

## ECONOMIC PLANNING AND ADOLPH LOWE'S ECONOMIC PERSPECTIVE

Bruce McFarlane\*

Introduction

Two pioneering articles written during the 1950s by Adolph Lowe (1952) refer to the need, for the "practical purpose of planning" (1955, p. 585) for a medium-level of disaggregation between the macro-planning models of the Harrod-Domar-Kalecki type and the inter-industry analysis of Leontief. It is too difficult to trace out the growth path of a large number of variables when each is simultaneously exposed to several stimuli. He proposed a creative development of Marx's expanded reproduction analysis with a division into Department Ia (machines to produce machines), Department Ib (machinery to produce consumer goods, such as textile looms) and Department II (final consumer goods) (1952, pp. 153-55 and 1976, Part I). We will later illustrate the practical importance of this approach by showing how it helps us to understand some problems in the recent development of China.

Lowe held that the problems elucidated in his structural model of production would arise in both individualist and collectivist economic organizations (Lowe, 1955, p. 582), since the specificity of the technical structure of the given stock of real capital creates key planning problems for both systems because it affects the adjustment processes through which capital formulation occurs - the links between successive stages of growth (1955, p. 585).

Planning must take the indivisibilities of the capital stock into account since the approach emphasizes that key variables such as "investment" or "consumption" must not be looked at solely as value aggregates "to the exclusion of the technical-physical properties which attach to them in an industrial system" (1952, p. 137).

Lowe focused attention on the machine-tools sector, as an example of the category "capital goods for producing more capital goods", in contrast with capital goods intended directly for the consumer goods sector (like textile looms). The "machine tools" sector has the peculiar ability to initiate and sustain a circular production process of its own (1952, p. 158 also see Lenin 1953, p. 100, Dobb, 1954) and thus not to be determined by the previously existing structural relations (Lowe, 1952, p. 155 and Dobb, 1960, Ch. iv). However, Lowe reminds us (1952, p. 146-55, 1955, pp. 587-90) that this sector is dependent on inputs of intermediate goods which could slow its rates of growth over a period of time. Imports to supplement the domestic output of capital goods could, however, relieve such bottlenecks, at least for a time (1955, p. 592, Sachs and Laski, 1971).

Besides these suggestions for a simple, but powerful, theory of the structural aspects of economic change, Lowe provides as a complementary part of his analysis, a systematic account of how economic agents behave (1965). Taken together these provide a picture of the structural economic interdependence of a growing economy, whether

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\*Professor of Political Economy, University of Adelaide, Australia. Thanks are due to Professor S. Ishikawa for making available results of his research on Chinese economic development (in Japanese), and to Edward Nell for comments and editorial assistance.

capitalist or socialist, which experiences investment cycles. It is Lowe's argument that the marginalist or general equilibrium variety of economic theory imposes unnecessary limitations on the study of economic behaviour and structural interdependence.

In relation to capitalism, Lowe questioned, as early as the 1970's, the then current economic crisis theories and reaffirmed the validity and usefulness of the Rodbertus Tugan and Luxemburg tradition (Kuznets 1954). He developed his own approach on this basis recognizing the difficulties of practical planning in the context of longer term cycles (Lowe 1928, 1955). He stressed the need to avoid the kind of general equilibrium-based planning theory now common (Heal 1973, Lowe 1926) as inadequate for understanding and cyclical fluctuations.

Planning under Socialism also requires what Lowe calls "instrumental analysis", combining a structural account of economic change with understanding of the behaviour of economic agents. There must be propositions about the means and not just the ends of economic action: "social relations of production" in the shape of interaction of planners, consumers, managers, project-makers, rural cadres all must be fed in to transform "models of production". In this, motivation and human action are the essence of the theory of planning in a Lowe perspective. (Lowe, 1965)

Mao Tse Tung seems to have understood this, as he explained in his Ten Great Relations (Mao 1956) and On the Correct Handling of Contradictions Among the People (Mao 1957). His attempts to get people mobilized by appeals to moral incentives (Wheelright and McFarlane, 1970), his promotion of the worker's innovation movement, his stress on the need to motivate the myriads of decision-makers to work for China's economic growth ("grasp revolution to promote production") and his calls to "fight self-interest" all indicate the practical importance of what Lowe called behavioral or "force" analysis. (The kind of motivation recently desired by China's leaders may have changed, but the need for motivation has not, as shown by the new wage incentive schemes in industry and the tolerance of the mass-scale movement back to small peasant proprietorship in the rural areas).

Moreover, the issues of investment planning - the rate, composition and nature of capital accumulation - are not mere "technocratic" questions for specialist planners. If they were, Kalecki, in advising socialist governments, would not have had to bring his "government decision curve" into the analysis. This traces a locus of points of compromise between investment plans and the public's willingness to accept restrictions on higher living standards. In sum, it represents a shorthand description of the outcome of the interaction of the economic actions of people versus government, peasants versus workers, planners versus consumers (Kalecki, 1969, Chs. iii-v), embodying both behavioral and structural relationships. We shall see the usefulness of this in understanding Chinese problems, especially when the decision curve itself is reinterpreted according to structural analysis.

