

A Theory of Long-Run Development

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Assumptions for the Simplest Possible Model of a Capitalist Economy

(1) The economy consists of workers and entrepreneurs. The workers consume all of wages. Consumption by entrepreneurs is negligible (all profits invested).

(2) Entrepreneurs command finance and are free to choose how much investment they want to make.

(3) Workers are free to strike or at least to die, when the real wage falls below a certain level. This sets the bottom limit to the real wage rate.

(4) To escape the index number problem we assume a composite commodity (consumption goods) which is consumed in fixed proportions.

(5) A given technique of production requires a definite outfit of capital equipment and work in progress per man employed. The capital goods require definite equipment of capital and amount of employment to produce them.

(6) For simplicity of exposition we treat the element of interest in the cost of production of capital goods as negligible.

(7) There are no bottlenecks due to scarce natural resources and no economies or diseconomies of scale to particular industries or to the economy as a whole. The size of individual firms is indeterminate.

Part I.

Accumulation with one technique

Assume only one technique known. Then a specific outfit of capital goods is required per man employed. This requires a definite quantity of labour time to produce. The labour time required to produce the capital goods being fixed by the technique, the value of capital in terms of commodities depends upon the wage rate in terms of commodities.

1. Real wages and rate of profit

Given the technique, the level of real wages depends upon the rate of accumulation. This comes about through the relation of prices to money wages. The excess of the sales value of commodities over the wages bill incurred to produce them (i. e. the total profits on sales of commodities) is equal to the wages bill for investment. Divide employment into two sectors, workers producing commodities and maintaining capital in the consumption sector, and workers producing new capital goods (net investment).

Sales value of commodities = total wages

Sales value — wages cost of commodities =

profit = total wages — consumption sector

wages = investment sector wages

E. g. Total number of workers 100

Output per man employed in consumption sector = 2 units

Then if 50 men are employed on investment, the real wage = 1 unit

If 25 men are employed on investment, the real wage = 1.5 unit.

Given the real wage, the value of capital per man and the rate of profit on capital are

determined.

2. Labour and capital Over the long run, with fixed technique, the ratio of accumulation to the stock of capital cannot exceed the rate of growth of the labour force. If entrepreneurs are accumulating at a faster rate than population is growing, first the reserve of unemployment is drained and then a *scarcity of labour* develops, in the sense that new factories can not find hands to man them. The real wage rate then rises. Consequently the value of investment represented by a given outfit of capital is raised, so that it requires more accumulation to equip an extra man; and at the same time the share of profit is reduced. Thus the amount of accumulation required to provide an extra man with equipment is increased while the rate of accumulation is reduced. Therefore the rate of accumulation is made to fit the rate of growth of population.

Unfortunately the converse may fail to be true when the rate of growth of population is higher than the rate of accumulation. The level of real wages corresponding to the required rate of accumulation may be lower than the tolerable minimum. In such a case it is impossible for accumulation to keep up with population growth and a surplus of labour develops, in the sense that there is not enough capital to employ all available labour. The surplus grows until Malthusian misery checks the growth of population. "Underdeveloped economies" are those which have already got into arrears and have a surplus of labour relatively to the stock of capital goods.

3. Monopoly Entrepreneurs by monopolistic agreement can raise profit per man employed, by raising prices relatively to money wages, but they can not raise total profits by

this means. A fall in real wages reduces the sales of commodities. The total of profit is still equal to the wages bill in the investment sector. The consequence of an increase in monopoly with constant investment is to reduce employment in proportion to the rise in profit per man. Accumulation is then checked by the emergence of surplus capacity.

An increase in monopoly accompanied by an increase in investment raises profit. But the same increase in profit would accompany the increase in investment without an increase in monopoly.

Part II.

Technical Progress Now introduce technical progress, but continue to assume only one technique available at each phase of technical knowledge.

1. Neutral Technical Progress For simplicity assume a constant labour force. Neutral technical progress means that output per man hour is rising, as time goes by, at the same rate in all sectors of the economy. The cost of capital goods in terms of labour time is then constant per man employed.

When accumulation is going on at the same proportionate rate as output per man is rising, the real wage rate rises at the same proportionate rate. The value of capital per unit of output remains constant. The rate of profit and the relative shares of wages and profits in output remain constant.

If accumulation is going on less rapidly a surplus of labour develops. This is generally known as "technological unemployment."

If accumulation is tending to be faster, then either a scarcity of labour raises the real wage relatively to output per man, and slows accumulation, as above, or technical progress is speeded up by the efforts of entrepreneurs

to overcome scarcity of labour by raising productivity per man.

2. The Growth Ratio The potential growth ratio of the economy, i. e. the highest rate of expansion that can be permanently maintained, is approximately equal to the percentage rate of growth of the labour force *plus* the percentage rate of growth of output per head.

