.3	4.7	0.0
Net agricultural output	15.7	...	...	-3.8	-12.4	11.5	4.0	-1.0	3.3	-12.0	3.7	-2.7	-7.4	9.0
National income	10.2	9.5	10.7	6.4	3.5	10.3	5.3	7.3	8.2	6.3	8.1	6.8	1.4	-2.4
Consumer spending	16.3	10.0	2.3	-9.7	14.0	7.9	8.2	8.4	1.1	5.1	9.5	3.4	2.4	1.1
Employment in industry	2.9	4.6	2.6	0.9	1.7	1.7	2.5	4.0	3.9	3.0	3.6	2.8	3.1	0.0

Source: Cobeljic and Stojanovic, op. cit., p. 158.

APPENDIX IV

No. 2

Czechoslovakia (in 1,000 mil. crowns)

	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965
Increment in inventories	3	1	4	1	5	9	9	6	...	...
Increment in capital-under-construction	3	4	7	4	1	10	9	-1	-4	...
Total accumulation	16	21	26	27	28	35	32	22	17	15
National income formed	133	141	149	152	163	172	175	173	170	174

Source: Goldmann and Kouba, op. cit., p. 44.
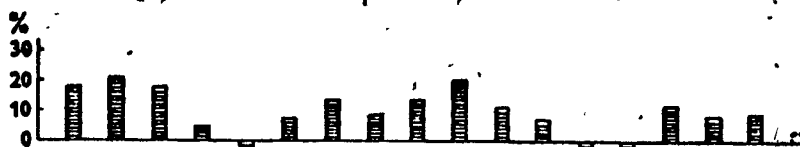
APPENDIX IV

No. 3

<u>Czechoslovakia</u>

<u>Mechanism of Wave-Like Movements in the Growth Rate</u>
(The echo-effect of investment waves in new-output-capacities flow
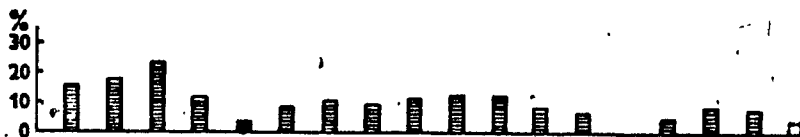in growth rate of producer goods industries, and in inventory
formation).

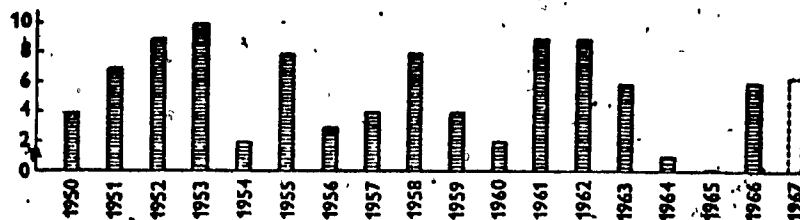1. *Changes in investment activity* (year-to-year changes, percentages)

2. *Increments in flow of new fixed assets, going into operation in industry* (billion Kčs)

3. *Growth rate of output of producers goods industries* (percentages)

4. *Changes in inventories* (year-to-year changes, billion Kčs)

Source: Goldmann and Kouba, op. cit., p. 46.