#### Lowe's Model Compared to Other Structural Models

Lowe's neat and incisive discussion of how the circular motion of the outputs of Departments Ia, Ib, and II fits together (Lowe 1952, pp. 153-55; Lowe, 1955, pp. 594-596 and 610-622) has two aspects: There is first the division of net positive investment between the three sectors affects the overall growth rate, and then there is the "productivity of investment" (or the reciprocal of the marginal capital-output ratio) which determines employment and output by interacting with the stipulated investment allocation to the capital goods sector as a whole. One implication to be drawn from Lowe's analysis for socialist or planned economies is that if an investment program is too

heavily concentrated in Department "Ia", then, instead of bringing forth future increases in consumption goods, the plan can end up delaying the increase in consumption unnecessarily. For example, looms cannot be built without machine tools, but textiles can't be produced without looms: A balance must be struck; Department "Ia" must not squeeze out Department "Ib". We shall now trace out the development of these ideas in recent writings on planning.

The family of structural growth models to which Lowe's analysis belongs stretches back to Marx, Tugan, Rodbertus and Rosa Luxemburg and is a forerunner of much interesting work on planning for structural change. The underlying force at work here is the recognition that the extraction of surplus under economic planning is carried out under constraints. The aim of this family of structural models from Luxemburg through Lowe to Feldman, Dobb and Ishikawa, has been to find the required and potential growth rates, taking into account the impacts of initial conditions and the relationship between the strategic sectors while incorporating behavioural norms of the production and management units in industry and agriculture.

The models of Feldman (1929) Mahalanobis (1953, 1955) Dobb (1955, 1960) and S. Ishikawa (1967) are perhaps closest in spirit to Lowe. Mahalanobis and Feldman (see Domar, 1957, ch. ix) identify the economy's capacity to supply fixed capital embodying modern technology as their major constraint. Dobb, however, allows a break in the circular flows between departments Ia, Ib, and II by assuming capital goods last forever. Ishikawa (1967) introduces the demand for fixed capital and the supply of wage goods as limiting factors on growth, but his model is a mixture of neo-classical theory and a Lowe-type model, in which aggregate production functions of the sectors incorporate the technical-physical properties of the system, while inter-sectoral output balances are held rigid.

His analysis brought Lowe close to the theory of economic growth produced for the Soviet plan by G.A. Feldman in the 1920s (Domar, 1957, Ch. 9) Feldman's model looked at the trade-off between the increased output of Department II and the net output of Department I, i.e. Lowe's Ia and Ib. Capital supply was assumed to be the only constraint on the Soviet economy. Production was independent of consumption, and consumption levels did not affect the productivity of workers. Feldman assumed no existing equipment can be transferred from Department I to Department II due to the specificity of equipment, so an increase in consumption depends on prior investment in Lowe's "Ia" and "Ib". Then, as Domar shows (1957) using incremental capital-output ratios and a choice variable (which is the share of Department I going to section I itself), the rate of growth of consumption depends on the past allocation of investment to Department I. Feldman's rigid assumptions (capital equipment cannot be moved between sectors etc.), rule out declines in the future level of consumption, which Kalecki subsequently showed (1969, Ch. 8) to be incorrect, as they underestimated the consumer sacrifices needed with increased mechanization.

S.G. Strumilin, a leading Soviet planner and one time associate of Feldman produced models close to those of Feldman and Lowe (Strumilin, 1954, pp. 22-39). While his main context of was the improvement of the system of "balances" used in Soviet planning and the use of Marx's two departments with a Lowe-type connection between them, he purported to show that to enable the output of consumer goods to grow annually by 10 per cent over the base year, the output of capital goods had to increase by as much as 17.8 per cent annually over the base year. The magnitudes used in the table were close to the "concrete structure of Soviet industry in 1950". Like Lowe (1952, p. 142), Burchhardt (1934, p. 528) and Nurkse (1961, pp. 31-38), Strumilin insisted on relaxing Marx's assumption that "constant" (fixed and circulating capital) is turned-over or used-

up annually, so that columns 1 and 2 of Strumilin's table represent constant capital as a stock and a flow respectively. Strumilin also had the growth rate of consumption dependent on the previous investment in Department I as compared to new investment in the consumer-goods industry. However, he failed to point out that both an equal (as between Department I and Department II) and a constant (over time) rate of growth can be maintained, provided the surplus of capital goods over replacement needs is positive and provided that there is no change in the capital: net output ratio. In addition, Strumilin's results rested on a very special assumption that increased "basic material funds" for Department I come from outside the system, while the same does not apply to Department II. Finally, due to arithmetical error, Strumilin overstated the necessary increase in the net output of Department I: correction of his figures allows the growth rates of the two departments to become equal after a year, although it remained true that to raise the growth rate of consumption, Department I must expand more rapidly than Department II, given the assumptions of the "structural model".

A perusal of early experience in Indian planning (Mahalanobis, 1955; Pant, 1959) also reveals an intense interest in the "engineering" rather than "pure economic" side of planning - in Lowe's "technical-physical aspects of production", as well as the structural representation of production. This is especially clear in Professor Mahalanobis' planning model for India (Mahalanobis, 1953, 1955), and also in Haldane's modification (1955). Haldane's adaption of Mahalanobis aimed to bring in such objectives as cheap food and drugs to increase labour efficiency and the need not to push too fast towards development of Department I in the early stages of a planned economy. Mahalanobis divided the economy into four sectors: (for the purposes of the Second Indian 5-year Plan): the investment-goods sector; the factory consumer-goods sector; the household industries (including agriculture) sector and the services sector. The last three constitute Department II and the first Department I. A "productivity of investment" reciprocal of capital-output ratio and a capital-labour ratio were worked out for each sector. The allocation of investment patterns desired by the Plan was then determined by the initial conditions (the level of real income and the rate of savings in the initial year) and certain planning goals, such as the number of additional workers to be absorbed and the annual growth rate of real income.