For the growth ratio to be realised the rate of net investment as a proportion of the stock of capital, must be equal to the growth ratio.

If for a time the actual rate of accumulation exceeds the growth ratio, then either the growth ratio is raised by an induced speeding up of technical progress, or the rate of accumulation is checked by a rise in real wages relatively to output per head.

When the rate of accumulation is less than the growth ratio, either it is speeded up by a fall in real wages relatively to output per head or a chronic surplus of labour appears.

3. Mr. Harrod's Dilemma Mr. Harrod calls the growth ratio the "natural rate of growth". He distinguished also a "warranted rate of growth" which is the rate that can be permanently maintained at a constant rate of profit. He shows that the two rates could be equal only by chance, and exhibits the course of development in terms of a conflict between them. This is correct if we take some arbitrary rate of profit as a datum, for the rate of accumulation required to maintain a given rate of profit is governed by the real wage rate corresponding to that rate of profit. But there is no reason to take the rate of profit as being arbitrarily determined. To each growth ratio, given technical conditions, there corresponds a rate of real wages which yields a rate of profit corresponding to that

growth ratio. Provided that the rate of wages required is not below the minimum there is no reason why it should not become established by the mechanism described above. Putting the same thing in another way! there is not a unique "warranted rate" but a series of warranted rates, each corresponding to a rate of real wages (a lower warranted rate going with a higher real wage rate). There is one rate of wages corresponding to the "natural rate" when real wages are at that level, the warranted rate and the natural rate coincide. Thus Mr. Harrod's dilemma is a delusion.

4. Biased Technical Progress When technical progress has a capital-using bias, so that capital in terms of labour time per man employed is growing, the rate of accumulation which will keep the rate of profit on capital constant exceeds the rate of rise of output per man. Real wages rise by less than output per man and the share of profit in output rises. Conversely with a capital saving bias.

Part III.

The Production Function Assume a constant labour force and given technical knowledge but a variety of techniques available. A *more mechanized* technique yields a higher output per man employed and requi-

Technique	Wage=1.			Wage=1.1		
	γ	β	α	γ	β	α
Capital	25	50	100	27.5	55	100
Output	55	60	65	55	60	65
Wage bill	50	50	50	55	55	55
Profit	5	10	15	0	5	10
Rate of Profit	20%	20%	15%	0	9%	9%

res a larger investment in terms of labour time to equip a man. Entrepreneurs are assumed to choose the technique which maximises the rate of profit on investment. The choice of techniques is governed by the real wage rate.

Suppose for the employment of 50 men the following conditions prevail with three known techniques:

1. Accumulation with given knowledge Suppose that the wage rate is 1 and that at certain moment all labour is equipped with γ capital goods.

Accumulation is going on and is being devoted to replacing γ capital goods as they wear out with β capital goods. The wage rate remains constant. The rise in output accrues as profit, and the rate of profit remains constant.

When all labour is equipped for β technique further accumulation causes a scarcity of labour. The wage rate rises and accumulation goes into replacing β capital goods produced at the lower wage rate with new ones at a higher wage rate. This corresponds to what Wicksell called the "absorption of savings by rising real wages".

When the wage rate has reached 1.1 it becomes profitable to switch to α technique. Accumulation then goes into raising the degree of mechanisation while the wage rate and rate of profit remain constant at the new level.

Accumulation with Technical Progress Technical progress raises output per

man over the range of degrees of mechanisation. Thus the possibilities $\gamma+, \beta+, \alpha+$ replace γ, β, α , and are replaced later by $\gamma++, \beta++, \alpha++$. When accumulation is going faster than the growth ratio the real wage rate rises relatively to output per head at a given degree of mechanisation and a higher degree becomes profitable. Thus the economy moves in the direction γ to $\beta+$ to $\alpha++$, with a falling rate of profit. When it is going more slowly, the wage rate rises by less and the economy moves in the direction α to $\beta+$ to $\gamma++$, with a rising rate of profit.

When accumulation is equal to the growth ratio, the rate of profit and the degree of mechanisation remain constant. With neutral technical progress and accumulation equal to the growth ratio, the real wage rate rises with output per head. The shares of wages and profits remain constant, and all elements in the economy expand in the same proportion. This is the condition of a "golden age".

This is a possible golden age corresponding to any given growth ratio, the rate of profit corresponding to the rate of accumulation.

In reality a golden age is never perfectly achieved. Short period fluctuations due to (a) changes in basic condition, e. g. an unforeseen change in the rate of technical progress (b) unexpected events and (c) inherent instability due to uncertainty give rise to a trade cycle. Long run accumulation takes place unevenly under the influence of short period impulses.