The only problem with Mahalanobis' very practical model was the treatment of the investment goods sector, which was not distinguished in its composition from a completely integrated sector. Output of the investment goods sector was treated as equivalent to total net investment, equal to total saving, and was not easily translated into a simple input-output "circular flow" model of the kind used by Marx and Lowe, which had the advantage of bringing out the multi-dimensional structure of an economy where a sector also receives its rationale from the differentiating characteristics of its output. It will be recalled here that Lowe and Burchhardt had insisted on a combined circular and vertical model, the latter aspect including the flow of inputs, although the specifically "Austrian" treatment of this was not adopted.

#### Comparison of Dobb and Lowe

Dobb's model of economic growth (1955a, 1955b, 1960) seems to have been largely based on Lowe's approach; in particular it reflects the proposition that employment in the investment industries is determined by the surplus in the consumption sector divided by the rate of consumption per capita. But the latter, in Lowe's framework, is variable while for Dobb it is a parameter. There are some other differences between the two, as will be indicated. Both, however, bring in the institutional character of the system and both see specific problems for a planned socialist system, such as avoiding excess capacity in the machine-tools sector. So Dobb's model (1955, 1960) can usefully be compared to Lowe's.

In his work, Dobb sees the rate of growth of total output and hence the rate of growth of future consumption levels as governed by the proportion in which current investment is allocated to the capital goods sector (Marx's "Department I") and to the consumer goods sector (Marx's "Department II"). In mathematical notation, the growth rate of total income is governed by the formula  $a/q/q'$  where 'a' is the proportion of investment devoted to capital goods industries,  $q'$  is the ratio of capital equipment to output in those industries, and  $q$  is the average capital/output ratio (Dobb, 1955).

Dobb argued that increased employment and output in Sector I is governed by the output of tractors in investment goods (given by employment there and the productivity of workers). Abstracting from problems of replacing capital goods, and on the simplifying assumption of a fixed ratio of one man/one machine, he constructs a model to yield two relationships sufficient to determine the path of growth by their interaction. Assuming  $L_e$  and  $L_i$  represent labor employed in the respective sector,  $P_c$  and  $P_i$  represent productivity per worker per period measured in corn and tractors respectively, while  $W$  represents the wage rate in corn per period, and  $S$  is the surplus per worker, these two relationships are:

$$(1) \quad L_i = \frac{L_c}{W} (P_c - W)$$

$$(2) \quad L_c = L_i P_i$$

Thus, the first relationship states that employment in the tractor industry depends on employment in corn, times the difference between the productivity of the worker and his wage or "surplus". If  $L_i$  is regarded as measuring the rate of investment, and increases in  $L_c$  in each period measure the rate of growth, the main factor limiting growth is the surplus of wage-goods corn. This, Dobb believed, corresponds to the conditions of underdeveloped countries, where the economic limits on construction work are given by the shortage of wage-goods with which to employ more workers.

The crucial question that Dobb put to his model was this: suppose the choice of machines involves different degrees of capital intensity and different capital/output ratios in industries, what should determine the choice of technique? His answer is that, if the aim is to maximize the rate of growth, a country should choose the technique which maximizes  $L_c(S/W)$ . This implies choosing the technique that maximizes surplus product in the corn sector. Dobb believes this is likely to involve a more mechanized technique than that dictated by the orthodox theory of factory proportions. This is not to say that the "corn" sector can be mechanized indefinitely, since wages rise and reduce the surplus, but it means that mechanization can be carried to the point where  $P_c - W$  is maximized.

Dobb's approach appears to have two main advantages. First, it concentrates attention on the effects of techniques (via their effect on labour-productivity) on investment-potential, and hence on the growth potential of the economy. If the productivity of labour can be raised in the corn sector, there can be a surplus to devote to investment, and this surplus may be worth paying for in the cost of current labour-effort. This puts a premium on land reform, the removal of exploitation in agriculture, and the need for more tractor, irrigation, fertilizer and seed inputs. The point is elementary, but it tends to be overlooked in Western growth models, which assume that the rate of investment and the capital-output ratio are independent, or that they are linked, in Keynesian fashion, through the savings ratio.

Secondly, Dobb's model concentrates attention on structural relationships between different sectors, rather than on the income-expenditure balance which is the

preoccupation of the Keynesian growth models. In this sense, it approaches Marx's two department schemes, outlined in the theory of "expanded reproduction" in Volume 2 of Capital. Clearly this is the right focus on attention in a planned economy. The more industrialized a country becomes, the more its practicable growth rate will tend to be limited, not by the size of the subsistence fund, but by the productive capacity of the capital-goods sector. It then follows that to devote a large share of investment to enlarging the capacity of the capital-goods sector will contribute more to growth than the same investment in the consumer-goods sector. But unlike Lowe, Dobb does not subdivide the capital goods sector, so he cannot effectively analyze the change from one growth rate to another.

Like Lowe, Dobb's model provides a challenge to models that treat investment and growth as resulting from and being limited by a pre-existing savings fund; a tradition which also has conservative implications for policy. If the rate of investment must be kept within the "propensity to save" of the community, this is a limiting factor from which the only escape is to employ the structurally unemployed, using labour-intensive methods of production to increase capital without prior savings. Such a conclusion is parallel to that of the "factor proportions" or traditional approach of marginalism, which Dobb, like Lowe, is criticizing.

Dobb denies that the "saving fund" is the key barrier to growth, since it can evidently be increased by raising productivity, and thereby enlarging the gap between output and subsistence. The more fundamental "fetters" are the issues raised by Lowe: structural disproportions. The danger of cycles and the shortage of agricultural surplus, are key problems in a socialist context.

Yet, Dobb's 1960 work, "An Essay on Economic Growth and Planning" has been criticized on two grounds: First, the model presented too great a degree of simplification and rigidity. The distribution of labour among employment sectors is strictly governed by the capacity of the consumer industry to furnish real wages at a pre-established rate per man employed while the sharp distinction between 'consumer' and 'investment' industries is a particular form of sector aggregation which throws up exoteric features that the interdependencies of the real world might obliterate. For example, it was suggested that the incorporation of raw-material or fuel-branches (linked with other sectors by simple ties of proportionality) would confer on Dobb's 'non-consumption' sectors a role quite similar to that which was made the exclusive preserve of the consumer industry. By contrast, Lowe's model promotes more room to show the relations between different parts of the capital goods sector. Second, Dobb did not draw out many of the price relations implicit in his model, or treat the matter of relative prices in an underdeveloped country seriously enough. What he dealt with was a maze of agios (investment effectiveness coefficients) and turnover taxes. If he had adopted the Lange-Lerner analysis of socialism he would, it is suggested, have seen the intrinsic importance of competition-mimicking price ratios. By contrast, in "The Path of Economic Growth", Lowe examines the working of prices, and argues that they will either not help, or tend to destabilize an economy shifting from one path of growth to another.

#### A New Type of Structural Model

Ishikawa's (1967), Chapter 1 achieves a half-way house between a Lowe-Feldman-Mahalanobis type of structural model and the use of marginalist analysis. The analysis is geared to planning under conditions similar to those of Mahalanobis: a modern sector (X) and a traditional (A) sector are assumed to exist. Cottage industry, however, is considered to be negligible, while permanent durability is assumed for the stocks of capital in the investment-goods subsector and the consumer goods subsector as in Dobb.

The assumption is then made (which Japanese experience supports) that the modern sector must carry on trade with the traditional sector and that there is a differential in living standards which induces labour to move from the traditional sector to find work in the modern sector.

Now the modern sector is treated, as having fixed proportions of capital to labour and of capital to output. Technological change is minimal. Ishikawa analyses the traditional sector by using the marginal productivity of labour in agriculture and the marginal productivity of labour in basic investments. The supply curve of labour is assumed to depend on its productivity and also on factors affecting this, such as the incentives of the working peasants (Ishikawa, 1967, p. 51), the land tenure system, the appropriate government disbursement of rural subsidies and the willingness of people to co-operate with the government. Here Ishikawa achieves what Lowe considers desirable; i.e. a mixture of structural conditions for overall economic growth and a favorable approach to motivation and behaviour by economic agents.

In Ishikawa's model the demand for fixed capital in both sectors (including the infrastructure for the traditional sector), and the supply of wage-goods (partly for those leaving the traditional sector for the modern) provide outer limits on potential growth. But the actual growth path is determined by resource flows between the two sectors, which in turn depends on the marginal productivity of labour in basic investments and the marginal productivity of labour in current production in the traditional sector. But as in Lowe, the outputs of the investment goods sector and the consumer goods sector are determined by the stocks of capital and the capital coefficients, with increments in output largely proportional to the amount of newly allocated investment goods.

#### Lowe Compared to Neo-Classical Planning Theory

It has not always been fully appreciated that Lowe's work can apply to both capitalism and socialism - to the investment cycles of Western industrial societies and to the planning and also the investment cycles of China, the USSR or Eastern Europe.

In relation to "dynamics" in this field, two points stand out even in Lowe's very early analysis. The first is a defence of rigorous theory to explain structural crises, against the empiricism of some business cycle theorists (Lowe, 1925, quoted by Mitchell, 1926a). Lowe's instrumental analysis made explicit something that empiricism and positivist economics hides: "it is theory which provides the principles by which the irreducible fullness of reality can be set in order: it is the theory which formulates the questions which the facts must answer" (Lowe, 1926, p. 367 in Mitchell 1925, p. 59).

The second point relates to the kind of theory that is to be used for cycles, growth paths etc. Wesley Mitchell reported on "Dr. A. Lowe's elaborate argument that the problem of cyclical fluctuations cannot be treated by the "variations method" of pure economics and calls for a dynamic theory in which the concept of equilibrium will be replaced by the concept of cyclical oscillations" (Mitchell, 1925, p. 452).

General equilibrium planning theory has advanced somewhat since 1925, and dynamic issues are now taken seriously. Yet one has only to compare Lowe's works in the area of "economic growth and planning" with the Theory of Economic Planning by G. Heal (1973) to see the enormous gap between a methodology rooted in Rodbertus and Luxemburg and one wholly informed by neo-classical orthodoxy.

In Heal's work, for example, the stated aim is to "examine, in an analytically manageable framework, the advantages and disadvantages of alternative patterns of communication between actors in an economic system" (Heal, 1973, p. viii). It is accepted almost without discussion that decentralized planning will be superior to central plans, but ideological neutrality is assured by the intention to "examine certain formal logical problems that are connected with the idea of a planned economy (Heal, 1973, p. ix). Economic planning is seen to experience the problems of internal planning in large corporations (Heal, 1973, p. 2). In theory and practice, planning is characterized by detailed attention to the productive side of the economy, whilst the requirements and preferences of consumers are assumed to be reflected in the objective function.

As a neo-classicist, Heal, like Arrow and Hurwicz finds this unsatisfactory, and like Fellner and S. Friedman he wants prices and the flow of divisible factors of production to determine the structure of production by a competitive process. A "tatonnement - like process" which was used only for plan implementation in the productive side of the economy would allow the prices announced by the centre to be bookkeeping prices, but a central planning board would, in representing consumers at the auction, have to consider their preferences between consumption goods and between work and leisure so that the amounts of labour individuals would be expected to supply would be identified. But this would only achieve an equilibrium with maximum efficiency if the production functions in the economy are concave and if any output-bundle the planners regard as satisfactory will be a convex set (Heal, 1973, p. 92).

What is Lowe's objection to this type of analysis? Since a full instrumental analysis requires an idea of the structure of production and growth, a notion of change and an adequate account of the motivation of economic agents, Lowe and the neo-classical tradition are on a collision course. Lowe wholly rejects "dynamic marginalism", which he thinks not only has a limited vision of the real economic interdependencies of the economy but also does not meaningfully link these interdependencies to the economic behaviour being postulated. Lowe also criticized as excessively mechanical cycle theories which use lags in groups of economic changes, (such as building cycles), to explain the trade cycle (Lowe, 1926, quoted in Kuznets, 1954, p. 10).

The kind of instrumental analysis sought by Lowe is not available in modern general equilibrium approaches to planning and growth. There is no proposition relating ends and means by specifying motivational forces except that of maximizing economic man, a most limiting concept. There is no social analysis of agents reacting to the trends in the economy other than in a purely competitive world. There is no discussion of the impact of the political decisions of government in a way that is really appropriate to a complex economy. It was precisely these weaknesses which led Lowe to break out of the use of a concept of the firm as merely a maximizing unit, and to treat the firm as a financial unit run by a corporate bureaucracy having its own objectives (Lowe, 1965).

Weaknesses in the perspective and analytical apparatus of general-equilibrium type analysis have their counterpart in the other crucial dimension of instrumental analyses - the treatment of the realities of the industrial system and its interdependencies. For example, an important part of these interdependencies is encompassed in the notion of "external" economies and diseconomies of scale. Heal handles these by introducing extra commodities and markets (e.g. pure water and water with various degrees of pollution). It is possible to assume certain goods must be used in proportions that are constant, or at least given once the scale of operation is known (Heal, 1973, p. 337). Thus constant proportions between capital stocks may be imposed by the requirements of technology. But a thorough examination of indivisibilities in production is of interest in a model which proceeds with high assumed elasticities of substitution. Hence, the situation depicted by

Dobb (1951, p. 58), one very typical in a planned economy, does not get treatment: the presence of large indivisible units where "a modern integrated heavy industry unit such as steel furnaces, coking plant and chemical works, containing a complex network of joint-demand and joint-supply relationships" is the normal order of things.

Lowe, on the other hand, makes contributions of a kind that could rarely come from a Heal-Arrow-Hurwicz type of analysis; specifically:

- (i) a stress of the indivisibility and specificity of capital equipment;
- (ii) a three-sector "snapshot" of the economy and a study of dynamic flow between the sectors;
- (iii) the strategic importance of the machine-building industry a key part of Department Ia in the planning process, and in the path of growth.

Like the Feldman model, Lowe's model produces a perspective and a conclusion that is antagonistic to the "factor proportions" analytical backbone of orthodox economic theory: it conceives of the major constraint to growth in the technical-physical properties of the system and the capability of the economy to produce investment goods. Let us now turn briefly to a case study: that of explaining investment cycles in China in the last two decades.

#### Structural Imbalance and Investment Cycles in Social Economies: The Chinese Case

Lowe's stress on indivisibility and gestation lags (1952, pp. 152-53; 1955, p. 605-9) suggests the possibility of investment cycles, even in a planned socialist economy, because periods of acceleration of the capital goods sector will lead to tensions in the vertical flows involving material supply.

In relation to Lowe's Departments Ia, Ib and II, China's planning record is briefly as follows: Department Ia increased its weight in total industry, going from 11.4 per cent in 1952 to 17.3 per cent in 1965 and 27.7 per cent at the death of Mao (Ishikawa, 1982). After a period of confusion, earthquake reconstruction, and uncontrolled development of the construction sector and Department Ia during 1976-78, a new course was announced in late 1978, under which heavy industry expansion was cut back. If one looks at the Chinese statistics for this period they indicate.

- (a) A drop in the growth rate of heavy industry from 7.7% in 1979 to 1.4% in 1980;
- (b) An increase in the growth rate of light industry from 9.6% in 1979 to 18.4% in 1980;
- (c) investment covered by the national budget was 28,100 million yuan, a decrease of 24.9% compared with 1979. Of the total investment, the proportion for costs of non-productive assets to meet the needs of the people's material and cultural life rose from 27% in 1979 to 33.7% in 1980, of which the investment in housing construction went up from 14.8% in 1979 to 20% while that in light industry increased from 6.4% in 1979 to 9.1%.

According to Chinese statements, economic readjustment is not only the major task for the Three-Year Programme of Readjustment but will be the central task of the Sixth Five-Year Plan (1981-85). What was the major cause of the new allocation policy in China between Departments I and II? Recall Lowe's warning that failure to keep the

departments in step will cause output fluctuations. This suggests that China, with its notorious imbalances between sectors, and swings in investment rates, has experienced investment cycles of the Lowe type. When applied to socialist political economy the essence of a Lowe-based analysis is that an investment programme should not be too heavily concentrated in the machine-tools sector, for instead of the expected increases in consumption goods, the plan can end up delaying consumption.

Behind this are a number of key points about the structure of production which are highly relevant to China's last decade. As Lowe reminds us the technical specificity of production of a given stock of capital represents a key planning problem, because it affects the adjustment processes through which capital formation occurs - the links between successive stages of growth. Lowe also hinted that a combination of indivisibilities, "over-shoot" with regard to the annual rates of capital accumulation, and gestation lags might produce investment cycles in both socialist and capitalist economies, again due to the technical-physical properties of the industrial system.

What has been the course of the Chinese experience? The appended Tables 1-3 suggest that a socialist investment cycle rooted in production structure, but overlaid with a political trade cycle, has been operating in China over the last thirty years. Eastern European experience, notably, Yugoslavia (Bauer, 1978; Roos 1976) suggests that the following can be responsible for such a cycle: (a) spurts and starts in the volume of new, incomplete and finished construction; (b) the responses of the government decision curve: reductions in the investment rate because the trade-off between accumulation and consumption has become too severe, followed by new political decisions to go for higher economic growth involving high investment rates.

This is a kind of political trade cycle in a socialist context. Both (a) and (b) are a result of optimism usually following a good harvest or trade surplus and lack of coordination in investment planning. The first is also due to the fact that uneven finishing rates in consumption causes later "bunching" as projects may come on stream together. This allows a drop in the necessary accumulation rate but eventually this is again accelerated by top decision-makers and the cycle starts again.

It would seem that both types of causation have operated in China over the last two decades. Xu Dixin (1982) has stated that China suffered both from a rash of non-effective "political" investment projects and from lack of analysis of investment involved in construction lags, gestation delays etc. He referred as well to the dangers of constructing a plan just after a successful harvest, as leading to the danger of a political investment boom being set in train. The years 1979 and 1980 were particularly difficult for China; wage increases and bonuses exceeded the plan, budget deficits were increasing and yet investment in basic construction work was not cut back. Yet Lowe-type structural disproportions were in evidence even earlier. The relative weight of machine-building industrial activity in total industrial output had risen from 11.4 per cent in 1952, to 17.3% in 1965 and 27.7% in 1975 - among the highest ratios of all the developing countries (Ishikawa, 1982).

These changes appear to reflect the impact of Soviet technology and its diffusion. This set off waves of construction as the Chinese copied and modified Soviet industrial technologies of 1940s and 1960 vintages. More waves of technology imports in 1962-65 and 1973-76 also played a role, and may have raised the level of the cycle once embodied in new plant (Ishikawa, 1982).

Political events such as the "Leap Forward" and the "Cultural Revolution", plus the objective structural constraints posed by overshoot of some sorts of construction (not

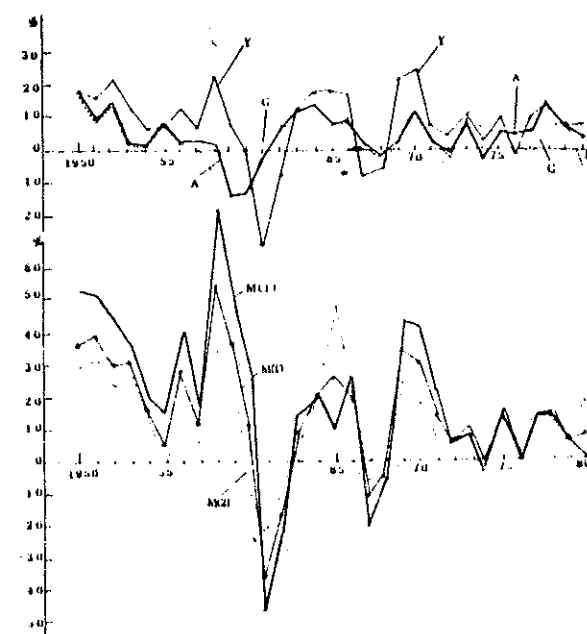
necessarily all: for example, labor-power campaigns for rural infrastructure may have been highly effective) explain the wide fluctuations shown in Table I, distorting the two cycles set off by construction. These factors caused two significant troughs in 1960-63 and 1965-69. Moreover, the restraints imposed by problems of adjustment of Departments Ia, Ib and II in the Chinese case were, in the past, only partly overcome by imports which had only a limited effect in the key Chinese economic sectors. Foodstuffs in 1959 had been almost a zero percentage of imports, but rose to 31% in 1961, 38% in 1964 and stayed at about 20% in 1969-79. To pay for this, investment effort was increasingly shifted to the export of oil. One can see that the political cycle, super imposed on the factors mentioned above, and the limited "escape from pressure" via imports will explain the severity of the Chinese cycle.

#### What Kind of Cycle

What happened in the Chinese cycles portrayed in Figure 1 can be explained by a building cycle, a Kuznets wave or a Lowe-type mechanism. The building cycle is a fifteen to eighteen years cycle linked to housing and construction activity changes (Mitchell, 1926). Peaks of building activity in American cycles antedated by a few years the depressions of the 1870s, 1890 and 1930s. It is, like a Juglar, a "major" cycle which embraces investment trends in buildings, roads, railways and some non-building construction work. Spiethoff blamed the lack of capital occasioned by previous over-expansion of residential buildings and public utilities with long gestation periods for the

FIGURE 1

THE CHINESE INVESTMENT AND OUTPUT CYCLE 1950-1980



y : national income  
A : agricultural output  
M(T) : total industry output  
M(2) : light industry output  
M(1) : heavy industry output  
G : food grain output

Source: Ishikawa, 1982, (in Japanese)

trade cycle itself. The Kuznets cycle (Kuznets 1930) originally arose from a recognition of similar 20-year cycles, which includes transport, six building-transport cycles have been identified (Isard, 1962) in recent U.S. economic history as being linked to population/immigration changes, canal construction, railway expansion and, finally, highway construction for the automobile age.

What would be the advantage of using a Lowe-model? Theorists who have explained the building cycle, like A.F. Burns and Wesley Mitchell have said little about incentives. Yet a capitalist construction cycle will clearly be different from a socialist one: the former will depend on fluctuations in rents and banking finance and the time it takes to recruit builders and skilled workers. The latter depends on planners' and politicians' preferences and resistance by workers and peasants to the threat to their consumption posed by very high rates of state construction.

Lowe (1926) gave reasons for rejecting explanations of cycles based mainly on lags of one group of indicators. To assume varying time-spans for the reaction of separate categories of agents in the accumulation and production process simply destroy general interdependence. If such variation in reaction time really creates costly cycles, Why didn't they learn to coordinate their reactions better? This sort of analysis is not able to integrate motivation and interaction of economic agents.

Lowe's discussion emphasized the shifting of resources between the sectors, and this can help to explain the fluctuations. Economists associated with the Yugoslav Federal Planning Institute (Stojanovic and Cobelic, 1964) with Czechoslovak economic plans (Goldman, 1964) and with Hungarian planning (Bauer, 1978) all linked investment cycles to: (i) fluctuations occasioned by the bunching of replacement needs for indivisible and specific industrial plants; (ii) gestation lags of a capital stock of uneven age profile; (iii) political decisions affecting the shape of the "government decision curve" (Kalecki, 1968, p. 49). Yet behind these general causes of socialist investment cycles were aspects of the circular flow between departments and the vertical input flows within departments highlighted by Lowe: a move of the "government decision curve" is a shift of resources from Department Ia to Departments Ib and II. Chinese investment cycles continued throughout the 1960s and 1970s despite a moderation of economic growth targets, so that the cycles were not mere corrections to forced-draft industrialization. This is now thought to be a result of simultaneous starting of new physical projects rather than investments "coming on stream" at some times and not others (itself a factor in cycles noted by Lowe), or with an acceleration of output in Department I. This may have been reinforced by some pressure of an accelerated rhythm of output in Department I on the material input supplies (Bauer, 1978, p. 250), in the ways shown by Lowe (1952, p. 146, 150); economic branches producing "end" products can expand more easily than raw materials sectors located in Ib and II.

#### Concluding Remarks

The kind of work done by Lowe as early as the late 1920s should really have been forthcoming in the USSR in the period 1930-1953 as this corpus of ideas corresponds to what we now know to be the behaviour of key variables and the dynamic sectors of production. A start had been made by Bazarov, Kovalevsky, Feldman and Groman. (Kaufman (1953); Miller (1953); Jasny, (1972) Ch. 5, 6, 7, and 10). It was interrupted by Stalin's view that "our Soviet plans are not playing with funny figures - they are instructions". Action to remove the Mensheviks, (Groman and Bazarov) and the non-Mensheviks, (Kovalevsky and Feldman) followed, and "structural models of production" were halted.

While critical of economic determinism to the detriment of social and individual behaviour in the political superstructure (perhaps a result of observing the Nazi Party), Lowe's writings are part of a family of Marxian-inspired growth models. One important qualification to this bold statement is that Lowe examines how networks of input-output and circular flows between sectors are generated. His emphasis is not only on the properties of his networks, but on the evolutionary theory linking the feedback process to human and social systems. Chapter II of "On Economic Knowledge" (1965) reflects Lowe's view of the problem. Industrial technology poses the need for a "Political Economics" which can use "instrumental analysis" linking ends with the postulated required means. Equilibrium will partly be the result of the transformation of inputs into a suitable set of outputs which agree with some postulated basket of consumer goods (Lowe, 1965, p. 267) but dynamic equilibrium involves more than a tripartite sectoral division of the system and a distribution of inputs over the three sectors so as to assure a constant output of capital goods and consumer goods over time. It involves a time profile of change, different paths and what Lowe (1965, p. 259, 273, 293) calls "forces". "Force analysis" study behaviour and motivations when dominated by "social relations". This seems to imply that relations between product prices, wage-rates, surplus product and its distribution depend on "forces" including in particular the motivation of economic agents. Lowe stressed that structural change and technical change-overs must be introduced not as dummies but as real life actors, so that technological determinism is avoided.

The place of Lowe in the line of economic thought dating back to the Tableau Economique is perhaps a final question. My hypothesis is that two lines of development have occurred; first, there is the Quesnay - Marx - Lowe - Leontiev tradition, which emphasizes certain problems of structural growth of a disaggregated kind. A second line of development is the Quesnay - Ricardo - Marx - Dmitriev - Sraffa tradition which emphasizes the distribution of surplus by means of a uniform rate of profit with the use of an average or standard industry. When Lowe discusses input flows he comes close to this group, (Nell's Appendix to Lowe, 1976).

Both of these "lines of economic thought" and Adolph Lowe's work undermine the role of general equilibrium analysis in economic planning. A comparison between Lowe (1976) and G.M. Heal (1973) reveals a world apart. In the latter, alternative plans are examined as "ideologically neutral" logical problems of general equilibrium; Lowe, on the other hand, utilizes a series of insights that have proven their relevance and usefulness to develop a theory which is designed to guide practice.

TABLE 1

National Income, Outputs of Industry, Agriculture and Food Grains, and Population: Absolute Amounts and Growth Rates by Phases, 1952-1980

	Phase I (1952-66)			Phase II (1966-76)		Phase III (1976-80)		Annual rate of growth: 1952-80
	1952	1966	Annual rate of growth	1976	Annual rate of growth	1980	Annual rate of growth	
	1. National Income (NDMP) - billion yuan in 1970 prices	65.4	151.0	6.2 (4.0)	245.6	5.0 (7.0)	338.9	
2. Total value of industrial production - same	27.5	144.8	12.1 (10.6)	326.1	8.5 (11.3)	498.2	11.2 (11.2)	10.1 (5.7)
3. Of which, heavy industry production - same	8.7	72.3	16.3 (14.4)	183.1	9.7 (13.6)	264.8	9.7 (13.6)	13.0 (11.3)
4. Of which, light industry production - same	18.7	72.3	10.2 (7.4)	143.0	7.0 (8.5)	234.4	13.1 (11.6)	9.5 (8.4)
5. Total value of agricultural production - same	63.6	94.7	2.9 (1.4)	131.7	3.4 (3.8)	162.7	5.4 (6.1)	3.4 (3.3)
6. Amount of food grain production-unprocessed, million tons	163.9	213.5	1.9 (0.6)	286.30	3.0 (3.4)	313.22	4.7 (5.6)	3.4 (2.8)
7. Population-yearly average million persons	568.2	735.6	1.9 (1.7)	926.19	2.3 (2.4)	976.74	1.3 (1.3)	2.0 (2.0)
8. Per capita national income yuan in 1970 prices	115.0	205.3	4.2 (2.3)	285.2	2.6 (4.4)	367.0	7.0 (7.1)	4.0 (3.5)
9. Per capita food grain output-unprocessed, ton	288	291	0.1 (-1.0)	309.0	0.6 (1.0)	326.0	1.4 (2.4)	0.4 (0.5)

Remarks: Annual rate of growth is derived as a compound annual rate of growth between the years at both ends of the phase indicated. That in the bracket is derived as the annual growth rate estimated by the least square method.

SOURCE: Ishikawa, S. "Major Factors in Medium and Long-Term Projects on the Chinese Economy" Japan-China Association, Tokyo, 1982 (in Japanese).

TABLE 2

(1) Period	(2) Percentage of accumulation in national income	(3) Average rate of growth of industrial & agricultural production (%)	(4) Average rate of growth of national income (%)	(5) Rate of increase of financial revenue (%)	(6) Rate of increase of labour productivity in enterprises owned by the whole people (%)
1st 5-Year Plan (1953-57)	24.2	10.9	8.9	11	8.7
2nd 5-Year Plan (1958-62)	30.8	0.6	-3.1	0.2	-5.4
Period of Readjustment (1963-65)	22.7	15.7	14.5	14.7	23.1
3rd 5-Year Plan (1966-70)	26.3	9.6	8.4	7	2.5
4th 5-Year Plan (1971-75)	33	7.8	5.6	4.2	-0.3
5th 5-Year Plan (1976)	31.1	1.7	-2.3	-4.8	-8.6
1977	32.3	10.7	8.3	12.6	8.1
1978	36.5	12.3	12.3	28.2	12.3
1979	33.6	8.5	6.9	-7.9	6.4

SOURCE: Peking Review, 23 March 1981

TABLE 3

Changes in the Accumulation Rate in Different Periods (in percentages)\*

	Average Rate of Accumulation (rate of investment)	Approximate Range of Fluctuation	
		Lowest	Highest
Ist FYP Period (1953-57)	24.2	23	26
IIInd FYP Period (1958-62)	30.8	10	44
The 1963-65 Period	22.7	18	27
IIIrd FYP Period (1966-70)	26.3	21	33
IVth FYP Period (1971-75)	33.0	32	34
The 1976-78 Period	33.4	31	37

\* For figures, see People's Daily, May 15, 1980, P.5; Social Sciences in China, English ed., No.2, 1980, pp. 198-93



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